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AN INVESTIGATION INTO THE EFFECTIVENESS OF FACIAL
MORPHING IN REDUCING UV EXPOSURE AMONG WOMEN AND
MEN AGED 35 YEARS AND OLDER

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A thesis submitted in partial fulfilment of the requirements of the
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Abstract

Background: Non-melanoma skin cancer, which is often caused by exposure to ultraviolet (UV) radiation, is a growing problem among men and women globally. Interventions highlighting the negative appearance-related consequences of UV exposure appear to be effective in changing behaviour and attitudes relating to UV exposure. Facial morphing is an appearance-related intervention (demonstrating future hypothetical ageing to the face) that has been shown to reduce long-term levels of UV exposure among those younger than 35 years; however, its effectiveness has not been tested with older age groups.

Aim: To investigate how those aged 35 years and older react to a facial morphing intervention, and to examine how effective this type of intervention can be in reducing UV exposure long-term, as compared to a health-focused intervention.

Method: A mixed-methods approach was used, comprising a systematic review and meta-analysis into the effectiveness of appearance-focused interventions to reduce UV exposure; two qualitative studies examining attitudes to UV exposure and a facial morphing intervention among men and women aged 35 years and older; and a small-scale experimental study assessing the long-term effectiveness of facial morphing in reducing UV exposure in this age group, as compared to a health-focused intervention.

Results: Appearance-focused interventions were associated with a small but positive effect in reducing UV exposure. Qualitative findings indicated that facial morphing

increased motivations to reduce UV exposure among both men and women, but the quantitative findings did not find significant improvements in sun protection.

However, when facial morphing was combined with implementation intentions, results revealed increased intentions to use sun protection among those who considered proximal consequences more important than distal consequences.

Conclusion: This PhD has concluded that facial morphing may need to be adapted to be effective with older age groups, and that implementation intentions may be a useful addition to this type of intervention. The current project has identified a number of relevant moderators that should be further examined in future research.

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Table of Contents

Chapter One: General Introduction	1
Chapter Two	2
Chapter Three	3
Chapter Four	4
Chapter Five	4
Chapter Six	4
Chapter Seven	5
Chapter Two: A Systematic Review and Meta-Analysis of Appearance-Focused Interventions to Reduce UV Exposure	7
UV Exposure and Skin Cancer	7
UV Exposure and Vitamin D	12
Skin Cancer and Gender	13
Skin Cancer and Age	14
Tanning and Appearance	16
Appearance-Focused Interventions to Reduce UV Exposure	18
Facial Morphing Interventions	19
Systematic Review and Meta-Analysis	20
Method	22
Protocol and Registration	22

Eligibility Criteria	22
Information Sources	23
Search	23
Study Selection and Data Collection Process	24
Meta-Analytical Strategy	26
Meta-Analytical Biases	29
Results	30
Descriptive Features of the Studies	30
Participants and settings	30
Appearance-based interventions	31
Measures employed.....	32
Descriptive Results from Systematic Review	33
Results of Meta-Analysis	36
Summary of risk of bias scores.....	39
Discussion	39
Summary of Evidence from the Systematic Review and Meta-Analysis	39
Sample Limitations and Future Research	42
Conclusions	44
Chapter Three: Methodology	47
Mixed-Methods Approach	47
Facial Morphing Software.....	51
Studies Two and Three.....	52

Qualitative Approach	52
Interview protocol	54
Data collection	55
Data analysis	57
Study Four	59
Quantitative Approach	59
Design	60
Stimuli	64
Health-focused intervention	64
Implementation intentions	65
Moderating variables	67
Appearance concerns	68
Consideration of future consequences (CFC)	69
Masculinity	70
Educational qualifications	72
Dependent variables	72
Sun protection intentions	73
Sun protection use	73
UV exposure	73
Conclusions	73
 Chapter Four: A Qualitative Study of Attitudes to UV Exposure, Sun Protection, and a Facial Morphing Intervention in Women Aged 35 Years and Older	 75
Background	75
Participant Group	76

The Current Study	78
Method	78
Participants	79
Apparatus	80
Materials	80
Procedure.....	81
Ethical Considerations	82
Data Analysis	82
Results	84
Theme One: Confusion and Contradiction	85
Theme Two: Change and Continuity	89
Theme Three: Shock, Surprise, and Negative Reactions to UV Photo.....	92
Theme Four: Positive Outcomes of the Intervention	95
Discussion	98
Attitudes to UV Exposure and Sun Protection.....	98
Goal-Directed Behaviour	101
Reactions to the Facial Morphing Intervention.....	104
Strengths.....	107
Limitations and Future Directions	108
Reflexive Analysis	110
Conclusions	113

Chapter Five: A Qualitative Study of Attitudes to UV Exposure, Sun Protection, and a Facial Morphing Intervention in Men 35 Years and Older	115
Background	115
Participant Group	117
Men and Appearance.....	119
The Current Study	121
Method	121
Participants	123
Apparatus	124
Materials.....	124
Procedure.....	124
Ethical Considerations	125
Data Analysis	126
Results	127
Theme One: Activity and Detachment.....	128
Theme Two: Gendered Appearance.....	133
Theme Three: Motivations, Health Concerns, and Scepticism.....	135
Discussion	139
Attitudes to UV Exposure and Appearance	140
Masculinity.....	142
Reactions to the Facial Morphing Intervention.....	145

Strengths	148
Limitations and Future Directions	149
Reflexive Analysis	151
Conclusions	154
Chapter Six: A Small-Scale RCT of the Effectiveness of Facial Morphing Versus a Health-Focused Intervention to Reduce UV Exposure	156
Background	156
The Current Study	157
Method	159
Design	159
Recruitment	161
Materials	162
Demographic questions.....	162
Moderators.....	163
The Multidimensional Body-Self Relations Questionnaire (MBSRQ-AS).....	163
Consideration of Future Consequences Scale (CFCS).....	163
Conformity to Masculine Norms Inventory (CMNI-46)	164
Outcome variables.....	164
Sun protective intentions (SPI).....	165
Sun protective behaviour (SPB).....	165
UV exposure (UVE).....	166
Procedure.....	166
Ethical Considerations	167

Data Analysis	167
Results	170
Sample Characteristics	170
Normality	171
Multivariate normality.	171
Heteroscedasticity.	172
Outliers.	172
Multicollinearity.....	173
Homogeneity of covariance matrices.....	173
Baseline Measures.....	173
Equivalence between conditions.	174
Missing values.....	174
Immediate follow-up.....	176
Four weeks and six months follow-up.	176
Within-Subjects Differences	177
Moderator Analyses	178
MBSRQ-AS.	178
CFCS.....	178
CMNI-44.....	179
Discussion	179
Summary of Results	179
Intervention Effects	180
Consideration of Future Consequences and Implementation Intentions.....	183

Strengths	186
Limitations and Future Directions	189
Conclusions	190
Chapter Seven: General Discussion	192
Summary of Findings	192
Synthesis of Findings	196
Strengths	199
Limitations	201
Implications for Healthcare Practitioners.....	206
Future Areas of Research	209
Conclusions	211
References	213
Appendices	259
Appendix A: Chapter Two	259
Appendix B: Chapter Two	261
Appendix C: Chapter Two	267
Appendix D: Chapters Four, Five, and Six	271
Appendix E: Chapters Four and Five.....	272
Appendix F: Chapters Four and Five	274
Appendix G: Chapter Six	275
Appendix H: Chapter Six	276

Appendix I: Chapter Six.....	277
Appendix J: Chapter Six	278
Appendix K: Chapter Six	279
Appendix L: Chapter Six	280
Appendix M: Chapter Six	281
Appendix N: Chapter Six	282
Appendix O: Chapter Six	283
Appendix P: Chapter Six.....	284

List of Tables and Figures

Figure 2.1. Full Prisma (2011) Flow-Chart.....	24
Table 2.1. Summary of Study Findings.	33
Figure 2.2. Plot of Effect Sizes and Standard Errors.	37
Figure 4.1. Thematic Matrix for Female Study.....	84
Figure 5.1. Thematic Matrix for Male Study.	128
Figure 6.1. Flow-Chart of Participants Through Test Stages and Conditions.	160
Table 6.1. Participant Demographics.	171
Table 6.2. Sample Baseline Measures.....	174
Table 6.3. Means and Standard Deviations Across Conditions.	175
Table 6.4. Repeated Measures MANCOVA.....	177
Table 6.5. Estimated Marginal Means for All Time-Points.....	177

Chapter One: General Introduction

Skin cancer is an increasing problem around the world, with the World Health Organization (WHO, 2018) reporting that 2 million new cases occur globally each year. This trend is reflected in the United Kingdom, where non-melanoma skin cancers are the most common type of cancer, with around 120,000 new cases being diagnosed annually (Cancer Research UK, 2018a). Given that the general public is quite aware of the strong link between ultraviolet (UV) exposure (e.g., indoor and outdoor tanning) and skin cancer (Miles, Waller, Hiom, & Swanston, 2005), there is a strong rationale for further research into why many still struggle to adopt safer behaviour in the sun, and why health-focused interventions to reduce UV exposure are not sufficiently effective in achieving this (Jackson & Aiken, 2006; Miles *et al.*, 2005; Persson, Benn, *et al.*, 2018). It has been proposed that interventions that focus on the negative appearance-related consequences of UV exposure may prove to be more effective in eliciting behaviour change, as sun tanning behaviours are in many instances motivated by a desire to improve appearance (McWhirter & Hoffman-Goetz, 2015; Williams, Grogan, Clark-Carter, & Buckley, 2013a).

Age appearance facial morphing is an appearance-focused intervention that demonstrates a hypothetical ageing process in response to a particular behaviour; it can therefore be used to illustrate what a person might look like at age 72 if they do not use sun protection when being exposed to UV rays. Previous research has demonstrated that this type of intervention can be effective in reducing UV exposure among participants aged 18-35 (Owen, Grogan, Clark-Carter, & Buckley, 2016; Williams, Grogan, Clark-Carter, & Buckley, 2013b), but this has not yet been researched in the context of an older sample, i.e., those aged 35 years and older. People of all ages are susceptible to a diagnosis of skin cancer (Cancer Research UK,

2018c), and those who are older still have appearance-related concerns (Baker & Gringart, 2009; Grogan, 2016), though people over 35 years have been an under-researched group in the context of appearance-focused interventions to reduce UV exposure (Persson, Benn, *et al.*, 2018). There is also limited research into the long-term effects of appearance-focused interventions to reduce UV exposure. This PhD thesis therefore fills a significant gap in the current research base, and it aims to:

- Investigate attitudes towards a facial morphing intervention to reduce UV exposure, on a sample of women and men aged 35 years and older
- Design and implement a facial morphing intervention based on the findings relating to these attitudes; and to assess the effectiveness of this intervention as compared to a health-focused intervention
- Contribute to the existing body of research aimed at increasing awareness of the dangers of UV exposure, thus improving strategies to reduce skin cancer levels among the population

These aims were achieved by conducting four independent research studies: a systematic literature review and meta-analysis; a qualitative study with women aged over 35 years; a qualitative study with men aged over 35 years; and a small-scale experimental study with women and men aged between 35 and 61 years. An overview of these studies is provided below.

Chapter Two

This chapter is a literature review, outlining research into skin cancer and appearance-focused interventions. It defines key concepts referred to throughout this thesis, and discusses other issues relevant to this programme of research, including those relating to the age and gender of the proposed participant group. This chapter also contains data from a published systematic review and meta-analysis into the

effectiveness of appearance-focused interventions to reduce UV exposure (Persson, Benn, *et al.*, 2018). The review examined 30 separate papers, reporting 33 individual studies published between 2005 and 2017. The resulting findings from this study contain information on different types of appearance-focused interventions, and how effective they are in reducing UV exposure and/or increasing sun protection, which includes previous research into facial morphing. Crucially, information derived from this chapter (e.g., methodological issues identified with the current research base) was utilised to inform the design and execution of the subsequent studies outlined in the following chapters.

Chapter Three

This chapter critically examines the methodological approach utilised for this PhD, which was mixed-methods. This includes outlining and justifying the use of both a qualitative and quantitative approach in data collection and analysis, as well as establishing the epistemological background of the studies. It is argued that a mixed-methods approach was the most suitable design for this PhD as it allowed for a comprehensive and nuanced investigation into the topic, thus expanding the scope of the research and improving analytic power (i.e., conclusions that can be drawn from findings) of the subsequent results (Sandelowski, 2000). Conducting qualitative research prior to the quantitative study enabled the latter to be informed by information gathered through the interviews. This chapter also details the material utilised for this PhD, including interview protocols, questionnaires administered to participants, the facial morphing software (APRIL® Age Progression Software [AprilAge Inc, 2017]), as well as all other stimuli.

Chapter Four

Chapter Four consists of a published qualitative study (Persson, Grogan, Dhingra, & Benn, 2018), detailing the results of semi-structured interviews with 25 women aged between 35 and 61. The interview questions focused on participants' general attitudes to UV exposure and sun protection, as well as their reactions to the facial morphing intervention. The material was subsequently subject to thematic analysis (Braun & Clarke, 2006).

Chapter Five

This chapter details the findings of the second qualitative study (Persson, Grogan, Dhingra, & Benn, *under revision*), consisting of individual semi-structured interviews with 25 men aged between 35 and 61. Similar to the study on women, interview questions focused on general attitudes to UV exposure and sun protection, as well as reactions to the facial morphing intervention, and the material was subject to thematic analysis (Braun & Clarke, 2006). Including men in research into interventions to reduce UV exposure is particularly relevant given that there is a lack of studies utilising male participants, and particularly those of an older age (Davidson & Meadows, 2010; Persson, Benn, *et al.*, 2018).

Chapter Six

This chapter discusses the design, implementation, and findings from a small-scale experimental study conducted on women and men aged between 35 and 61 years. The study examined the effectiveness of a facial morphing intervention as compared to a health-focused condition on sun protective behaviour and intentions, and actual UV exposure. Given that the published review (Persson, Benn, *et al.*, 2018) identified an overall lack of long-term follow-ups, the current study included follow-up points of up to six months after the intervention. As the qualitative studies

identified a number of barriers to adopting safer behaviour in the sun among this participant group, appearance concerns (measured by the Multidimensional Body-Self Relations Questionnaire-AS [Cash, 2000]), consideration of long-term consequences (measured by the Considerations of Future Consequences Scale [Strathman, Gleicher, Boninger, & Edwards, 1994]), and specifically for men, masculinity (measured by the Conformity to Masculine Norms Inventory-44 [Parent & Moradi, 2011]) were included as moderators. Findings revealed no main effect of either of the interventions on any of the outcome variables, but did indicate that facial morphing with implementation intentions may be more effective with those considering proximal consequences more important than distal consequences. It is therefore noted that practitioners intending to use facial morphing to reduce UV exposure may need to adapt the intervention to suit the target group, particularly in regard to temporal perspective of future consequences.

Chapter Seven

Chapter Seven summarises the main findings of the PhD, and draws conclusions based on the overall programme of research with an emphasis on how the results of the individual studies can be synthesised. It is concluded that although some of the findings from the individual studies may appear contradictory, the overall results nonetheless indicate that facial morphing interventions can be implemented with an older age group, albeit in an adapted format to account for shifting attitudes to ageing and appearance. It is recommended that future research consistently includes moderator analyses, and this PhD has signposted temporal perspectives of future consequences as one important avenue for further research. Despite limitations associated with the relative homogeneity of the participant group, the current PhD nonetheless makes a significant contribution in expanding

knowledge of facial morphing to reduce UV exposure, as well as improving skin cancer reduction strategies more generally.

Chapter Two: A Systematic Review and Meta-Analysis of Appearance-Focused Interventions to Reduce UV Exposure

The current chapter will establish the relevance of this PhD by outlining previous research into skin cancer incidence, and how it is distributed across age and gender groups. Key terms and concepts referred to throughout this thesis will also be defined. The chapter will also outline previous research into interventions to reduce UV exposure, focusing specifically on appearance-focused interventions and possible mechanisms behind their effectiveness. It will thereafter consider previous research into facial morphing, and how this kind of appearance-related intervention can be used to promote sun protective behaviours. Lastly, this chapter examines data from a published systematic review and meta-analysis (Persson, Benn, *et al.*, 2018) that was conducted as part of this PhD to investigate the effectiveness of appearance-focused interventions in reducing UV exposure, and discusses how the findings relate to previous literature in this area.

UV Exposure and Skin Cancer

Skin cancer is a substantial problem around the world, with the World Health Organization (WHO, 2018) reporting that between 1 and 2 million new cases occur globally each year, and this continues to increase year by year. Non-melanoma skin cancer, as compared to melanoma skin cancer, consists of two main types: basal cell carcinoma (BCC) and squamous cell carcinoma (SCC). Non-melanoma skin cancer does not generally spread to organs other than the skin (as opposed to melanoma skin cancer), and has a far better prognosis than melanoma skin cancer, with around 90% of cases cured (Cancer Research UK, 2018a), but a previous diagnosis does increase the risk of another incident occurring in the future. Both melanoma and

non-melanoma skin cancer are mainly caused by ultraviolet (UV) exposure (Cancer Research UK, 2018a). As non-melanoma skin cancer is far more common than melanoma skin cancer (Cancer Research UK, 2018c), the primary focus of this thesis will be on the former.

In the UK, non-melanoma skin cancers are by far the most common type of cancer with around 131,000 new cases diagnosed annually (Cancer Research UK, 2018a). This is probably an underestimate as not all non-melanoma skin cancer cases in the UK are recorded (Public Health England, 2018). A systematic review of non-melanoma skin cancer incidence rates around the world suggests that the rates in the UK are increasing at a greater speed than any other European country (Lomas, Leonardi-Bee, & Bath-Hextall, 2012). This is thought to be because of an increased detection rate, an increase in holidaying in high-sun countries, as well as the perceived social rewards associated with a tanned appearance (Addley, 2009; Cancer Research UK, 2018a; Lomas *et al.*, 2012).

Vallejo-Torres, Morris, Kinge, Poirier, and Verne (2014) argue that non-melanoma skin cancer places substantial strain on public health resources, and that the number of new incidences will continue to grow over the coming 30 years, making the burden even greater. In 2008, the cost of skin cancer to the UK National Health Service (NHS) was estimated between £106.4 and £112.4 million, and it is expected this will rise to at least £180.1 million in 2020 (Vallejo-Torres *et al.*, 2014). There is therefore a strong economic incentive to target the causes of skin cancer, particularly in a political climate that has seen significant cuts to public spending, although the specific cuts to the NHS will possibly be reversed by the end of five years (Department of Health and Social Care, 2018; Emmerson & Pope, 2017). This is especially relevant in light of recent debates about 'life-style rationing', i.e.,

whether patients with medical issues that are partially self-induced due to life-style choices - such as obesity, type 2 diabetes, and cardiovascular disorders - should face some of the costs involved in treating the resulting illness (Stoppard, 2017).

Although this has mainly been discussed in relation to smoking and obesity, it is not implausible that this debate will extend to behaviours such as indoor tanning, given the strong link between this and skin cancer (Cancer Research UK, 2018a; WHO, 2018). As with smoking and unhealthy eating, it is a behaviour that is self-induced, with negative consequences for the person's health.

There is an established link between UV radiation exposure and all types of skin cancer. This includes intentional (e.g., indoor tanning or outdoor sunbathing) or incidental (e.g., walking or gardening outside) UV exposure (Cancer Research UK, 2018a; Skin Cancer Foundation, 2016a; WHO, 2018). It is estimated that UV radiation causes at least 86% of non-melanoma cases in the UK, making it to a large degree behaviourally preventable (Cancer Research UK, 2018a). This means that developing strategies to reduce UV exposure has the potential to be extremely effective in limiting new incidences, thus reducing the burden on public healthcare services (Jackson & Aiken, 2006).

Aiming to examine the potential effectiveness of behavioural interventions to reduce UV exposure, Olsen *et al.* (2018) used a simulation scenario to model the impact of a hypothetical behavioural intervention to increase sunscreen use on skin cancer incidences in the US and Australia. They utilised available sunscreen prevalence data, an estimate of the effect of sunscreen use on skin cancer rates, and published non-melanoma incidence projections to model an increase in sunscreen users of five percent per year over a 10-year period, as well as a theoretical maximum incidence reduction where an intervention enabled 100% of the

population to use sunscreen over a period of 20 years. The five percent increase in sunscreen users per year over a 10-year period resulted in an approximately 10% reduction in skin cancers in the US and Australia after 20 years. Using the theoretical maximum scenario, they estimated a skin cancer incidence reduction rate of between 34% in Australia and 38% in the US, where less-than-perfect adherence to sunscreen application was a main reason incidence rates were not cut further. In summary, although sunscreen promotion interventions (particularly those stressing application technique) may not be able to completely eradicate skin cancer incidence, they have the potential to protect a great number of the population from requiring medical treatment for UV exposure-related illnesses.

The potential to break the trend of increasing skin cancer rates has been demonstrated in Australia: the country has the highest rates of Basal Cell Carcinoma worldwide, but has managed to establish a plateau of new incidences, meaning that rates are no longer rapidly increasing (Lomas *et al.*, 2012). This has been achieved through rigorous campaigning by the Australian Cancer Council, most notably through the televised information campaign ‘Slip, Slop, Slap’, featuring Sid the Seagull (Cancer Council Australia, 2018). It is evident that similar campaigns in the UK (e.g., ‘SunSmart’) have only been moderately effective, as skin cancer rates continue rise (Cancer Research UK, 2018a). Oyebanjo and Bushell (2014) argue that the UK’s ‘SunSmart’ campaign was particularly ineffective with Black and Ethnic Minority (BME) groups, who, despite their overall lower rate of skin cancer, tend to be diagnosed later than their Caucasian counterparts, resulting in higher mortality rates.

Despite the general UK population being relatively aware of the health-related costs of UV exposure and the benefits of sun protection, previous

interventions to increase sun-safe behaviours have had limited success (Miles *et al.*, 2005). Why some people expose themselves to the dangers of UV exposure despite knowing the risks can be understood in the context of temporal self-regulation theory (TST), proposed by Hall and Fong (2007). The TST posits that engagement with any health behaviour is dependent on temporal perspective, i.e., whether someone considers the short or long-term perspective of a given action. Hall and Fong (2007) note that most health behaviours can be regarded as involving short-term costs (e.g., going to the gym) weighted against long-term benefits (reduction in risks of cardiovascular disease); this also holds true for sun protection use, which can be viewed as involving short term costs (e.g., foregoing a tan), in favour of long-term benefits (avoiding skin cancer) (Orbell & Kyriakaki, 2008).

This further links with concepts such as consideration of future consequences (CFC), as proposed by Strathman *et al.* (1994), which suggests that the degree to which an individual considers distal or proximal consequences important is a relatively stable personality trait. This would therefore mean that people who consider distal consequences more important than proximal ones would be more willing to use sun protection, and that interventions that can shift temporal perspective from short-term to long-term consequences may have the potential to reduce UV exposure (Murphy & Dockray, 2018). As noted by Murphy and Dockray (2018) there is currently a paucity of research into UV exposure and CFC, making it somewhat difficult to draw definite conclusions on how sun protection use interacts with temporal perspectives.

Moreover, Miles *et al.* (2005) argue that there remains scope for more rigorous campaigning and intervention implementation to reduce new incidences of skin cancer. Specifically, sun protective behaviours appear to be more prevalent

among those with higher educational qualifications and those who are female, suggesting that there is a substantial part of the population that still needs to be targeted (Gillespie, Watson, Emery, Lee, & Murchie, 2011; Miles *et al.*, 2005; Ventenilla, Franca, Lotti, & Keri, 2018). The relationship between sun protective behaviour, age, and gender, is discussed in greater detail below. It therefore appears that previous campaigns intended to raise awareness of the consequences UV exposure (e.g., ‘SunSmart’) have increased knowledge about the dangers of UV exposure and the benefits of sun protection, but not sufficiently managed to impact upon behaviour, particularly among BME populations, and those with fewer educational qualifications (Dodd & Forshaw, 2010). In sum, there have been many challenges with the implementation of previous strategies aimed at reducing UV exposure, resulting in a limited impact on improving sun protective behaviour. This provides a strong rationale for developing new strategies to target the problem, as they may have the potential to prevent many new incidences (Olsen *et al.*, 2018).

UV Exposure and Vitamin D

It should be noted that humans do require some exposure to sunlight - specifically UVB rays - to enable the body to create vitamin D, something that is needed to aid absorption of calcium (NHS, 2018). A lack of vitamin D can result in brittle and deformed bones (Cancer Research UK, 2017; NHS, 2018). Despite claims that sunscreen use may be resulting in population-wide vitamin D deficiency (NHS, 2016a), a substantial evidence base suggests that people who use sun protection still maintain healthy vitamin D levels (Skin Cancer Foundation, 2016b). This is thought to be because although sunlight is indeed the main mechanism for vitamin D production, it appears that short periods of direct sunlight in spring and autumn are sufficient to guarantee vitamin D levels across the year (Cancer Research UK, 2017;

NHS, 2016a). Further, the NHS (2018) specifically points out that sunbathing (or indoor tanning) is not required, and that less than perfect sunscreen application will inevitably lead some parts of the body receptive to UVB rays, thus ensuring vitamin D production (Skin Cancer Foundation, 2016b). This would therefore suggest that vitamin D deficiency is not a result of sunscreen use, but rather a result of not spending enough time outdoors. Moreover, it is difficult to establish whether population-level vitamin D levels are decreasing because not many cases are serious enough to warrant medical attention and will thus not be reported to health professionals (NHS, 2016a). While the NHS (2016a) estimates that around one in five UK adults are low in vitamin D, they also note that this is not the same as a vitamin D deficiency, the latter involving more serious consequences particularly if present long-term. In sum, although some sunlight is indeed required to maintain a healthy vitamin balance in the body, the current evidence base suggests that so long as a person spends sufficient time in the sunlight while not attempting to achieve a tan (for instance by using sunscreen, especially in summer), vitamin D levels will not suffer.

Skin Cancer and Gender

Out of the 100,000+ people diagnosed with non-melanoma skin cancer in the UK each year, slightly more are men than women (Cancer Research UK, 2018c). This disparity increases with age, meaning that older men are at particular risk (Cancer Research UK, 2018c). Research from around the world proposes several reasons as to why this might be. Yan *et al.* (2015) found that, among a sample of nearly 6000 Chinese adults, men and older people were particularly poor at engaging in sun protective behaviours, something that appears to be representative of populations in other countries as well. International studies confirm that generally,

males have less knowledge about sun safety recommendations and the dangers of UV exposure, are poorer at using sun protection, and are less likely to seek medical advice for skin changes (Antonov, Hollunder, Schliemann, & Elsner, 2016; Falk & Anderson, 2013; Haluza, Simic, & Moshhammer, 2016; Wright, Reeder, & Albers, 2016). This is supported by an analysis by Cancer Research UK (2014) of trends and awareness relating to UV exposure and sun protection (2003 – 2013), where women were more likely than men to report a greater number of protective behaviours (e.g., reducing time in the sun).

Moreover, skin cancer survival rates are generally poorer for men as compared to women; in 2016 around 1,400 men died of the disease, as compared to 930 women (Cancer Research UK, 2018c). Although more men than women are initially diagnosed with skin cancer, mortality rates for men have seen a higher increase (20%) than that of the rest of the population (15%) (Agence France-Presse, 2018; Cancer Research UK, 2018c). A possible reason for the gender disparity in mortality rates could be that men are generally poorer than women at adhering to health advice (Baker *et al.*, 2014; Robertson & Gough, 2010). This ties in with the overall gender health gap reported by the WHO (Baker *et al.*, 2014), where men all over the world have a shorter life expectancy and poorer health outcomes. It is, therefore, highly relevant to further examine older men's general attitudes to UV exposure and sun protection, as well as their engagement with an appearance-focused intervention such as facial morphing, to determine whether it can be effective in promoting safer behaviour in the sun.

Skin Cancer and Age

Cancer Research UK (2018c) and the American Cancer Society (2018) identify older age as the main risk factor for developing skin cancer, as DNA

damage accumulates over time. A systematic review by Garcovich *et al.* (2017) concluded that individuals aged 65 years and older are the biggest risk group for developing skin cancer, posing a significant challenge to health care providers globally. Increased age is also associated with a decreased five-year survival rate, although this is likely influenced by other age-related illnesses (Cancer Research UK, 2018c). Although older people may be at increased risk of skin cancer, there is currently conflicting evidence as to whether they engage in more (Gillespie *et al.*, 2011; Miles *et al.*, 2005) or less (Antonov *et al.*, 2016) sun protective behaviours as compared to younger people. Moreover, older people may perceive themselves to be at less risk for skin cancer (Buster, You, Fouad, & Elmets, 2012) but may engage in more self-examination of the skin (Lakhani, Saraiya, Thompson, King, & Guy, 2014).

Interestingly, in the simulation study by Olsen *et al.* (2018), hypothetical interventions targeting older adults as compared to children yielded a greater reduction in incidence rates; because of this, the researchers specifically recommend that future interventions target those aged 39 years and older. This argument is also presented in a systematic review of behavioural interventions to reduce UV exposure by Stapleton, Hillhouse, Levonyan-Radloff, and Manne (2017), who recommend including older women in future research. The current PhD addresses both these recommendations, as the participant group includes both males and females over the age of 35 years. A majority of previous research into appearance-focused interventions to reduce UV exposure has focused on people under the age of 35, raising issues surrounding the generalisability of these findings to older age groups (Persson, Benn, *et al.*, 2018; Williams, Grogan, *et al.*, 2013a). It is therefore highly

relevant to examine the effectiveness of this type of intervention among participants aged 35 years and over.

Tanning and Appearance

A tanned complexion has been considered desirable and attractive among Caucasian populations in Western societies throughout the 20th and 21st centuries, which can be contrasted with the previous ideal of remaining pale (Addley, 2009). A naturally pale but tanned skin was previously stigmatised as it was associated with being of a lower socio-economic class and engaging in manual labour, and it was not until the early 20th century that pale skin went out of fashion (Addley, 2009; Chang *et al.*, 2014). This is thought to be because changes to leisure time and working conditions led to people associating tanned skin with higher socio-economic status (SES) and the ability to go on foreign holidays (Addley, 2009; Chang *et al.*, 2014). There was also an emerging belief that the sun could treat a number of illnesses, including psoriasis and syphilis (Randle, 1997).

Some of these attitudes are still prevalent today, where a tanned skin leads to feelings of increased self-confidence among Caucasian populations, and those of lighter skin tones who are tanned are perceived as attractive and healthy (Cafri *et al.*, 2006; Hillhouse, Turrisi, Stapleton, & Robinson, 2008). Factors relating to appearance have continued to be the main motivators for tanning well into the 21st century. This is supported by numerous studies that have found cosmetic improvement to be a key reason for indoor and outdoor tanning across genders and age groups, both inside and outside of the UK (e.g., Dodd, Forshaw, & Williams, 2013; Gambla, Fernandez, Gassman, Tan, & Daniel, 2017; Mingoia, Hutchinson, & Wilson, 2017). Specifically, Stapleton *et al.* (2017) argue that social rewards

associated with improved appearance are key to understanding tanning addiction in light of well-known costs to personal health.

Given that tanning is primarily motivated by a desire to improve appearance, it is possible that the failure of traditional health-interventions to reduce UV exposure can be attributed to this behaviour as a result being less responsive to health warnings (McWhirter & Hoffman-Goetz, 2015). Dodd and Forshaw (2010) argue that people are willing to forgo long-term health consequences such as protecting themselves from skin cancer in favour of what is perceived as short-term benefits to personal appearance, i.e., to achieve a tan; this also fits into the previously discussed TST framework of temporal perspective (Hall & Fong, 2007). This pattern has been documented using in-depth interviews with student populations, although no research to date has examined how older age groups negotiate costs and benefits associated with UV exposure and sun protection (Kirk & Greenfield, 2017).

Interestingly, Miles *et al.* (2005) found that although knowledge about the importance of sun protection was greater among those with higher educational qualifications, this group was also more likely to cite appearance-related motivations for achieving a tan, and older people expressed concern about ageing of the skin associated with UV exposure. Similarly, research conducted in Austria by Haluza *et al.* (2016) found that appearance-concerns were cited as a main reason to tan as well as not to tan; and Cafri *et al.* (2006) found that college women cited general attractiveness as a key motivator for tanning, but that concerns about skin ageing correlated with intentions to use sun protection. These findings, as well as others, suggest that appearance can have a role to play both in the motivations for risky UV exposure, as well as in possible deterrence. It should be noted that the above mainly

applies to Caucasian populations, as Black people tend to be perceived more negatively if they have darker than average skin, in line with theories about colourism (Alter, Stern, Granot, & Balcetis, 2016).

Appearance-Focused Interventions to Reduce UV Exposure

Blume-Peytavi *et al.* (2016) argue that skin ageing is one of the most important challenges to skin health globally, with UV exposure being a main contributing factor to this. Premature skin ageing is often associated with severe damage to a person's skin, which can be detrimental to appearance, health, or both (Blume-Peytavi *et al.*, 2016). Appearance-focused interventions to reduce UV exposure can be defined as any intervention that highlights the appearance-related costs of UV exposure, for instance by providing written (Cornelis, Cauberghe, & De Pelsmacker, 2014) or visual (Mahler, Kulik, Gerrard, & Gibbons, 2006a) photo-ageing information, manipulating images of a tanned ideal (Mahler, Beckerley, & Vogel, 2010a, 2010b), or providing participants with images demonstrating actual (Mahler, Kulik, Gerrard, & Gibbons, 2006b) or potential (Williams, Grogan, Buckley, & Clark-Carter, 2013) UV damage to the face. A systematic review and meta-analysis of 21 studies by Williams, Grogan, *et al.* (2013a) found that appearance-related interventions had a positive effect on UV exposure and sun protective behaviours and intentions. This study also identified a number of problems with the data-set, including limited long-term follow-ups and a lack of *a priori* power calculations, issues which the authors recommend are accounted for in future research in the area. Similarly, and as discussed in greater detail below, Persson, Benn, *et al.* (2018) found that appearance-focused interventions were generally effective in reducing UV exposure and increasing sun protection, both long-term and short-term.

A possible benefit of communicating the appearance-related costs of UV exposure through visual means is the ability of this medium to elicit strong emotional responses, something that may not be achieved as easily through text-format messages (Sontag & Noar, 2017). Pictorial messages are also processed 60,000 times faster than text, and can convey more complex information than simple written messages (Sontag & Noar, 2017). In a systematic review of 23 studies, McWhirter and Hoffman-Goetz (2015) found that images had a positive impact on knowledge and behaviours relating to sun protection and UV exposure, suggesting that framing messages in this way may be a promising strategy to promote safer behaviour in the sun. Relating to the notion that tanning behaviours are driven by motivations to alter appearance according to social norms of appearing healthy (Dodd & Forshaw, 2010; Mahler, Kulik, Gerrard, & Gibbons, 2010), the review also found that images had a positive impact on influencing the perceived attractiveness of a tanned or untanned skin. Importantly, level of visible skin damage (i.e., pigmentation to the skin and wrinkles) generally correlates with the development of skin cancer, giving it a deeper meaning than simply being appearance-oriented (Bae, Bae, Wang, & Gilchrest, 2017).

Facial Morphing Interventions

Facial morphing is an appearance-focused intervention that utilises visual methods to communicate a message. Specifically, APRIL® age progression software (AprilAge Inc, 2017) simulates real-life ageing up to 72 years of age. The software produces two images, presented side by side for participants to compare: one which is aged as through it has been exposed to an unhealthy behaviour (smoking or excessive UV exposure), and one that is aged naturally, i.e., without this behaviour. Further details on this software can be found in Chapter Three on page 51.

Qualitative research using facial morphing has indicated that it increases motivation to reduce unhealthy behaviours such as smoking and intentional tanning, and can personalise the issue of cancer among both men and women (Flett, Grogan, Clark-Carter, Gough, & Conner, 2017; Williams, Grogan, Buckley, & Clark-Carter, 2012; Williams, Grogan, Buckley, *et al.*, 2013). It appears to achieve personalisation of the issue of cancer specifically through demonstrating skin damage to a participant's own face, as compared to other health promotion material that will use a model's face (Williams *et al.*, 2012). It also appears to give participants a sense of agency by providing two photos; one demonstrating the skin damage, and one that is naturally aged, essentially giving participants a choice as to which photo they would like to look like in the future (Persson, Grogan, *et al.*, 2018; Williams *et al.*, 2012). Further details on findings from two qualitative studies on older men (Persson *et al.*, *under revision*) and women (Persson, Grogan, *et al.*, 2018) can be found in Chapters Four and Five. Quantitative research has demonstrated that facial morphing can be effective in reducing positive attitudes towards tanning, and decrease intentions to engage in these behaviours, among both men and women (Grogan *et al.*, 2011; Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b). This type of intervention has previously been used with younger participants (under 35 years), overwhelmingly drawn from student populations. Data from a novel small-scale experimental study examining the effectiveness of facial morphing among an older age group is discussed in Chapter Six.

Systematic Review and Meta-Analysis

The study discussed below is a published (Persson, Benn, *et al.*, 2018) systematic review and meta-analysis, carried out to examine the effectiveness of appearance-focused interventions to reduce UV exposure and increase sun

protection, both immediately and long-term (up to 12 months post-intervention). It is important to provide an updated review of the literature on appearance-focused interventions to reduce UV exposure, as the last literature review in this area was carried out in 2012 by Williams, Grogan, *et al.* (2013a). This update is particularly relevant in the context of appearance-focused interventions to reduce UV exposure as both technology and research into this area have developed significantly since 2012. For instance, facial morphing to reduce UV exposure was introduced during this period, which is the focus of this PhD. The review is largely modelled (e.g., search terms and eligibility criteria) on Williams, Grogan, *et al.* (2013a) but includes 20 additional articles (consisting of 22 independent studies) that were not included in the previous review. This study was conducted to inform the design and execution of the qualitative and quantitative projects discussed in later chapters, and therefore focuses specifically on aspects such as study design and methodology. The aims of this study are as follows, to:

1. Examine whether appearance-based interventions increase sun protective intentions and behaviour, and/or decrease sun seeking intentions and behaviour immediately after the intervention and/or long-term
2. Outline the specific sample and methodology characteristics of current research into appearance-focused interventions to reduce UV exposure
3. Examine what research since Williams, Grogan, *et al.* (2013a) adds to current understanding about the efficacy of appearance-related interventions to reduce UV exposure

Method

Protocol and Registration

A review protocol was not used, however, the review has been reported in accordance with the PRISMA (2011) guidelines; this is a checklist that provides guidelines on what to include in the title, abstract, introduction, methods, results, and discussion. The full PRISMA (2011) checklist can be found in in Appendix A in Table A2.1.

Eligibility Criteria

Eligibility criteria were identical to that of Williams, Grogan, *et al.* (2013a). Studies had to include an appearance-based intervention, either in isolation (i.e., assessing scores before and after the intervention) or in comparison with another intervention (or control condition); and were required to adopt a pre-test and post-test design, but not necessarily a randomised controlled design. Correlational studies were not included. An appearance-based intervention was defined as an intervention that highlighted negative effects of UV exposure on appearance, such as UV photography or photoageing information. Furthermore, studies had to assess the effects of the intervention on sun seeking and/or sun protective behaviours or intentions. Sun seeking behaviours were defined as behaviours that increased UV exposure, and included spending time in the sun or using indoor tanning booths; sun protective behaviours were defined as behaviours intended to decrease UV exposure, such as sunscreen use or wearing of protective clothing. Finally, studies were required to administer a post-test measure to assess the effectiveness of the intervention.

Information Sources

The primary source of articles was *Web of Knowledge*. This included the following databases: *Science Citation Index Expanded*, *Social Sciences Citation Index*, *Arts & Humanities Citation Index*, *Conference Proceedings Citation Index – Science and Social Science*, *Emerging Sources Citation Index*. In addition to this, seven other electronic databases (*CINAHL*, *ZETOC*, *PsycARTICLES*, *PsycINFO*, *Medline*, *OVID*, *ProQuest Theses*) were accessed to search for studies. To ensure the searched databases provided a relevant literature base, it was confirmed that the list of studies included in the Williams *et al.* (2013) paper was indeed found. An ancestry search, i.e., identifying references that cited the identified papers, was also carried out to identify any missing studies.

Search

The current study used the same search terms as Williams, Grogan, *et al.* (2013a) to ensure consistency: ‘(*sun**OR *UV*) AND (*appearance* OR *age spots* OR *photoageing* OR *damage* OR *wrinkles*) AND (*skin cancer* OR *melanoma* OR *health*) AND *intervention** AND (*sunscreen* OR *protect**OR *tan** OR *expos**OR *prevent**OR *behav**)’, and included studies conducted Jan 1st 2005 – May 16th 2017. 2005 was used as a starting point as research up until this point was sufficiently covered in previous reviews, and is also discussed above.

To account for the ‘file drawer problem’ (Rosenthal, 1979) i.e., that non-significant studies remain unpublished and thus not included in meta-analyses, a number of strategies were employed. First, prominent authors (e.g., authors of the Williams, Grogan, *et al.* [2013a] study) in the field were contacted and asked whether they had any unpublished material. Second, *ProQuest Theses* was searched for unpublished material. Finally, when a number of authors were contacted (see

below for further details) to provide further data to facilitate effect size calculations, they were also asked if they had any unpublished material in the same field of research. Only one unpublished study was found, and it was an unpublished thesis by Dwyer (2014).

Study Selection and Data Collection Process

Eligibility assessment was performed by the author of this thesis and agreed upon with the supervisory team. The full PRISMA (2011) flow-chart with detailed information on the study selection process can be found in Figure 2.1.

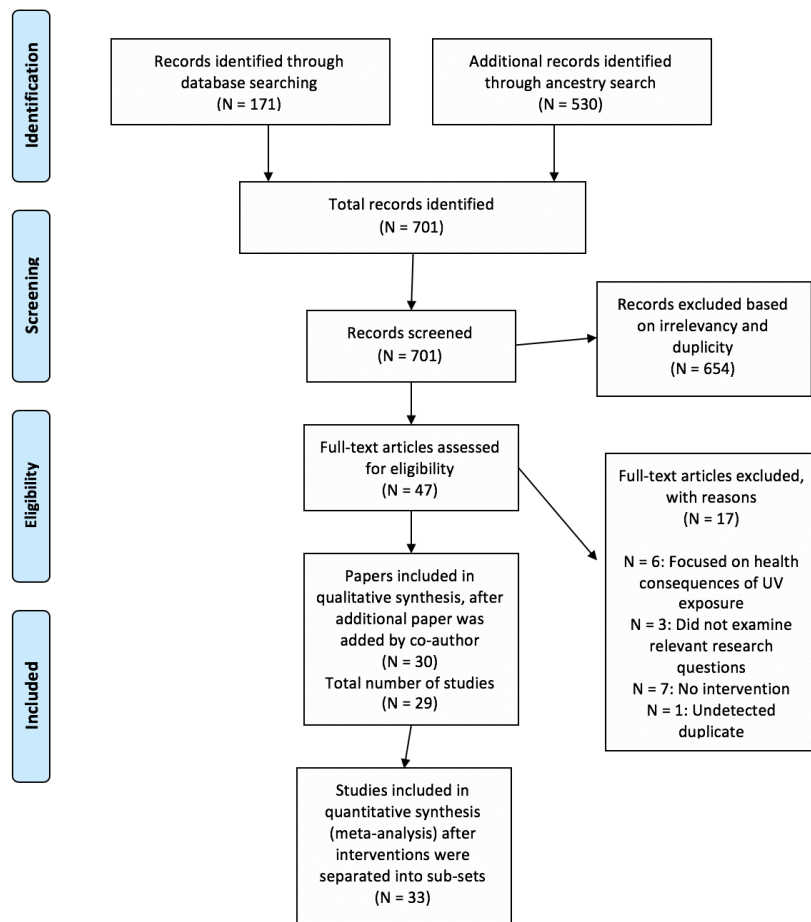


Figure 2.1. Full Prisma (2011) Flow-Chart.

A total of 170 records were identified through database searches, and a total of 532 records were identified through the ancestry search, yielding a total of 702

screened records. Following this, 655 records were excluded based on irrelevancy and duplicity, leaving a total of 47 papers to be examined. Following a full read, six studies were excluded because the intervention focused on health consequences of UV exposure (Cheng, Guan, Cao, Liu, & Zhai, 2011; Dykstra, Gerrard, & Gibbons, 2008; Hernandez *et al.*, 2014; Lazovich *et al.*, 2013; Olson, Gaffney, Starr, & Dietrich, 2008; Thomas *et al.*, 2011), three due to not examining relevant research questions (Cox *et al.*, 2009; Hillhouse, Turrisi, Stapleton, & Robinson, 2010; Walsh, Stock, Peterson, & Gerrard, 2014), and seven for not containing an intervention (Cheetham & Ogden, 2016; Hillhouse *et al.*, 2016; Noar *et al.*, 2015; Pagoto *et al.*, 2009; Taylor, Westbrook, & Chang, 2016; Welch, Chang, & Taylor, 2016; Williams, Grogan, Buckley, *et al.*, 2013).

An extraction table was designed based on the main elements reported in Williams, Grogan, *et al.* (2013a). Data were extracted by the author of this thesis, with 10% checked blind (i.e., independently extracted by a supervisor and then compared to the data extraction conducted by the author of the thesis) during April and May, 2017. Due to the high level of agreement (88.0%), the remainder of the data were checked non-blind by the same supervisor, with agreement of 94.0%. Any disagreements were resolved by discussion. The final review includes 30 articles (33 independent studies, as some articles reported more than one study); 20 of these articles (22 individual studies) were not included in Williams, Grogan, *et al.* (2013a). Information extracted from the studies included participant characteristics, study location and settings; intervention characteristics, outcome measures, and which, if any, theoretical constructs were utilised to inform the intervention, and methodological issues.

A formal tool was not utilised to assess methodological bias, but bias in each study was assessed by examining the methodology (i.e., study design, proposed analyses, type of intervention, comparison groups, etc.), randomisation process, quality of the outcome measures (e.g., Cronbach's alpha), and research funding. No studies were deemed to be biased, aside from Bae *et al.* (2017), as it was neither controlled nor randomised, and did not compare the intervention with a control condition. However, the study was excluded from the meta-analysis due to lack of sufficient details for effect-size calculations, and is therefore only commented on in the systematic review. In addition, small study bias and publication bias were assessed utilising Egger's regression (Egger, Smith, Schneider, & Minder, 1997) and trim-and-fill analyses (Duval & Tweedie, 2000). In sum, the main outcomes of interest included sun seeking behaviours and intentions (i.e., indoor and outdoor tanning), and sun protective behaviours and intentions (i.e., use of protective clothing or sunscreen).

Meta-Analytical Strategy

The meta-analysis employed a random effects model. Contrary to a fixed effect model, a random effects model accounts for natural variability across studies, such as differences in age and nationality, type of intervention, and follow-up length (Riley, Higgins, & Deeks, 2011). As the studies in this sample varied considerably (e.g., drawing from different populations and countries, and applying varying inclusion/exclusion criteria), a random effects model was considered the most appropriate choice.

All but one of the studies included in the review were also included in the meta-analysis. Bae *et al.* (2017) was not included as the main author declined a request for additional data to facilitate effect size calculations. Three papers (Mahler

et al., 2006a, 2006b; Mahler, Kulik, Gerrard, & Gibbons, 2013a, 2013b; Mahler, Kulik, Gerrard, & Gibbons, 2007a, 2007b) included separate UV photo and photoageing information components (with the same participants), hence were added as two separate studies under the two relevant interventions. Studies were categorised according to the type of appearance intervention, creating four separate data-sets: 1. Interventions with UV photo, 2. Interventions with photoageing information, 3. Interventions combining UV photo with photoageing information, 4. Interventions that could not be classified as either, for instance facial morphing or group discussions. Due to the heterogeneous nature of the final category, it was not possible to further distinguish between these interventions. The process of categorisation into types of interventions enabled the inclusion of the same participants in separate analyses. In addition, the two studies described in Gibbons, Gerrard, Lane, Mahler, and Kulik (2005) were originally analysed as one by the authors, but inserted separately to the meta-analysis, resulting in a total of 34 independent studies included in the meta-analysis.

For each of these studies, correlation coefficient r was calculated to assess the relationship between the appearance-based intervention and the outcome variable, which was classified as either sun protection (behaviour and intentions) or UV exposure (behaviour and intentions). Following recommendations by Cohen (1992), $r = .10$ was taken to represent a 'small' effect size, $r = .30$ a 'medium' effect size and $r = .50$ a 'large' effect size. Long-term (i.e., any follow-up longer than immediately following the intervention, ranging from one week to 12 months) effects of the interventions are commented on in the systematic review as there were not enough studies with similar levels of follow-ups to include this as a moderator analysis. Although some studies did include longer follow-ups, due to the decision to

create four meta-analysis sub-sets (rather than analyse the sample as one) and the variability in variables measured in the papers, there were not enough studies with similar levels of follow-ups to facilitate the analysis of these effects.

Where studies contained two (or more) conditions, the appearance-focused condition was defined as the one with the strongest focus on appearance, and the control condition contained, where possible, active elements (e.g., another intervention, as compared to a passive control being waitlist only). Where studies contained more than one appearance-focused intervention, these were compared separately to a control condition, creating separate effect sizes. Where studies lacked relevant statistics, authors were contacted to provide additional information that could facilitate the effect size calculations. All authors except one (Bae *et al.*, 2017) responded with the requested information (Christensen, Champion, & Wagner, 2014; Cornelis *et al.*, 2014; Gibbons *et al.*, 2005; Hevey *et al.*, 2010; Mahler, Beckerley, *et al.*, 2010a, 2010b; Morris, Cooper, Goldenberg, Arndt, & Gibbons, 2014, 2014a, 2014b; Sontag & Noar, 2017; Stapleton, Turrisi, Hillhouse, Robinson, & Abar, 2010). These authors were also asked about any unpublished material they might have. As the majority of the studies included a follow-up immediately after the intervention, where possible, this point in time was used to calculate effect sizes to ensure homogeneity of the data. For studies that did not have an immediate follow-up ($N = 7$), or did not report sufficient data for this point, effect sizes were calculated for the nearest available time following the intervention.

The meta-analysis assessed the effectiveness of the intervention on four specific outcome variables: sun protective intentions, sun protective behaviour, UV exposure intentions, and UV exposure. If multiple outcomes for each of these categories were measured (e.g., sun lotion use and use of protective clothing for sun

protection behaviour), an overall effect size was calculated as the weighted-mean of these measures. Effect sizes were computed using SPSS version 22, and macros developed by Wilson (2005). Effect sizes were weighted by sample, with a 95% confidence interval. To determine whether all included studies examined similar effects, Cochran's Q was utilised as a measure of heterogeneity. Higgins, Thompson, Deeks, and Altman (2003) argue that this measure does not normally have sufficient power to detect heterogeneity, and that the alpha level therefore needs to be set higher to counter this. For the purpose of this meta-analysis, their proposed significance level of .10 was therefore used.

Meta-Analytical Biases

There are several biases to consider when interpreting results of a meta-analysis, among them publication bias and small study bias. Referring to the 'file-drawer problem', Rosenthal (1979) argue that as little as five percent of conducted studies are actually published, and that both authors and journals only consider significant results for publication. This can result in a significant publication bias, which overestimates the effect of an intervention or treatment on a particular behaviour. To counter this, it is therefore recommended that meta-analyses attempt to include both unpublished and published material as this will estimate a more accurate effect of the intervention (Thornton & Lee, 2000). Although significant attempts were made to locate grey literature (i.e., unpublished material) for the current meta-analysis, only one unpublished study (Dwyer, 2014) was identified and included in the study. Therefore, publication bias was assessed using a trim-and-fill analysis (Duval & Tweedie, 2000) which estimates the number of missing studies in a meta-analysis and creates a new mean (and p-value) plotting this in a funnel plot.

Trim-and-fill is considered an effective and relatively powerful means of detecting publication bias in meta-analyses (Duval & Tweedie, 2000).

Another bias that can adversely affect results of meta-analyses is small study bias (Egger *et al.*, 1997). Small study bias refers to the fact that on average, smaller studies tend to overestimate the effect of the treatment or the intervention, as compared to larger studies that tend to find a smaller (and supposedly more accurate) intervention effect (Nuesch *et al.*, 2010). Therefore, if a meta-analysis includes a large number of small studies, it is recommended to account for this effect through statistical testing. Consequently, for the current meta-analysis, Egger's regression (Egger *et al.*, 1997) was conducted to ensure the results were not biased because of a large number of relatively small studies. Egger's regression plots the effect of the study sample, and assesses whether there is symmetry (no small study bias) or asymmetry (small study bias present) in the effect sizes.

Results

Descriptive Features of the Studies

Participants and settings. Across all samples, there were 7,348 participants, with sample sizes ranging from 50 to 965 participants ($M = 222.67$). Participant numbers were calculated from those completing post-intervention testing. Twelve studies specifically targeted females, whereas four studies targeted males. The remainder had a mixed-gender participant group. Twelve studies based their sample size on power calculations. Heckman *et al.* (2013) specified that they did not use power calculations due to it being a pilot study, and Dwyer (2014) reported a sample size too small to detect a medium effect size, but compensated for this by excluding a number of variables in the final analysis. The remaining studies did not comment on how sample size was decided.

Twenty studies used university students as their sample; this was by far the most common participant group. The overall age range of the participants was 13-86 years. A majority of the studies included participants aged 16-35 years. One study included participants below 16 years of age (Tuong & Armstrong, 2014). Three studies (two separate papers) did not specify age range (Gibbons *et al.*, 2005; Hillhouse *et al.*, 2017). Participants were predominately White, with percentages ranging from eight percent (Tuong & Armstrong, 2014) to 100% (Dwyer, 2014). Morris *et al.* (2014a, 2014b) specifically excluded Black participants on the basis of their UV photo technique not being able to demonstrate skin damage on darker skin. Eight studies targeted a risk group such as indoor tanners (Hillhouse *et al.*, 2008; Stapleton *et al.*, 2015; Stapleton *et al.*, 2010), beach patrons (Cooper, Goldenberg, & Arndt, 2014; Mahler *et al.*, 2006a, 2006b; Pagoto, Schneider, Oleski, Bodenlos, & Ma, 2010) or highway workers (Stock *et al.*, 2009). A majority (75.8%) of the interventions were implemented in a research facility or university setting, with the remainder (24.2%) being administered online or in a community setting (e.g., a public beach).

Appearance-based interventions. The most common type of intervention ($N= 17$) was UV photography, either in isolation or combined with information about photoageing. Three of the UV photo papers (six individual studies) (Mahler *et al.*, 2006a, 2006b, 2013a, 2013b; Mahler *et al.*, 2007a, 2007b) administered two separate interventions on UV photo and photoageing. The second most common type of intervention ($N= 7$) was photoageing information. The remainder of the studies utilised alternative types of interventions, such as discussing and challenging the tanned ideal, manipulating media images, or implementing facial morphing.

Twenty-one of the studies based their interventions fully or in part on theory. These theories included, among others, the health belief model (Mahler *et al.*, 2006a, 2006b), terror management health model (Cooper *et al.*, 2014), and theory of planned behaviour (Hevey *et al.*, 2010). Three of the studies that specifically targeted a male population used the prototype-willingness-model (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008) to inform their intervention, suggesting that stereotypes about masculinity may have an important role to play in research on male UV exposure (Dwyer, 2014; Stock *et al.*, 2009; Walsh & Stock, 2012). See Table A2.2 in Appendix B for full details of the theoretical basis and critical points for each of the studies.

Measures employed. All but one of the studies (Bae *et al.*, 2017) administered post-intervention measures to assess the effect of an appearance-based intervention on UV exposure intentions and/or behaviours, as compared to a control condition, and in six studies this was a passive control. Ten studies measured immediate effects of the intervention, with 19 having a follow-up of between one week and 12 months. Participants were aware of the follow-up in seven of these studies, not aware of any follow-up in three of the studies, and a final 10 of the studies did not specify whether or not participants were aware of the follow-up. All of the papers utilised some form of self-report measure to assess intervention efficacy, which could be categorised as actual UV exposure and/or intentions, and sun protection use and/or intentions. An alternative method to assess behavioural efficacy of the intervention examines skin colour; it involves the use of a skin reflectance spectrophotometer which, when based on hue lightness and saturation on various skin sites, can indicate level of UV exposure (Mahler *et al.*, 2006a, 2006b). This technique was utilised by four studies.

Descriptive Results from Systematic Review

Table 2.1. *Summary of Study Findings.*

Sample	Settings	Interventions	Outcomes measured	Follow-up	Findings	Theoretical basis
$N=7,348$ ($M=222.67$, Median = 148, SD = 189.96)	75.8% research facility or university	17 = UV photo (with or without photoageing information)	12 = SPI/SPB	12 = immediately only	29 = positive	27 = theoretical basis
72.9% women	15.2% online	7 = photoageing information	10 = UVI/UVE	12 = between one week and 12 months	4 =positive findings confined to particular condition	6 = no theoretical basis
12 – 75 years 12 = utilised power calculations	9.0% other	9 = neither of the above	11 = combination		4 = no difference	

Table 2.1 provides a summary of the overall pattern of findings. Table A2.3 in Appendix C provides a detailed description of the main findings of the individual studies, including intervention design and findings.

Overall, a majority ($N = 29$) of the studies reported that an appearance-focused intervention had a positive effect on reducing UV exposure and/or increasing sun protection. Interestingly, four of the studies that reported positive findings only found this effect when examining a particular participant group or a combination of conditions; Cornelis *et al.* (2014) found that an appearance intervention decreased intentions to tan when the argument against tanning was two-sided, but not when it was one-sided; Stapleton *et al.* (2010) found that their intervention decreased indoor tanning frequency among a sub-group of tanners with previously low knowledge of the health or appearance costs of tanning; and Walsh and Stock (2012) found that UV photo increased sun protection willingness among

masculine men. Finally, Morris *et al.* (2014b) found that UV photo had a positive effect on sun protection intentions only when participants were primed with mortality. However, it should be noted that for this study, the simple effects analyses were performed on a significantly smaller sample size ($N = 33$) than the original sample, and power calculations were not included.

For the studies including a longer (i.e., longer than immediately following the intervention) follow-up, findings were generally positive. Up until one month after the intervention, participants reduced indoor and outdoor sunbathing frequency and increased use of sun protection (Chait, Thompson, & Jacobsen, 2015; Gibbons *et al.*, 2005). These effects were evident for up to six months, including reduced intentions to tan and increased intentions to use sun protection (Hillhouse *et al.*, 2008; Jackson & Aiken, 2006). Pagoto *et al.* (2010) found that after one year, a UV photo intervention reduced sunbathing, but did not increase sun protection. A number of the findings comparing UV photo and photoageing interventions were contradictory. In some instances, both UV photo interventions and photoageing information resulted in lighter skin colour readings at a six-month follow-up, but this effect persisted at the next 12-month skin reading only for the photoageing information group (Mahler *et al.*, 2006a, 2006b; Mahler *et al.*, 2007a, 2007b).

Conversely, Stock *et al.* (2009) found that when combining skin readings and self-report items, only the UV photo group increased sun protection levels at a the 12-months follow-up. Additionally, Mahler *et al.* (2013a, 2013b) found that both photoageing information and UV exposure separately resulted in lighter skin-colour readings at a 12-months follow-up. Neither of the interventions increased sun protective behaviours. Interestingly, Owen *et al.* (2016) did not find an effect of a facial morphing intervention as compared to a health literature intervention on

participants' short-term sun protective attitudes, but did find a long-term effect on their sun protective behaviours six months later. It should be noted that for this study, the follow-up sample included less than half of the original sample, which may have compromised the analysis. Thus, the evidence is inconclusive as to which particular intervention is most effective in reducing UV exposure in the long-term, and this would warrant further research.

Three studies did not find an effect of the appearance-based intervention on the main measured outcome. Christensen *et al.* (2014) found that participants in the UV photo condition did not progress in UV protective stages of change long-term, and the health-oriented intervention was significantly more effective in increasing immediate sun protective intentions; and Hevey *et al.* (2010) found no significant difference between a health or appearance-framed message on intentions to use sunscreen and sunbeds. As the latter study did not include baseline measurements, it was not possible to determine whether the individual interventions increased any of the intentions. Similarly, Sontag and Noar (2017) reported no difference between a health and appearance-framed message on UV exposure intentions.

Pertaining to the research aim regarding the contribution of the 20 studies published since 2012 (i.e., those not included in Williams, Grogan, *et al.*, [2013a]), there was a similar selection of interventions, apart from the inclusion of two studies utilising facial morphing, which is particularly relevant given the overall focus of this thesis (Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b). This technique had positive results on participants' sun protection intentions and behaviour when compared to a health literature intervention. Moreover, three of the four studies specifically targeting males were found in this sample. Although most research is still conducted females, this suggests that research into UV exposure is increasingly

considering men’s motivation to tan and their barriers to sun protection. The majority of these studies reported modest results, or positive findings confined to a particular combination of conditions (e.g., mortality priming or two-sided arguments). This suggests that appearance-focused interventions to reduce UV exposure may need to consider drawing on other aspects of behaviour change or persuasion theory to enhance efficacy.

Results of Meta-Analysis

Table 2.2. *Meta-Analyses Results.*

Relationship between UV photo interventions and outcome variables

Outcome variable	<i>r</i>	<i>p</i>	95% confidence interval	<i>k</i> (studies)	<i>N</i> (participants)
Combined outcome variable	.19	<.001	.08, .30	10	1564
SPI	.17	.01	.04, .30	8	1251

Relationship between photoageing interventions and outcome variables

Outcome variable	<i>r</i>	<i>p</i>	95% confidence interval	<i>k</i> (studies)	<i>N</i> (participants)
Combined outcome variable	.32	<.001	.21, .45	4	863
SPI	.27	.040	.20, .34	3	840

Relationship between UV photo combined with photoageing information and outcome variables

Outcome variable	<i>r</i>	<i>p</i>	95% confidence interval	<i>k</i> (studies)	<i>N</i> (participants)
Combined outcome variable	.26	.02	.05, .48	6	918
SPI	.42	.02	.28, .57	3	319

Relationship between other interventions and outcome variables

Outcome variable	<i>r</i>	<i>p</i>	95% confidence interval	<i>k</i> (studies)	<i>N</i> (participants)
Combined outcome variable	.19	<.001	.12, .27	14	3895
SPI	.22	.07	-.02, .46	5	836
UV exposure	.15	.04	.01, .30	6	1878
UVEI	.23	<.001	.13, .37	7	1798

- Sun protection intentions
- UV exposure intentions

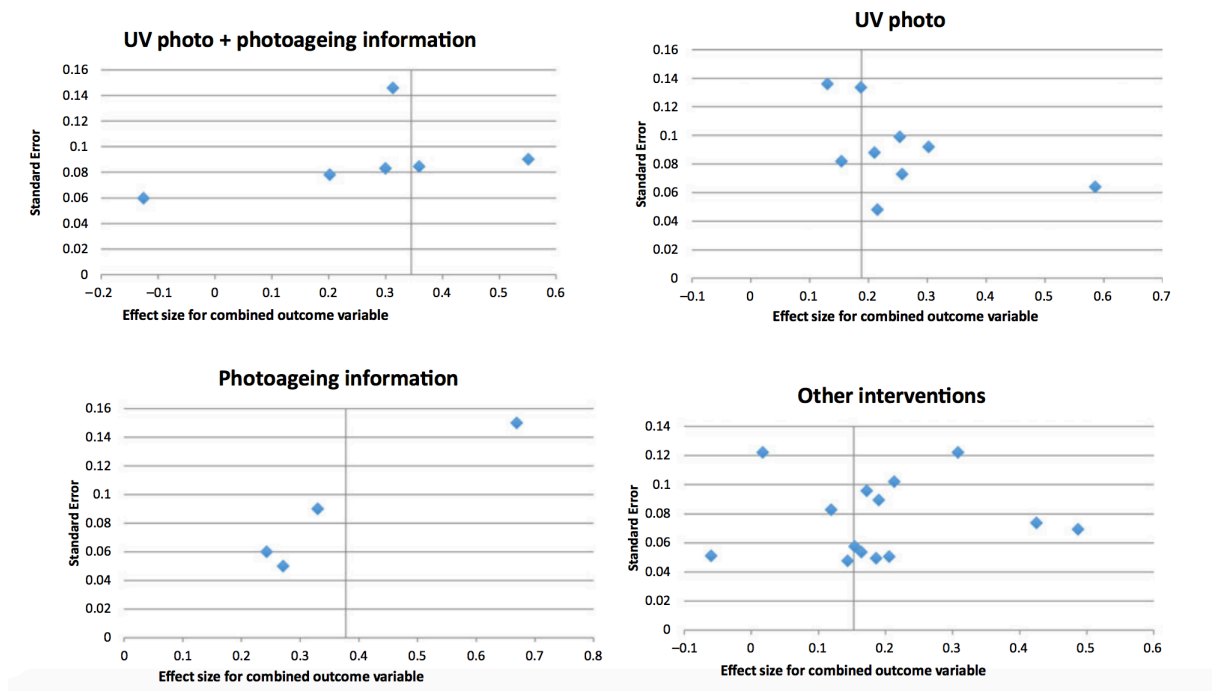


Figure 2.2. Plot of Effect Sizes and Standard Errors.

Table 2.2 presents the summary of the meta-analyses results (with combined effect sizes), and Figure 2.1 plots effect sizes and Standard Errors. The meta-analysis was carried out on four sub-sets categorised according to the type of intervention utilised; this is because some participants took part in more than one intervention, thus it was not possible to analyse the sample as one.

Ten studies (Christensen *et al.*, 2014; Dwyer, 2014; Heckman, Wilson, & Ingersoll, 2009; Mahler *et al.*, 2006b, 2013b; Mahler *et al.*, 2007b; Morris *et al.*, 2014a, 2014b; Pagoto *et al.*, 2010; Walsh & Stock, 2012) examined the effectiveness of UV photo on the combined outcome variable, and on sun protective intentions specifically. For the overall effect of this intervention on all outcomes, the combined effect size was small: $r = .19$; $k = 10$, $N = 1,564$, 95% CI: .08 to .30, $p < .001$. The effect size on sun protective intentions only was also small $r = .17$; $k = 8$, $N = 1,251$,

95% *CI*: .04 to .30, $p = .012$. Effect sizes were heterogeneous, $Q(9) = 35.38$, $p < .001$.

Four studies (Mahler *et al.*, 2006a, 2013a; Mahler *et al.*, 2007a; Tuong & Armstrong, 2014) examined the effectiveness of photoageing information on sun protective behaviour and intentions combined, and sun protective intentions separately. For the overall effects of photoageing on all of the above outcome variables, the combined effect size was medium $r^+ = .33$; $k = 4$, $N = 836$, 95% *CI*: .21 to .45, $p < .001$. On sun protection intentions only the effect size was small $r^+ = .27$; $k = 3$, $N = 813$, *CI* = .203 to .341, $p = .04$. Effect sizes were heterogeneous, $Q(9) = 7.65$, $p = .05$, using Higgins *et al.*'s (2003) proposed significance level of .10.

Six studies (Gibbons *et al.*, 2005; Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008; Mahler *et al.*, 2005; Mahler, Kulik, *et al.*, 2010; Sontag & Noar, 2017; Stock *et al.*, 2009) examined the effectiveness of UV photography combined with photoageing information on a combination of three outcome variables: sun protective behaviour and intentions and UV exposure (combined), and sun protective intentions separately. For the effectiveness of this intervention on the above outcome variables, the combined effect size was small, $r^+ = 0.26$; $k = 6$, $N = 918$, *CI* = .05 to .46, $p = .02$. The combined effect size on sun protection intentions only was medium, $r^+ = .42$; $k = 3$, $N = 32$, *CI* = .28 - .57, $p = .02$. Effect sizes were heterogeneous, $Q(13) = 54.89$, $p < .001$.

Fourteen studies (Chait *et al.*, 2015; Cooper *et al.*, 2014; Cornelis *et al.*, 2014; Heckman, Handorf, Darlow, Ritterband, & Manne, 2017; Hevey *et al.*, 2010; Hillhouse *et al.*, 2017; Hillhouse *et al.*, 2008; Jackson & Aiken, 2006; Mahler, Beckerley, *et al.*, 2010a, 2010b; Owen *et al.*, 2016; Stapleton *et al.*, 2015; Stapleton *et al.*, 2010; Williams, Grogan, *et al.*, 2013b) examined the effectiveness of

interventions not classed as either of the above on a combination of all of the outcome variables, as well as sun protection intentions, UV exposure and UV exposure intentions separately. For the effects of these interventions on the above outcome variables, the combined effect size was small, $r^2 = .19$; $k = 14$, $N = 3895$, $CI = .12$ to $.27$, $p < .001$. On UV exposure intentions only, the combined effect size was small, $r^2 = .24$; $k = 7$, $N = 1798$, $CI = .13$ to $.37$, $p < .001$. On actual UV exposure, the effect size was small, $r^2 = .15$, $k = 6$, $N = 1878$, $CI = .01$ to $.30$, $p = .04$. Finally, the effect on sun protection intentions was non-significant, $r^2 = .22$; $k = 5$, $N = 773$, $CI = -.02$ to $.46$, $p = .07$. Effect sizes were heterogeneous, $Q(6) = 26.67$, $p < .001$.

Summary of risk of bias scores. As only one unpublished study was included in the analysis, it was not possible to assess publication bias by directly comparing effect sizes of published and unpublished studies. Thus, a trim-and-fill analysis was performed (Duval & Tweedie, 2000) using STATA version 11 (StataCorp, 2009). Results revealed that there was no bias in interventions utilising UV photo, photoageing information or interventions classed as neither. It did, however, reveal a publication bias in interventions utilising UV photo in combination with photoageing information, filling three studies, rendering the results non-significant, $p = .41$.

To ensure the meta-analytical effect sizes were not adversely impacted by underpowered studies from relatively small samples, an Egger's regression was also performed (Egger *et al.*, 1997). Results revealed no small study bias in any of the intervention types.

Discussion

Summary of Evidence from the Systematic Review and Meta-Analysis

The current study provides a valuable contribution to the existing literature, as it includes 20 individual articles (consisting of 22 independent studies) published between 2012 and 2017 that were not included in Williams, Grogan, *et al.* (2013a), yielding an updated examination and analysis of current directions within research on appearance-based interventions to reduce UV exposure. Furthermore, as the meta-analysis contains a greater number of individual studies, it represents a more reliable reflection of the effectiveness of these interventions. Additionally, the current review includes one unpublished paper, a factor that goes some way towards counteracting publication bias.

Appearance-based interventions were generally successful in reducing UV exposure, supporting the findings reported by Williams, Grogan, *et al.* (2013a). The inclusion in the current review of research utilising facial morphing indicates that this could be an effective intervention for behaviour change, which is an important finding in light of the focus of this PhD. However, three studies did not find an effect of an appearance-based intervention when compared to a health-based intervention, which was not identified by Williams, Grogan, *et al.* (2013a). One observation made in the current review is that two of these studies used active rather than passive control. This therefore calls for further investigation, especially since the type of control condition can have a notable impact on effect sizes (Karlsson & Bergmark, 2015).

The results of the meta-analyses indicate that appearance-based interventions are associated with a small positive effect on intentions and behaviours. The largest effect sizes were associated with UV photography combined with photoageing information. These results may indicate that providing individuals with two sources of information - visual and descriptive - with subjective (i.e., participants viewing

their own skin damage) and objective (i.e., factual information about skin damage) focus, could be an effective way to influence UV-related behaviours. The component of photoageing information can also be manipulated according to theory, which may be beneficial, as it could enhance health interventions with theoretical constructs. As noted by Norman *et al.* (2018), interventions based on theory appear to be more effective than those who are not, possibly because a significant amount of formative work has proceeded the experimental stage of the research (Evans, Norman, & Webb, 2017). For instance, Mahler *et al.* (2005) utilised theory of alternative behaviours (Jaccard, 1981) by aiming to alter participants' perceptions of UV exposure and providing an alternative to tanning (sunless tanning products). Other effective theoretical constructs in this sample included social comparison theory (Festinger, 1954), and theory of planned behaviour (Ajzen & Madden, 1986). As these interventions appeared to be effective in reducing UV exposure and increasing sun protection among students as well as the general public, it is likely they could be widely implemented. However, due to the issue of publication bias in this sample, it is difficult to draw definitive conclusions. Future research would benefit from investigating this issue further, for instance by designing interventions based on formative work and theory, or by examining theory-driven moderators such as CFC. The subsequent chapters of this thesis will outline a number of studies that have considered interventions and moderators that are driven by formative, as well as theoretical work.

There are a number of issues to consider when interpreting the results of the meta-analysis. The most common outcome variable was sun protective intentions, which limits the conclusions that can be drawn on other variables. Given the limited number of studies with longer follow-ups, it was not possible to include follow-up

length as a moderator in the analysis; it is therefore difficult to determine whether the techniques used would have long-term effect on behaviour, as well as immediate effect on intentions. Considerable variability of research methodologies (e.g., control group conditions and inclusion/exclusion of darker skin tones) and reporting style (e.g., inclusion/exclusion of baseline comparisons and non-significant variables) between the studies makes it difficult to directly compare results between the studies. Furthermore, there was a wide span of effect sizes in the sub-set of the meta-analysis which included any intervention that did not utilise UV photo or photoageing information. This suggests that some of these interventions may be more effective than others, and this should be further investigated in future research. Lastly, the meta-analysis identified a publication bias among studies utilising UV photo in combination with photoageing information. It is therefore recommended that researchers and journals alike consider null results for publication, as this would improve accuracy in estimations of the effectiveness of these types of interventions.

Sample Limitations and Future Research

Despite men being slightly more likely than women to be diagnosed with skin cancer (Cancer Research UK, 2018c) there was an overwhelming majority of female participants. Given that the current review identified only four studies of male participants, future research would benefit from including men in the study population, particularly as men also value a tanned appearance, and have higher levels of skin cancer mortality than do women (Cancer Research UK, 2018c; Day, Wilson, Hutchinson, & Roberts, 2017). As men may perceive tanning and appearance norms in different terms than women, such as reluctance to engage in practices regarded as feminine (Gough, 2006; Grogan, 2016), future appearance interventions with men may need to consider the role of masculinity.

Moreover, study samples were overwhelmingly young (16-35 years); as age increases, the risks of skin damage build up, so it therefore seems relevant to include an older population in future studies (Cancer Research UK, 2018c). Most participants were White; as populations with darker skin are also at risk of skin cancer (Skin Cancer Foundation, 2016a), future research would benefit from more diverse samples. Two studies (Morris *et al.*, 2014a, 2014b) specifically excluded Black participants, which is concerning given that Oyebanjo and Bushell (2014) identify this group as particularly susceptible to future diagnoses of skin cancer, including an elevated mortality risk, due to late diagnosis. Finally, some studies (Mahler *et al.*, 2013a, 2013b) included a sample where a large number (47.3-51.0%) of participants had experienced skin cancer themselves, or known a family member to do so whereas others did not include this as a variable in the analyses (Morris *et al.*, 2014a, 2014b). There is some evidence that people who have had a previous diagnosis of skin cancer, or known a family to do so may, in line with the health belief model (Rosenstock, 1974), view this as a ‘teachable moment’, which improves engagement with sun protection practices, although this is possibly dependent on health care availability and level of education (Azzarello, Dessureault, & Jacobsen, 2006; Manne & Lessin, 2006; Soto *et al.*, 2010). To avoid this variable skewing results, it should be consistently measured in future research.

The majority of the studies were conducted in the USA, raising concerns about generalisability of findings to other areas. They were also mainly conducted in locations with high levels of sun exposure (such as Florida), and it might therefore be difficult to predict whether interventions are effective in countries with fewer days of sun. Qualitative research has indicated that people living in locations with fewer hours of sun (such as the UK) associate UV exposure with leisure time and

holidays; this may affect the effectiveness of an intervention to impact motivations to reduce UV exposure among these participants (Persson, Grogan, *et al.*, 2018).

Finally, 12 studies based their sample size on *a priori* power calculations, with the remaining studies stating a lack of power, or not specifying power calculations. This is problematic, as a potential lack of power in a majority of the examined studies may limit the conclusions that can be drawn from their results, as it can over or under-estimate the effect of the intervention, particularly in combination with publication bias (Charles, Giraudeau, Dechartres, Baron, & Ravaud, 2009; Minarik *et al.*, 2016). It is therefore recommended that future research consistently include *a priori* power calculations, as well as comparing any intervention with an active, rather than a passive, control condition, to ensure that the effect of an intervention is not overstated (Karlsson & Bergmark, 2015).

Conclusions

This chapter has reviewed research into skin cancer prevalence and it has been argued that there is a strong need to develop effective interventions to further reduce UV exposure among the population, thus providing a rationale for this PhD as a whole. It has further noted that appearance-focused interventions may prove to be effective in ways that health-focused interventions have not been, specifically focusing on facial morphing as a promising strategy. It has been concluded that older participants have been a particularly under-researched group, and that future research needs to target both women and men, as the latter have particularly poor health outcomes when considering skin cancer (Agence France-Presse, 2018).

This chapter has further presented findings from a published systematic review and meta-analysis that was conducted to examine the effectiveness of appearance-focused interventions to reduce UV exposure. This review and meta-

analysis provides a valuable perspective on current research into appearance-based interventions to reduce UV exposure, as it contains a large number of studies and includes findings on novel techniques such as facial morphing. The findings suggest that a variety of appearance-based interventions are associated with small positive effects on reducing sun seeking behaviours and/or increasing sun protective behaviours. With the previously discussed high levels of skin cancer rates across Western Europe and the US, this would suggest that implementation of these interventions have scope to prevent skin cancer in a large number of people, thus reducing both an economic burden on global health services whilst also preventing individual suffering. Findings indicate that practitioners who are looking to increase sun protection intentions should administer UV photo in combination with photoageing information, as this was associated with the largest effect size. These interventions could be administered to men and women alike, over a wide age-span, and they appear to be effective when implemented in a clinical and/or research setting.

A number of methodological issues may limit the conclusions that can be drawn from the existing studies. However, within the current context, this review contributes significantly to the existing body of research into appearance-based interventions to reduce UV exposure, and recommends that future research consistently employs a rigorous methodology (e.g., inclusion of power calculations, long-term follow-ups, etc.) and focuses on more varied outcomes (e.g., both sun protection and UV exposure) and includes a diverse sample population from a wider array of cultures. As motivations for UV exposure might differ in populations living in locations with less opportunities for sun exposure, this review specifically recommends that additional future research on the effectiveness of appearance-

focused interventions is conducted in places such as the UK and Northern Europe. Finally, the findings from this chapter were used to inform the design and implementation of the qualitative and quantitative studies discussed in subsequent chapters in this thesis. Specific focus was placed on addressing gaps identified in previous research, for instance by examining how an appearance-focused intervention is perceived by older age groups and men, as well as what theory-based moderators may impact on its effectiveness.

Chapter Three: Methodology

This PhD has adopted a mixed-methods approach, i.e., combining both qualitative and quantitative methods of data collection and analysis (Johnson & Onwuegbuzie, 2004) with a critical realist epistemological position (Willig, 2014). This chapter will argue that, in light of previous recommendations on behaviour change research in a health context, as well as the specific requirements of this PhD, a mixed-methods approach is the most suitable methodology. The different methods involved will also be described, including the main apparatus of this PhD: the facial morphing software (APRIL® age progression software). The qualitative methodology utilised for Study Two and Study Three will be outlined; this includes the interview protocol employed for the data collection, and the thematic analysis (Braun & Clarke, 2006) used for analysing the data. Finally, the chapter will detail the quantitative design of Study Four, the Randomised Controlled Trial (RCT); this includes an outline of the study design, stimuli, and all the scales administered to participants (outcome measures and moderator variables).

Mixed-Methods Approach

‘Mixed-methods’ can be defined as a procedure where a researcher collects, analyses, and integrates both quantitative and qualitative data within a single study or a programme of inquiry (Bryman, 2007; Creswell, Fetters, & Ivankova, 2004; Tashakkori & Teddlie, 2003). There is an increasing body of research advocating the benefits of utilising a mixed-methods approach to research, rather than viewing qualitative and quantitative approaches as incompatible (e.g., Johnson & Onwuegbuzie, 2004; Polit & Beck, 2010; Sandelowski, 2000). Specifically, the Medical Research Council (MRC) notes that experimental interventions can be successfully complemented by qualitative research to assess the efficacy of

behaviour change interventions within a healthcare setting (Craig *et al.*, 2013). Similarly, Johnson and Onwuegbuzie (2004) propose that qualitative and quantitative methods can complement each other, particularly concerning larger-scale projects (i.e., comprising of more than one study), as the integration of qualitative methods acknowledges that subjective decisions will be made by humans throughout the research process. As applied to this PhD, the current programme of research evolved through human decisions, specifically by using qualitative enquiry to inform the quantitative study, resulting in several projects rather than one individual study. Johnson and Onwuegbuzie (2004) further argue that mixed-methods research has the capacity to comprehensively answer a number of research questions, as it allows the researcher freedom from dogmatism and restriction. As the current PhD contains several multi-faceted aims, it is argued that a mixed-methods approach will be flexible enough to allow these to be answered in the most comprehensive manner.

Moreover, in their discussion of the most suitable way to evaluate the effectiveness of behaviour change interventions in health promotion contexts, Hanbury, Wallace, and Clark (2011) argue that a mixed-methods approach is likely to provide a richer and more accurate evaluation of an intervention (as compared to utilising only qualitative or quantitative methodology), something that is a crucial objective of the current PhD. Similarly, Sandelowski (2000) presents the idea that the complexity of any human phenomena is not readily captured by qualitative or quantitative methods alone. This is particularly true for UV exposure and appearance; both are dynamic phenomena with factors at times dissuading people from using sun protection, and at other times encouraging it (Cafri *et al.*, 2006). UV exposure is also considered by some to be a form of addiction, and is as such a

highly complex human behaviour (Stapleton *et al.*, 2017). Sandelowski (2000) further posits that researchers within a health context can improve the scope and power of their research by utilising a mixed-methods approach. It has also been suggested that a mixed-methods approach has the potential to improve generalisability of research findings if it is based on rich and complementary data sources (Polit & Beck, 2010). The current PhD was therefore designed with these recommendations in mind, aiming to employ data collection and analysis strategies that would complement one another, thus improving the scope of the research (Malterud, 2001)

Finally, a mixed-methods approach is the most suitable option for this PhD as a main aim is for the experimental research to be informed by in-depth enquiry into attitudes to UV exposure and sun protection among older people, and specifically, how the proposed age group interacts with facial morphing in a UV exposure context. This is in line with recommendations by Epton *et al.* (2015) who note that the development of interventions to improve health should be based on considerable formative work (driven by theory or exploratory research) prior to implementing experimental research. As there is a paucity of research into facial morphing in a UV exposure context (and none on people over 35 years of age's experience of facial morphing and sun damage), it is considered appropriate to utilise a qualitative approach to gain in-depth understanding about this, before proceeding with quantitative research to evaluate the long-term efficiency of this type of intervention. This can be further understood in the context of Ritchie, Lewis, and Nicholls (2013), who argue that qualitative research is interpretive and explorative, allowing the research to be participant-driven, a key objective of the earlier stages of this PhD. Once the inquiry has proceeded from abstract and exploratory to a stage

where the researcher can make predictions, it is appropriate to then implement a quantitative method of data collection and analysis (Sofaer, 1999). This further relates to suggestions that interventions based on theoretical and formative work may be more effective in changing behaviour (Epton *et al.*, 2015; Norman *et al.*, 2018). In sum, based on previous research into the benefits of utilising a mixed-methods approach, as well as the specific requirements of this PhD, the current methodological approach is considered the most appropriate choice.

The epistemological position of this research is critical realism (Willig, 2014), whereby it is acknowledged that the reality behind the findings (both qualitatively and quantitatively) exists independently of the researchers, but that the observations and findings from the research still hold true, as knowledge can be accessed through individuals (Ormston, Spencer, Barnard, & Snape, 2013). Importantly, a critical realist position is also compatible with the perspective of combining qualitative and quantitative research methodologies (Maxwell & Mittapalli, 2010), as it validates and supports key aspects of both quantitative and qualitative approaches. Moreover, this PhD seeks to explain a number of phenomena related to appearance-focused interventions to reduce UV exposure, and not merely describe them, a key aspect of realism (Maxwell & Mittapalli, 2010; Ritchie *et al.*, 2013). The critical realist position does however acknowledge that knowledge is produced by social structure, and as such, cannot be considered truly objective (Willig, 2014).

Finally, throughout the research process, care was taken to maximise the benefits of utilising a mixed-methods approach, thus adhering to the ‘fundamental principle of mixed research’ (p.18) proposed by Johnson and Onwuegbuzie (2004). The principle states that mixed-methods researchers should apply data collection

techniques and analyses in such a way that it results in complementary strengths, while minimising weaknesses. As is detailed throughout this thesis, a wide variety of sampling methods (e.g., meta-analysis, interviews, etc.) and data analysis strategies (e.g., thematic analysis, statistical testing, etc.) were therefore used.

Facial Morphing Software

The facial morphing software used for Studies Two, Three, and Four in this PhD is APRIL® age progression software (AprilAge Inc, 2017). It simulates real-life ageing on the face up to the age of 72 years old, i.e., demonstrating what a person could potentially look like as they age up to a maximum of 72 years. An example facial morphing image can be found in Appendix D.

This means that the number of years a participant is morphed will vary according to the person's current age, i.e., a person who is 30 will 'age' 42 years, whereas a person who is 50 will 'age' 22 years, resulting in both their 'future' photos simulating their appearance at the age of 72 years. The software uses an ageing algorithm, and is based on previously published material on facial ageing, as well as a five-year study on the facial ageing of 7000 people of varying ethnicities, ages, and lifestyles (AprilAge Inc, 2017). The APRIL® software shows future, hypothetical damage, as compared to UV photo techniques which demonstrate actual and current sun-related damage (Gibbons *et al.*, 2005). APRIL® produces two separate photos over a 55 second period for participants to compare: their faces aged as though they had not been exposing their skin to UV rays and had also been using sun protection, and their faces aged as though they had been exposing their skin to UV rays and had not been using sun protection, so that the differences in facial damage are visually represented side by side. These effects can also be produced for smoking and weight gain. There is a 3D version of each photo, encouraging a life-like experience of the

ageing by highlighting UV damage to the sides and neck (Grogan *et al.*, 2011). The software can be used effectively with people of different ages and ethnicities, and has previously been used in qualitative and quantitative research on men and women in the context of smoking and UV exposure (e.g., Grogan *et al.*, 2011; Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b). No research up to date has examined how people aged 35 years and older interact with this type of software in a UV exposure context.

Studies Two and Three

Qualitative Approach

A qualitative approach was utilised for Study Two and Three, which consisted of semi-structured interviews with men and women aged 35 years and older. Qualitative research is considered a useful means for developing and evaluating behaviour change interventions to improve health in response to a wide array of unhealthy behaviours; some notable examples include diabetes (Penn, Moffatt, & White, 2008), smoking (Clancy, Zwar, & Richmond, 2013), and obesity (Hesketh, Waters, Green, Salmon, & Williams, 2005). A qualitative methodology is useful within health policy research as it seeks to meaningfully explain human behaviour, particularly in the early stages of examination and exploration (Sofaer, 1999).

Crucially, a qualitative approach has been routinely used to study attitudes relating to UV exposure and sun protection use, both in the UK and internationally (Kirk & Greenfield, 2017; Leske, Young, White, & Hawkes, 2014). In the context of health promotion strategies to target addictive behaviours, Dugdale, Elison, Davies, and Ward (2017) argue that qualitative research has the capacity to provide novel insight into how well an intervention works, and mechanisms behind its

effectiveness. Qualitative methods have been widely utilised to assess factors that may impact the effectiveness of interventions to reduce UV exposure, suggesting that this is a useful approach for future research in this area (see Garside, Pearson, and Moxham [2010] for a systematic review of 15 qualitative studies on this topic).

Importantly, findings from qualitative studies can therefore be used to develop and improve an intervention, and to maximise its impact on a particular population (Michie *et al.*, 2005; Sofaer, 1999). This is particularly relevant in the context of facial morphing; as this is a relatively new intervention, it is important to study the ways in which it can be most effective in changing behaviour, especially in the context of an under-researched participant group such as those aged 35 years and older. Sofaer (1999) contends that a qualitative approach is particularly useful in situations where a researcher is not only unsure about the answers to questions, but unsure about the questions themselves. This aligns with an overarching aim of this PhD, which is that each stage of the research should inform the next; i.e., the qualitative methodology is applied to discover what questions should be further examined and quantified by using a quantitative methodology in the later stages of the research.

While acknowledging previous criticisms of qualitative research lacking in generalisability, Groleau, Zelkowitz, and Cabral (2009) argue that conversations around health are a vital means of shaping a common narrative for humans, and that these experiences are generalisable. They further point out that qualitative research has the capacity to inform public health policy, and influence clinicians, which align with the overall aims of the current PhD, which seeks to be informative to healthcare practitioners. The capacity for qualitative research to be generalisable (albeit in different ways than quantitative research) is further supported by other researchers

(e.g., Firestone, 1993; Polit & Beck, 2010). The qualitative research outlined in this PhD is carried out with the standards of relevance, validity, and reflexivity in mind, as proposed by Malterud (2001).

Interview protocol. A list of topic areas was developed for the interview protocol, which was based on topics covered by similar research with younger women and men (Owen *et al.*, 2016; Williams *et al.*, 2012), and modified to accommodate the aims of the current study. Modification involved adding questions on general attitudes to UV exposure and sun protection, to widen the scope of the research to be relevant outside a facial morphing context. The full interview protocol can be found in Appendix E. The interview questions were designed in line with recommendations by Malterud (2001) of relevance, where method and design should seek to address the overall aims of the research. Crucially, the interviews contained questions on participants' current and previous attitudes to UV exposure and sun protection (e.g., "Do you use sun protection?", and "Was there a particular age when your attitudes to UV exposure and sun protection became relevant to you?"), as well as reactions to the facial morphing intervention (e.g., "How do you feel about the high-UV photo" and "Do you notice any differences between the two photos?"). The inclusion of questions on attitudes to UV exposure and sun protection is different to previous work on younger women (Williams *et al.*, 2012); this decision was made to allow for the study findings to be relevant to anyone seeking to understand attitudes to sun exposure among this age group, even outside a facial morphing context. It was also expected that the general questions on UV exposure would signpost relevant moderators to be examined in the experimental study. Moreover, it was decided to include questions on participants' general attitudes to UV exposure as there is a paucity of research examining how older people negotiate motivations and barriers

for sun protection, and none to date in the UK. This is in line with the previously discussed benefits of utilising a mixed-methods approach, where the different methodologies can complement each other, and be used to maximise the efficacy of an intervention (Johnson & Onwuegbuzie, 2004; Sandelowski, 2000)

Participants' spontaneous reactions to their faces being morphed were also recorded. To allow any gender differences to occur naturally, men and women were asked the same list of questions, however this list was used flexibly in interview sessions to stimulate discussion. Importantly, questions relating to participants' general attitudes to UV exposure were asked prior to the facial morphing, to ensure the answers to these questions were not unduly affected by the intervention process. Finally, it was also anticipated that these findings would be useful for other researchers looking to design interventions to reduce UV exposure among this age group.

Data collection. The method of data collection for Study Two and Three was semi-structured interviews, which was chosen in line with considerations by Malterud (2001) of adopting a data collection method suitable for the aims of the study, thus maximising validity of findings.

There have been many criticisms of in-depth interviews as a method for data collection, including those arising from positivism (i.e., that results are too subjective to be generalised, and lack scientific value) or - on the opposite side of the spectrum - the pitfall of uncritically accepting interview data as a completely accurate representation of reality (Ritchie *et al.*, 2013). Whilst acknowledging this, interviews are still considered a useful means of data collection, and are consistently used to gather information on various health-related behaviours (e.g., Groleau *et al.*, 2009; Sofaer, 1999). Strengths of using semi-structured interviews as a method for data

collection include that they allow for the gathering of in-depth information, findings have good interpretative validity, and probing allows the researcher to explore issues of interest in more depth (Burke-Johnson & Turner, 2003). Legard, Keegan, and Ward (2013) further argue that interviewing is a robust way of data collection, particularly when aiming to explore a phenomenon. This applies well to the current research project, where a main aim is to explore how participants 35 years and older experience the facial morphing process, something that has not been done before. Individual interviews have been previously and successfully used in the context of facial morphing research, and rendered rich findings that have furthered the understanding of this particular intervention (e.g., Flett *et al.*, 2017; Williams *et al.*, 2012). Finally, a number of researchers have presented the potential benefits to participants from participating in interviews, something that is rarely acknowledged when considering methods of data collection. Some of these benefits include giving participants a voice, and providing a platform for self-reflection and self-awareness (e.g., Beck, 2005; Hutchinson, Wilson, & Wilson, 1994)

Sample size was guided by recommendations on data saturation (Guest, Bunce, & Johnson, 2006), i.e., when little or no new information is presented in the interviews, as well as considerations of information power (Malterud, Siersma, & Guassora, 2016), and was also informed by previous work in this area with women and men under 35 years (Owen *et al.*, 2016; Williams *et al.*, 2012). This approach is consistent with the contention by Strauss and Corbin (1990) that saturation is never an absolute but always a "matter of degree" (p.136). They suggest that there is always the potential for "the new to emerge" and that instead saturation should be more concerned with reaching a point where it becomes "counter-productive" and that "the new" does not necessarily add anything to the overall story, model, theory

or framework (p.136). This sample size is in line with previous research indicating that variation of a phenomenon in question reaches saturation at round 20 participants (Alexandersson, 1994).

Data analysis. Inductive thematic analysis (Braun & Clarke, 2006) was used to analyse data from the interviews. The six stages identified by Braun and Clarke (2006) were followed, including reading through the interviews scripts and identifying words and concepts that appeared meaningful, developing these into themes, reviewing these with the supervisory team, and picking out the most prominent themes based on how relevant they appeared. Transcripts were initially read, and interesting points were noted. They were then re-read, and coded line by line. Finally, these codes were analysed further and organised into themes with a more abstract meaning. Themes were agreed upon by the supervisory team, further ensuring validity of findings.

Thematic analysis was chosen because it is generally considered theoretically ‘free’, in that it is not tied to a specific theory, thus allowing for freedom and flexibility in interpretation of data (Nowell, Norris, White, & Moules, 2017). Braun and Clarke (2006) list a number of advantages of using thematic analysis when analysing interview data. First, because of its theoretical freedom, it can easily be adapted to suit a variety of research projects. Second, it provides a rich and detailed account of complex data, and can be a useful method for highlighting similarities and differences between participants. This is particularly relevant for UV exposure, where practices of sun protection appear to vary significantly between individuals (Kirk & Greenfield, 2017). Third, themes are generally considered to be clearly derived from the data, a key advantage as it demonstrates confirmability and validity, i.e., that the findings are not subjectively imagined by the researcher, but

are strongly grounded in the data itself (Malterud, 2001; Tobin & Begley, 2004). Finally, it is considered a useful method for analysing larger data sets as it produces a clear and organised output (Braun & Clarke, 2006). This is particularly relevant for the current programme of research, as it consists of 50 individual interviews across the two qualitative studies, resulting in a large amount of data. Thematic analysis is an established method of qualitative analysis, and has previously been used to analyse interviews with both men and women in the context of UV exposure-related behaviours (e.g., Loosemore & Grogan, 2015; Prior & Rafuse, 2016).

Data were analysed using NVivo Qualitative Data Analysis Software (QSR International, 2016). NVivo is increasingly popular as a computational tool for data analysis, and is routinely used in health research contexts (Bringer, Johnston, & Brackenridge, 2004; Woods, Paulus, Atkins, & Macklin, 2016). NVivo was chosen as the analytic tool for several reasons. First, qualitative data analysis programs such as NVivo enhance transparency of data, as it can be readily made available to other researchers, who can easily understand the data structure because of the organisation of the software itself (Bringer *et al.*, 2004). This contributes to the previously discussed objective of ensuring that the qualitative research produced findings that adhere to validity and confirmability (Malterud, 2001; Tobin & Begley, 2004). Second, software such as NVivo has the potential to promote scientific rigour of qualitative research, as it structures the raw material and the emerging themes in a way that clearly organises, and to a certain extent standardises, the analytic process (Woods *et al.*, 2016). It is therefore highly compatible with thematic analysis, as this aims to produce themes strongly anchored in the raw data (Braun & Clarke, 2006). Finally, the UK Economic and Social Research Council (ESRC) specifically recommends that doctoral students are skilled in using qualitative data analysis

software, so it was considered highly relevant to follow these recommendations and develop this particular skill-set (Bringer *et al.*, 2004).

Despite the many advantages of using thematic analysis as a method for data analysis, the current research project also acknowledges, and attempts to account for, weaknesses and common pitfalls of this type of method. Throughout the analysis, the raw data were continually checked to ensure the final themes were directly related to the original material (Braun & Clarke, 2006). As the freedom of thematic analysis can sometimes lead to inconsistency of themes, data were checked by more than one researcher to ensure credibility, as recommended by Nowell *et al.* (2017). This was further accounted for through peer-review, as Study Two went through several stages of revision, and was published in *Psychology & Health* (Persson, Grogan, *et al.*, 2018). Study Three (Persson *et al.*, *under revision*) is currently under revision in *Psychology & Health*, and findings have thus also been checked by other researchers through peer-review. Finally, to ensure methodological rigour, the research process and decisions taken in relation to it were documented and justified at each stage of the process (Fereday & Muir-Cochrane, 2006; Nowell *et al.*, 2017; Tobin & Begley, 2004).

Study Four

Quantitative Approach

A quantitative approach was utilised for Study Four, which consisted of a small-scale RCT with men and women. A quantitative approach is generally recommended when the aim is to directly measure the impact of an intervention on a particular behaviour, whilst simultaneously using software and scales (e.g., Babbie, 2010). It also provides a solid evidence base from which to draw conclusions, and results can often be generalised to a wider population (Babbie, 2010; Firestone,

1993). In a typography of three generalisation types (sample-to-population; analytic generalisation; case-to-case transfer), Firestone (1993) argues that sample-to-population is the only one that cannot be applied to qualitative research, although some researchers (e.g., Dugdale *et al.*, 2017; Malterud, 2001) contend that qualitative findings adhering to principles of scientific rigour may be transferred to other populations. This means that by also including quantitative research, the current PhD aims to maximise generalisability of the findings, thus adhering to the previously discussed ‘fundamental principle of mixed research’ (p.18), as proposed by Johnson and Turner (2003).

Design. The study is a small-scale RCT with men and women; it examines the impact of two independent variables (IVs) on a number of dependent variables (DVs), namely participants’ self-reported sun protection use (SPB), sun protection intentions (SPI), and UV exposure (UVE). The first IV is type of UV-intervention, which compares a facial morphing intervention to a health-focused intervention (further details on this stimulus can be found on on page 64). The second IV is presence of implementation intentions instructions versus absence of implementation intentions instructions (Gollwitzer and Schaal [1998]; discussed in greater detail on page 65), resulting in a 2x2 factorial design. The impact of several moderating variables, including appearance concerns, consideration of future consequences (CFC), and masculinity (for men only), was also examined. Educational qualification was an intended moderator, but was later excluded based on the limited spread of responses; it was nonetheless controlled for in analyses. Analyses further controlled for baseline levels of SPI/SPB/UVE, gender, and previous experience of skin cancer. Due to the limited sample size, data for men and women were analysed as one, apart from when examining the moderating effect of masculinity, which was analysed for

men only. Detailed information on the moderators can be found on page 67, and information relating to the dependent variables can be found on page 72.

RCTs are widely considered the gold standard for evaluating healthcare interventions, as they allow researchers to directly compare the effect of an intervention with a control condition (Higgins & Green, 2011; Karlsson & Bergmark, 2015). Moreover, it is proposed that observed treatment effects can be directly attributable to characteristics of the intervention in question, as known and unknown confounders will vary randomly across the trial groups (Cochrane, 1972; Eccles, Grimshaw, Campbell, & Ramsay, 2003; Higgins & Green, 2011); therefore, one can be more confident that the observed outcome is a direct result of the intervention, rather than any confounding factors.

For the current study, a block randomisation technique (also called restricted randomisation) was used to allocate participants to conditions; this involves sequencing a set number of participants to be randomised to conditions (Matts & Lachin, 1988). Block randomisation is generally considered a useful means of ensuring approximately equal sample size across conditions, something that can minimise the risk of confounding factors in a study (Sedgwick, 2014). A quantitative approach specifically using RCTs has been widely implemented in assessing appearance-focused interventions to reduce UV exposure (e.g., Hillhouse *et al.*, 2008; Pagoto *et al.*, 2010; Stapleton *et al.*, 2015). A quantitative approach has also been utilised to assess the impact of facial morphing in reducing UV exposure and improving sun protection practices (Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b). However, it should be noted that the facial morphing studies were not RCTs, but instead used a block design (i.e., allocating a set number of participants to each condition for every testing session; not to be confused with block randomisation) to

allocate participants to conditions; this further adds to the relevance of the current research project, as the randomisation technique improves the quality of the evidence base for facial morphing as a means to reduce UV exposure (Cochrane, 1972).

The Cochrane handbook (Cochrane, 1972; Higgins & Green, 2011) largely distinguishes between active control conditions (e.g., a different type of intervention or treatment) and inactive/passive control conditions (e.g., no treatment or waitlist only). The notion of a control condition is important for any RCT because, as Holland (1986) notes, the effect of a cause will always be relative to what the cause is compared to, i.e., the effect of an intervention will inevitably be relative to the control condition that it is compared to. Despite this, Karlsson and Bergmark (2015) argue that too little attention is paid to the type of control group utilised in studies assessing behavioural interventions for addiction, and the potential impact of this on effect sizes. For the current study, an active control condition was therefore implemented, where participants in this condition received a different type of intervention (health-focused).

Moreover, an active control condition assesses whether an intervention is effective relative to something else (i.e., another intervention), whereas an inactive control condition determines absolute effects, i.e., how effective the intervention is compared to participants receiving nothing else (Karlsson & Bergmark, 2015). This can be further understood in the context of Brigham, Feaster, Wakim, and Dempsey (2009) who suggest that the type of control group should be determined based on the aims of the research; they specifically recommend that an active control group is used when there is prior evidence for other interventions aimed at changing a particular behaviour, and a study aims to assess whether a novel intervention can improve effectiveness when compared to the established one. The most appropriate

choice for the current research project is therefore to use an active control condition, as there is currently no public health body recommending that nothing is done to reduce skin cancer levels (e.g., WHO, 2018). In fact, as was discussed in Chapter Two, the impact of health-focused information on UV exposure is widely researched, and is currently the most common strategy used by public health bodies in an attempt to increase sun protection use; it is therefore relevant to compare any novel intervention to what is currently considered best practice (NHS, 2017; WHO, 2018). By comparing appearance-focused interventions to current best practice it can therefore be determined if a policy change should be recommended, i.e., whether interventions such as facial morphing may in some cases be preferential to those emphasising the health-related consequences of UV exposure. Finally, the decision to include an active control condition rather than an inactive one was also based on the findings from Study One, which identified the need for future studies into appearance-focused interventions to reduce UV exposure to employ active control conditions.

It is strongly recommended that any behaviour change study bases its sample size on power calculations, to ensure that the study is capable of detecting an effect of a particular intervention, whilst simultaneously avoiding recruitment of unnecessary participants (Cohen, 1992; Jones, Carley, & Harrison, 2003). To know whether a study is sufficiently powered or not also provides a useful context for interpreting findings. A review of ethics applications in clinical research by Clark, Berger, and Mansmann (2013) notes a general lack of detail in regard to sample size calculations. In the current context, this was supported by the findings from the systematic review discussed in Chapter Two, where the majority of studies did not include sample size calculations. Therefore, the current study utilised G*Power v3

(Faul, Erdfelder, Lang, & Buchner, 2007) to determine an appropriate sample size, where calculations were based on the desired power (.80), anticipated effect sizes ($f= 0.4$ for facial morphing [Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b]; $f= 0.25$ for implementation intentions [Gollwitzer & Sheeran, 2006]), as well as the number of factors (i.e., IVs, DVs and moderator variables) involved in the study. G*Power is considered a useful means of calculating power across the behavioural sciences (Faul *et al.*, 2007). Finally, as the systematic review in Chapter Two identified a need for future studies to employ long-term follow-ups, intervention efficacy was assessed immediately, four weeks, and six months following the intervention.

Stimuli. Below is a discussion of the stimuli used for the experimental study outlined in Chapter Six.

Health-focused intervention. As is noted above, an active control condition in the form of a health-focused intervention was delivered to participants in the comparison group. This intervention consisted of a PowerPoint presentation (four slides, no sound), delivered to participants individually. Full details on the health-focused intervention can be found in Appendix G.

A health-focused intervention was chosen as it reflects what is currently the most common strategy to reduce UV exposure among the population (WHO, 2018). To ensure that the comparison intervention given to participants reflected the current ‘Treatment as Usual’ (as recommended by Brigham *et al.* [2009] when comparing a novel intervention with current best practice), information in the health-focused condition was derived from the skin cancer information pages of Cancer Research UK (2018a) and the NHS (2017) – two of the most prominent public health bodies in the UK. Information included details on skin cancer incidences in the UK, causes of

skin cancer, health-related consequences of skin cancer, and warning signs of skin cancer. Care was taken to not include information on the appearance-related consequences of UV exposure, as this would have made the condition too similar to the facial morphing intervention.

There are several notable features to consider about the design of the control condition, particularly in how it is matched to the facial morphing intervention. The health-focused intervention was designed to match the appearance-focused intervention in delivery medium (laptop screen) and time (five minutes). The time of the intervention was chosen as several facial morphing sessions had been timed prior to designing the RCT, with an approximate mean time of five minutes. In addition, in order for the control condition to mirror the image-based nature of APRIL® (i.e., participants viewing two large photos), the control condition stimulus is largely image-based, containing nine images in total. These images were mainly derived from Cancer Research UK (2018a) and the (NHS, 2017) and mostly contained visual information on the health-related dangers of UV exposure, for instance graphs of skin cancer incidences or body areas affected by skin cancer.

Implementation intentions. The RCT also examines the effect of implementation intentions on the DVs, either in combination with the appearance-focused intervention, or the control condition. The implementation intentions are adapted from Armitage (2004) and consist of an A4 sheet of paper with implementation intentions-based instructions, where participants are asked to formulate and write down plans about future sun protection strategies on the empty lines below the instructions. Participants were allowed to do this in private. The implementation intentions can be found in Appendix H.

Implementation intentions are contingent, if-then plans that facilitate goal achievement through the planning of a course of action in a given situation (Gollwitzer & Schaal, 1998). It has been argued that implementation intentions can bridge the gap between positive intentions towards a particular behaviour (e.g., healthy eating), and actually executing the action (e.g., buying healthy food) that is necessary to facilitate goal achievement (Gollwitzer & Schaal, 1998; Orbell, Hodgkins, & Sheeran, 1997). In a meta-analysis of 94 independent studies, Gollwitzer and Sheeran (2006) summarise the main functional mechanisms behind implementation intentions, which include helping a person suppress unwanted responses, ignoring distractions, and providing an alternative course of action. Crucially, implementation intentions appear to create goal salience in relevant situations; environmental cues can be used to activate implementation of a particular behaviour, even to the point of automaticity, and as such minimise the need for expending mental resources (Armitage, 2004; Gollwitzer & Sheeran, 2006; Hostler, 2017). This is particularly relevant as the findings from the qualitative studies (discussed in Chapters Four and Five) are interpreted in the context of goal-directed behaviour theory (Carver & Scheier, 1982, 1990), noting that the goal of sun protection use is not sufficiently salient in certain situations (e.g., when gardening in the sun as compared to actively sunbathing) resulting in impaired goal achievement. This therefore provides a strong imperative for examining the effect of increasing goal salience through implementation intentions in the context of UV exposure, further emphasising that each stage of this PhD informs the subsequent one.

Implementation intentions have been successful in promoting achievement of a wide array of health-related behaviours, including adopting a low-fat diet, exercising, and quitting smoking (Gollwitzer & Sheeran, 2006). Importantly, asking

participants to write down future plans to use sunscreen, either in the form of generating a specific action plan or imagining future obstacles and suggesting counter-actions, have been found to have a positive impact on sun protection use (Craciun, Schuz, Lippke, & Schwarzer, 2012; Jones, Abraham, Harris, Schulz, & Chrispin, 2001). There is currently a paucity of research specifically utilising implementation intentions to reduce UV exposure. Still, a study aiming to examine parental sunscreen use in the Netherlands found that implementation intentions improved sun protection use, but only among those already highly motivated to use sun protection (van Osch, Reubsæet, Lechner, & de Vries, 2008). Importantly, implementation intentions have not been previously administered in conjunction with other interventions to reduce UV exposure, meaning that the current enquiry offers a unique insight into strategies to improve sun protection. It should also be noted that the majority of the participants in previous studies were female and younger than 40 years old, something that further highlights the relevance of the current research project, which includes men, and participants aged between 35 and 61 years.

Moderating variables. A moderator influences the strength of the relationship between two variables, e.g., the effect of a type of intervention on a given behaviour or attitude (Field, 2013). Depending on the value of the moderator (e.g., an attitudinal variable), the effect of an intervention may be stronger or weaker (Hayes & Rockwood, 2017). This can be contrasted with a mediator, which is a variable that fully or partially explains the effect of a variable on another (Field, 2013). Moderation analysis examines under what conditions an intervention is the most, or least, effective (Hayes & Rockwood, 2017). This can include the context of the intervention, or specific characteristics of the participants. As with qualitative

research, it allows for a detailed exploration of an intervention, something that is particularly important when examining a novel intervention such as facial morphing with a participant group it has not been previously implemented with (Hayes, 2012; Sandelowski, 2000). MacKinnon and Luecken (2008) argue that moderation analyses have great potential in yielding detailed information about interventions and participant groups that can be of significant benefit to future researchers in similar fields. Below is an outline of the four moderators examined in Study Four.

Appearance concerns. Appearance concerns form part of the wider construct of body image, and can be broadly defined as the extent to which a person is concerned about their physical appearance (Cash, 2000). Despite common misconceptions that appearance concerns decrease with age, several studies have found that appearance remains an important determinant of self-esteem and well-being well into older age, for both men and women (Baker & Gringart, 2009; Grogan, 2016). Importantly (and as discussed in greater detail in Chapter Two), appearance improvement is a key motivator for indoor and outdoor tanning, suggesting that this is a relevant variable to examine in relation to interventions aimed at reducing UV exposure (e.g., Dodd *et al.*, 2013; Stapleton *et al.*, 2017). This is particularly important given that the facial morphing intervention highlights the detrimental effects of UV exposure on facial appearance; it is therefore reasonable to predict that the level of concern people experience about appearance will play a role in how much the effect of UV exposure on appearance deters them from spending time in the sun.

The Multidimensional Body-Self Relations Questionnaire (MBSRQ), developed by Cash (2000) is used to measure appearance concerns. The original MBSRQ contains 10 sub-scales, measuring several facets of body image attitudes.

For the current study, the shortened version (MBSRQ-AS; 19 items) - measuring only appearance concerns and appearance evaluation - was used (Cash, 2000; Cash, Morrow, Hrabosky, & Perry, 2004). This scale has been validated on large populations of both men and women of varying ages, ethnicities and socio-economic backgrounds (Baker & Gringart, 2009; Cash *et al.*, 2004; Loland, 2000).

Consideration of future consequences (CFC). Conceptualised by Strathman *et al.* (1994), CFC is considered a relatively stable personality trait regarding whether people prioritise immediate versus distant consequences of a given behaviour, and the extent to which they are influenced by these to change their behaviour. It is argued that when presented with information detailing the negative, future consequences of a particular behaviour (e.g., lung cancer as a result of smoking), people who are unconcerned about distant consequences are less likely to be persuaded to change their behaviour (Kim & Nan, 2016; Orbell, Perugini, & Rakow, 2004; Strathman *et al.*, 1994). CFC is particularly relevant within a health context, as health behaviours generally involve delayed benefits and immediate costs (Murphy & Dockray, 2018; Orbell & Kyriakaki, 2008). A recent meta-analysis by Murphy and Dockray (2018) found that CFC predicted health behaviours across 53 studies, and the authors specifically recommend that the construct is further examined with sunscreen use.

Temporal perspective of future consequences applies to sun protective behaviours, as these can be perceived as involving immediate (e.g., inconvenience of applying sunscreen) and distal (e.g., reducing skin cancer risk in the long-term) consequences (Leske *et al.*, 2014; Rodrigues, Sniehotta, Birch-Machin, & Araujo-Soares, 2017). The inclusion of this measure was informed by the findings from the qualitative research (Chapters Four and Five) where participants negotiated their UV

exposure and sun protection use in terms of immediate and distal costs and benefits. Examining the effect of temporal framing of sun protection benefits messages, Orbell and Kyriakaki (2008) found that participants high in CFC were more persuaded to use sunscreen when the benefits were presented as long-term rather than immediate, with opposite effects in low-CFC participants. Consequently, based on previous research on CFC and health behaviours in combination with the specific findings from Studies Two and Three, CFC was included as a moderator in the RCT.

The Consideration of Future Consequences Scale (CFCS) (Strathman *et al.*, 1994) is a 12-item scale intended to measure CFC. The CFCS has been validated among both men and women of varying ages and ethnicities (Orbell *et al.*, 2004; Strathman *et al.*, 1994). Interestingly, Heckman *et al.* (2009) examined how appearance concerns as well as CFC relate to tanning and sun protection, and found that higher scores on both variables predicted greater sunscreen use and protective behaviours. Surprisingly, they also found that higher CFC scores predicted more instances of summer tanning. Their sample had a median age of 19, meaning that no research up to date has examined the impact of these variables in a UV exposure context in an older age group. Additionally, CFC has not been examined in the context of appearance-focused interventions to reduce UV exposure, which provides a strong rationale for the current research project.

Masculinity. Originating from role socialisation paradigms, masculinity can be broadly understood as stereotypes about male sex roles that provide a collective and organised understanding of who men are, particularly in relation to women (e.g., Courtenay, 2000; Mahalik, Burns, & Syzdek, 2007). Masculinity therefore guides the general perception of what a man is, as well as men's own behaviour. Masculine attitudes also encompass strongly endorsed beliefs relating to health, with many of

these grounded in the underlying self-perception of men as independent, self-reliant, and tough (for a detailed review, see Courtenay [2000]). In turn, this may result in men being less willing than women to seek out health advice, monitor their own health, and engage with interventions aimed at improving health (Courtenay, 2000; Robertson & Gough, 2010). Moreover, men who strongly endorse masculine norms are at particular risk for engaging in behaviours with negative consequences for personal health such as alcohol and tobacco use, poor dietary habits, and physical fighting (Galdas, Cheater, & Marshall, 2005; Mahalik *et al.*, 2007). It has been argued that this has a significant impact on men's health globally, going some way towards accounting for the previously discussed health gap between men and women (Baker *et al.*, 2014; Mahalik *et al.*, 2007; Robertson & Gough, 2010).

In the context of UV exposure, being male is associated with riskier sun exposure; this includes lower levels of sun protection use and limited adherence to sun safety recommendations (Courtenay, 2000; Julian, Bethel, Odden, & Thorburn, 2016; Kasparian, McLoone, & Meiser, 2009). Crucially, Walsh and Stock (2012) demonstrated that an appearance-focused intervention negated the negative relationship between masculinity and sun protection use. However, Dwyer (2014) found that masculinity was not a significant moderator in the effects of an appearance-focused intervention to reduce UV exposure, suggesting that further research is needed to establish how this variable may impact on the effectiveness of appearance-focused interventions to reduce UV exposure. Masculinity was therefore examined as a potential moderator among the men in the sample.

To measure masculinity, a shortened version of the Conformity to Masculine Norms Inventory (CMNI) (Mahalik *et al.*, 2003) was administered to the self-identified men in the sample, namely the CMNI-46 (Parent & Moradi, 2011). The

CMNI-46 consists of 46 items, and measures various constructs related to masculinity. The scale has been validated with men of varying ages and ethnicities (Parent & Moradi, 2009, 2011).

Educational qualifications. Several studies have found an association between educational level and a host of skin cancer-related attitudes and behaviours. Lower educational levels and SES appear to be associated with riskier sun exposure and less sun protection use (Falk & Anderson, 2013; Gavin *et al.*, 2012), fewer instances of self-skin examinations (Coups, Geller, Weinstock, Heckman, & Manne, 2010), and lower perceived skin cancer risk (Buster *et al.*, 2012). Highest educational qualification, as measured by the ONS (2010), was therefore an intended moderator, but the limited spread of responses resulted in this variable being treated as a covariate instead. For this question, participants indicate their highest level of education ranging from no formal educational degree to a postgraduate level education.

Dependent variables. The effect of the intervention is measured on three DVs: sun protective intentions (SPI), sun protective behaviour (SPB), and UV exposure (UVE). These DVs were chosen based on the literature review of the current research-base for appearance-focused interventions to reduce UV exposure (discussed in Chapter Two), and include items most commonly used to assess the effects of interventions. This ensures scale validity, but also allows for direct comparison of the current findings with past research. Items were derived from multiple studies as some only measured a given behaviour with a single question, and items were adapted where the original phrasing was not deemed to be applicable to the current context.

Sun protection intentions. The SPI scale consists of six items. Items include questions on intentions to use various sun protection strategies, including wearing protective clothing and applying sunscreen. Items also include questions on intentions to get a tan, either from indoor or outdoor tanning, and are largely derived from similar research into appearance-focused interventions to reduce UV exposure (Dwyer, 2014; Williams, Grogan, *et al.*, 2013b).

Sun protection use. The SPB scale consists of four items. Items include questions on past practices of sun protection strategies, e.g., how often participants have sought out the shade or used sunscreen. Items are largely derived from similar research into appearance-focused interventions to reduce UV exposure (Dwyer, 2014; Williams, Grogan, *et al.*, 2013b).

UV exposure. UV exposure is measured with two separate items, where participants indicate frequency of outdoor and indoor UV exposure. These items are derived from similar research into appearance-focused interventions to reduce UV exposure (Dwyer, 2014; Stapleton *et al.*, 2010) and have been widely used in research examining frequencies of indoor and outdoor tanning.

Conclusions

The present chapter has outlined the methodology used for the current programme of research, explaining the many benefits of utilising a mixed-methods approach, specifically focusing on how it can be applied to a behaviour change context (Craig *et al.*, 2013; Johnson & Onwuegbuzie, 2004; Polit & Beck, 2010). The chapter has detailed how these benefits specifically apply to the current PhD, as it examines a complex human behaviour (UV exposure and tanning) and assesses the efficacy of a novel intervention to reduce UV exposure (facial morphing). The PhD broadly aims to adhere to the ‘fundamental principle of mixed-methods research’

(p.18; Johnson & Turner, 2003), where data collection and data analysis strategies should complement one another, thus increasing the validity and generalisability of findings. Moreover, this chapter has positioned this PhD as being from a critical realist epistemological position.

Finally, this chapter outlined the qualitative methodology for Studies Two and Three; including the use of semi-structured interviews with men and women and the use of thematic analysis for extracting themes. Benefits of this approach have been discussed in detail. It has also outlined the quantitative methodology utilised for the RCT in Study Four. This involved detailing the notable features of the study design, including the use of an active control group and the inclusion of power calculations, whilst contextualising this with previous research in this area. The study stimuli, moderator variables, IVs and DVs have also been outlined. This chapter has specifically focused on how the findings from each stage of the PhD are used to inform the subsequent stage, and has concluded that the current methodological approach is the most appropriate choice when aiming to comprehensively answer the research questions outlined in Chapter One.

Chapter Four: A Qualitative Study of Attitudes to UV Exposure, Sun Protection, and a Facial Morphing Intervention in Women Aged 35 Years and Older

This chapter will outline the findings of a qualitative study into attitudes to UV exposure, sun protection, and a facial morphing intervention in women aged 35 years and older. Findings from the study were previously published (Persson, Grogan, *et al.* [2018]; attached in a folder to this thesis) but the current chapter will expand on information relating to the participant group, design, and implementation of this study, and how it relates to the other chapters of this thesis. The work described in this chapter contributes to the achievement of the first and second aims of this PhD: to investigate attitudes to UV exposure and a facial morphing intervention, as well to inform the design of the upcoming quantitative project by signposting relevant moderators that can be examined in the experimental study. By investigating general attitudes to UV exposure and sun protection, the findings of this study can hopefully be of use to other researchers studying strategies to reduce UV exposure, thus also achieving the third aim of this PhD: to contribute to the existing knowledge on strategies for increasing sun protection and reducing the number of skin cancer cases in the population.

Background

As discussed in greater length in Chapter Two, many people are aware of the dangers of UV exposure, yet fail to incorporate this understanding into taking precautions when exposed to the sun (Cancer Research UK, 2014; Miles *et al.*, 2005). There is therefore a strong rationale for examining novel interventions to reduce UV exposure, as health-focused interventions appear to be only moderately effective (Jackson & Aiken, 2000). Given that the systematic review and meta-

analysis (Persson, Benn, *et al.* [2018]; outlined in Chapter Two) indicated that appearance-focused interventions can be successful in promoting sun protective behaviour - both short-term and long-term - this appears a worthwhile avenue for future research to explore. The review also found that facial morphing interventions can reduce UV exposure long-term, but noted that as it is still a relatively novel intervention, more research is needed to understand how well it works in varying contexts and on different populations. Qualitative research with young women and men (age range 18-34 years) has indicated that facial morphing interventions can be effective in highlighting the dangers of UV exposure and making the threat of skin cancer self-relevant, therefore increasing motivations to reduce unsafe UV behaviour (Owen *et al.*, 2016; Williams *et al.*, 2012). Quantitative research with both genders has shown that this type of intervention can reduce intentions to tan, as well as increase actual sun protective behaviour (Owen *et al.*, 2016). However, the effectiveness of facial morphing has not previously been examined among people aged 35 years and older in a UV exposure context.

Participant Group

As discussed in greater detail in Chapter Two, body image research in general, and interventions to reduce harmful behaviours in particular, have tended to focus on a people aged under 35 years (Golinowska, Groot, Baji, & Pavlova, 2016; Persson, Benn, *et al.*, 2018; Williams, Grogan, *et al.*, 2013a), partly because of the well-known sampling bias of recruiting university students. Another reason - particularly relevant within the context of appearance-focused interventions to reduce UV exposure - is the general conception that young people are more concerned about their appearance than older people (Grogan, 2016). However, longitudinal research on large populations has indicated that while this is not

necessarily true, older people may perceive the importance of appearance in different terms than do young people (Grogan, 2012, 2016). Research suggests that older people are by no means unconcerned with their appearance, although the focus may shift to the preservation of a youthful appearance, particularly among women (Bordo, 2003; Jeffreys, 2014). Given that older participants (i.e., those aged 35 years and older) are under-researched in the context of behavioural interventions and health promotion (e.g., Golinowska *et al.*, 2016), the current study aims to expand the current body of research aimed at improving health across the entire population, by specifically focusing on strategies to reduce skin cancer levels, in line with the third aim of this PhD. The current study is therefore important in a general health promotion context, as well in a skin cancer prevention context.

Around 44% (53,602 women) of non-melanoma skin cancer incidences involve women (Cancer Research UK, 2018c). This provides a strong rationale for including women in any intervention to reduce UV exposure, particularly given the overrepresentation of women engaging in indoor tanning, a key risk factor for skin cancer (e.g., Choi *et al.*, 2010; Dodd *et al.*, 2013). The relationship between older women's body image and the ageing process is multi-faceted and dynamic (Grogan, 2016). Women aged 35 years and older are concerned about preserving a youthful appearance; societal pressure, media images, and attitudes of friends and family all contribute to worry and dissatisfaction about key areas of appearance, including the face (Lewis-Smith, 2014). At the same time, there is also evidence that older women self-objectify to a lesser degree than do younger women, although this effect possibly occurs later than 65 years of age (Tiggemann & Lynch, 2001). A contributing factor could be that many older women have experienced childbirth,

which has resulted in a more utilitarian view of the body, rather than the body being perceived as something for others to look at (Grogan, 2016).

The Current Study

Age increases the risk of skin cancer, and interventions targeting older adults are likely to have a greater effect on reducing skin cancer levels compared to those targeting younger people (Cancer Research UK, 2018a; Olsen *et al.*, 2018). It should also be noted that women of an older generation are less likely to have been exposed to UV-related health messages in their youth as compared to younger women; the first UK national skin cancer campaign ‘Sun Know How’ was implemented from 1996-1998 (Eagle, 2010). It is therefore of key interest to examine if, and how, an appearance-focused intervention like facial morphing could increase motivations to reduce UV exposure among older women. In order to contribute to the achievement of the first and second overall aims of this PhD, this study addresses two questions:

1. What are the attitudes (e.g., motivations and barriers) to UV exposure and sun protection among women aged 35 years and older?
2. How do women aged 35 years and older react and relate to a facial ageing intervention to reduce UV exposure?

Method

The current study utilised a qualitative approach, consisting of individual interviews with women aged between 35 and 61 years. The interviews focused on general attitudes to UV exposure, as well as reactions to a facial morphing intervention. As discussed in Chapter Three, this approach was chosen as facial morphing has not been previously examined in the context of UV exposure and older people, and the research is therefore, to a certain degree, exploratory (Sofaer, 1999). In line with the overall objective of this PhD, it is also considered important to assess

what processes are involved in this type of intervention, and how well it works on a specific population such as older women (Dugdale *et al.*, 2017; Sofaer, 1999). This, in turn, will inform the upcoming quantitative inquiry (Chapter Six) into the long-term effectiveness of facial morphing on actual behaviour. In addition, participants were asked about their general attitudes to UV exposure and sun protection, as it was anticipated that this would generate knowledge into what, if any, moderating variables would need to be considered for the RCT. Individual interviews were chosen as they result in rich data, allowing participants to answer the questions in an in-depth and personal manner (Willig, 2014).

The interviewer (the author of this thesis) was a female PhD researcher in her mid-20s, Fitzpatrick (1975) Skin Type 3 (cream white: sometimes mild burn). The supervisory team were three women in their 30s (Skin Type 2: white, fair; usually burn, tan less than average - with difficulty), 40s (Skin Type 3) and 50s (Skin Type 2). The interviewer engaged in reflexive analysis throughout the process of analysing and interpreting the data, following Finlay and Gough (2008). A detailed account of this reflexive analysis can be found at the end of this chapter.

Participants

This study specifically recruited female participants aged 35 - 61 years. The lower limit (35 years) was decided on as women older than this threshold are under-represented in research into appearance-focused interventions to reduce UV exposure (Persson, Benn, *et al.*, 2018), and facial morphing has not previously been investigated in a UV exposure context on women aged 35 years and older. The upper limit (61 years) was chosen as the facial morphing software can only 'age' a person up until 72 years of age; trial morphing prior to the study guided the decision that participants should be morphed by at least 10 years to see a noticeable difference

between their current and future image. The study focused exclusively on women, while men are the focus of the study outlined in Chapter Five.

There were 25 participants with a median age of 51 ($M = 49.32$, $SD = 6.92$). The most common Skin Types (Fitzpatrick, 1975) were 3 (36.0%; cream white; sometimes mild burn, tan about average) and 2 (32.0%; white, fair; usually burn, tan less than average - with difficulty). Twenty percent of participants described themselves as having Skin Type 1 (white, very fair; always burn, never tan), and 12.0% percent as having Skin Type 4 (brown; rarely burn, tan with ease). The number of participants was based on reaching data saturation (Guest *et al.*, 2006), i.e., when little or no new information was presented in the interviews, as well as considerations of information power (Malterud *et al.*, 2016). Sample size was also guided by previous work in this area with women under 35 years (Williams *et al.*, 2012). Participants were initially recruited by approaching people at a British university, and from this a snowball recruitment approach was used. All women spoke fluent English.

Apparatus

A laptop and web camera with the APRIL® software installed and an audio recorder (mobile telephone) were used in this study. Full details on the APRIL® software can be found in Chapter Three, on page 51.

Materials

An interview protocol was utilised. A detailed discussion on the content and development of this can be found in Chapter Three (on page 54), and the full interview protocol can be found in Appendix E.

Procedure

The study mostly took place at a British university, but also in participants' homes if the person facilitating the recruitment was previously known to the interviewer, and university lone working policies were followed (Manchester Metropolitan University, 2006). All sessions took place in a private space to allow for an element of participant-researcher confidentiality. Participants were first given the study information sheet, and were asked to sign a consent form. They were then asked to identify their Skin Type according to the Fitzpatrick (1975) test. Following this, the interviewer gave a brief introduction of the structure of the session, which was as follows: initially participants had their photo taken, and a few personal details (age and sex) noted to set up the software. At this stage, the session was not recorded, and it was used as an opportunity to familiarise the participant with the interviewer, to create rapport. This is in line with guidelines by Ritchie *et al.* (2013) who recommend that any interviewer establishes familiarity and makes the interviewee comfortable prior to commencing the research process.

Once the software was set-up, the audio recorder was turned on, and participants were asked about their general attitudes to UV exposure, e.g., "Do you use sun protection?" and "Do you sunbathe?". This was before any facial morphing took place, to enable capturing participants' attitudes unaffected by the intervention. The rationale for the order of the questions is outlined in Chapter Three, on page 48. After these questions, the basics of facial morphing were explained (e.g., that the right-hand photo viewed on the computer screen would be a simulation of the participant's future if they were exposed to UV, while the image on the left of the screen represents their future look should they abstain from UV exposure). Participants' faces were then morphed and displayed on the computer screen.

Natural verbal reactions to this process were recorded, initially without asking any specific questions. Following this, participants were asked specific questions about their reactions to the facial morphing, e.g., “Is there anything in particular you notice about the photo on the right?”, and its impact on their future intentions, e.g., “Does the photo on the right make you motivated to change your behaviour?”. Subsequent questions were based on participants’ responses to the initial questions, ensuring that topics considered important by participants were covered. Finally, participants were asked if there was anything they would like to add, to ensure no crucial information was overlooked. The recorder was then turned off, and participants were given a debrief sheet and thanked for their participation.

Ethical Considerations

The study had gained university ethical approval, and was conducted in accordance with The British Psychological Society (2018) guidelines; participants gave informed consent, were fully debriefed following the study, and data were anonymised by assigning pseudonyms to each participant. Details on the ethical approval can be found in Appendix F.

Data Analysis

The audio-taped interviews were transcribed verbatim, and the resulting data were analysed through inductive thematic analysis (Braun & Clarke, 2006) using NVivo Qualitative Data Analysis Software (QSR International Pty Ltd., 2016). The epistemological position underpinning the research, as well as the rationale behind employing thematic analysis, are discussed in detail in Chapter Three. For the thematic analysis, the six stages identified by Braun and Clarke (2006) were followed, including reading through the interviews and identifying words and concepts that appeared frequently, developing these into themes, reviewing these,

and picking out the most prominent themes based on how meaningful they were. Transcripts were initially read and interesting points were noted. They were then re-read, and coded line by line. Finally, these codes were analysed further and organised into themes with a more abstract meaning. Codes were short, and often based on words or brief phrases by participants (e.g., “sunscreen”, “getting a tan”, “going abroad”). The coding and themes were discussed and agreed upon by the supervisory team. Inductive thematic analysis was chosen as it allows rich themes to emerge from the data, thus linking them strongly to the information provided by participants (Patton, 1990). For the quotes below, (.) is used to denote a pause.

As discussed in Chapter Three, this research was carried out with the standards of relevance, validity, and reflexivity in mind, as proposed by Malterud (2001). A conscious effort was made to ensure that themes were strongly anchored in the raw data and produced with a certain degree of objectivity, so that validity and confirmability of findings were ensured (Malterud, 2001; Tobin & Begley, 2004). This aligns with the epistemological position of this PhD – critical realism – as it acknowledges that there is independent and objective knowledge to strive for, but that this knowledge will invariably be shaped by social realities and by the researcher (Ormston *et al.*, 2013). Validity and confirmability were further achieved by ensuring themes were agreed upon by the supervisory team, thus safeguarding against themes being a subjective product of one researcher. In addition, the study was written up for publication, and published in *Psychology & Health* (Persson, Grogan, *et al.*, 2018). As a published paper, it went through several stages of peer-reviewed revisions (by other researchers), further confirming the relevance of the themes.

Results

The themes that were found were organised under two categories. These categories were the topics covered in the interview questions: attitudes to UV exposure and reactions to facial morphing, and two key themes were found in each category. The thematic matrix in Figure 4.1 illustrates the relationship between the themes (including sub-themes). Quotes below are reported verbatim, with pseudonyms, ages and Skin Types in parentheses to provide context.

Attitudes to UV exposure:

1. Confusion and contradiction
2. Change and continuity

Reactions to facial morphing:

3. Shock, surprise, and negative reactions
4. Positive outcomes of the intervention

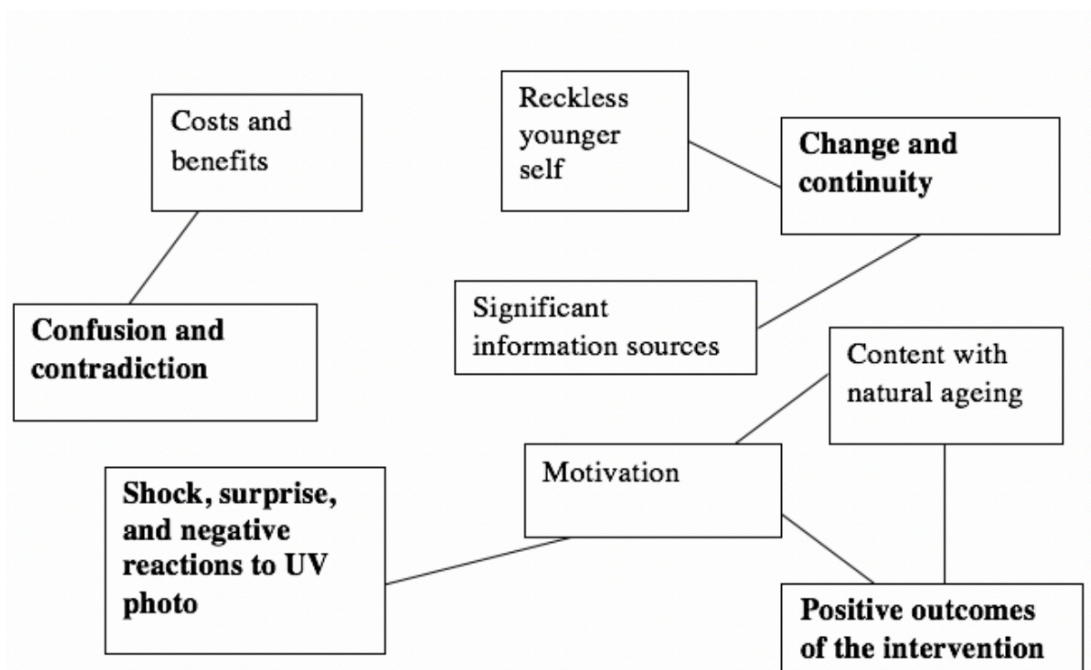


Figure 4.1. Thematic Matrix for Female Study.

Theme One: Confusion and Contradiction

There was a degree of confusion and contradiction in how the women discussed their attitudes to UV exposure and negotiated the use of sun protection, clearly demonstrating awareness of some sun safety recommendations but remaining unsure about others. They sometimes viewed UV exposure in terms of costs and sometimes in terms of benefits. The women's perceptions of the drawbacks and benefits of UV exposure impacted the choices they made, and sometimes served as a post-exposure justification that was used to make inferences about their own behaviour in certain situations. Long-term costs included the impact on health:

“I know I like tanning but I don't like it that much that I can put my body in danger” (Laurie, age 56, Skin Type 3)

“From... um a skin cancer point of view, in terms of being aware of the impact it can have on your skin” (Maya, age 40, Skin Type 4).

The women were also aware of the long-term costs on appearance:

“Overexposure does... um... damage your skin and makes you look older” (Kristin, age 61, Skin Type 3)

“Sun damage equals wrinkles when you're older... so... I've avoided it” (Simone, age 43, Skin Type 2)

Participants further identified sun-burns as a significant short-term cost of UV exposure, which was considered a strong deterrent to excessive UV exposure:

“I got really, really, really painful burns on my shoulders and it was, it was quite bad um... and I think, I think, I think that did make me more careful about, about the sun after that” (Molly, age 50, Skin Type 3).

Benefits of UV exposure included short-term appearance, health, and recreation.

Appearance-wise, women generally felt that a tan improved their physical appearance:

I quite like... having a tan... and um... you know it makes you look better”

(Hilary, age 54, Skin Type 2)

These women emphasised the importance of spending time in the sun for their well-being, and they felt that it had positive impact on their health, particularly highlighting the perceived benefit for their vitamin D levels (a consideration of vitamin D production versus sunscreen use can be found in Chapter Two on page 12):

“Yeah, cos you get vitamin D from the sun don't you so... that's important that you get enough vitamin D for your body from the sun” (Eva, age 61, Skin Type 3)

Furthermore, UV exposure was associated with leisure time and holidays, and this was a more common reason given for tanning than wanting a tanned appearance. A tan was sometimes valued as a representation of having been on holiday, e.g., achieving “a bit of a glow” (Naomi, age 51, Skin Type 2). That the primary motivations for UV exposure were not about appearance concerns may be something that differentiates them from a younger sample:

“You feel better I think when you're in the sun (.) makes you feel (.) good, gives you them good vibes” (Kristin, age 53, Skin Type 3)

Costs and benefits would be more or less salient at different times. Simultaneous awareness of various costs and benefits of being in the sun led the women to feel confused about UV exposure, as they were unsure whether spending time in the sun was good or bad for them. This confusion also appeared to stem from a lack of

knowledge about some aspects of the dangers of UV exposure and when to use sun protection:

“I read you're supposed to have it [sunscreen] on all year around and I also know that you're supposed to get some (.) is it 20 minutes of sunshine (.) or daylight so that your vitamin D. (.) grows so I'm a bit confused about that, about having it on or not having it on (laughter) or when you should put it on generally” (Doris, age 54, Skin Type 1)

“My skin will probably build up a resistance to it [UV exposure]” (Soraya, age 58, Skin Type 3)

There was also evidence of a mental distinction between harmful UV exposure (i.e., actively sunbathing), and what was perceived as less harmful UV exposure (i.e., incidental sun exposure, for instance gardening or going for a walk), where site and situation-specific cues determined whether women would protect their skin, and what precautions they would take to do this. This was particularly evident in situations where women were exposed to the sun but not actively sunbathing (perceived as not harmful UV exposure):

“If I was thinking I'm gonna go in the garden and read a book I'd think I'd need to put some sun (.) [protection on] whereas if I was just popping out to do a bit of gardening (.) It's mad isn't it, you fool your brain” (Margaret, age 51, Skin Type 2)

It was also evident that the women perceived the sun in the UK as less harmful compared to the sun abroad, and reported not feeling the need to take as many precautions when in the UK; this was generally associated with it not being hot enough in the UK to warrant the use of sunscreen. This further supports the notion

that although the women were aware of some sun safety recommendations, they lacked knowledge and were generally confused about others:

“I think it's different... I mean when you're staying here in this country, cos I always think like temperature is different over there and the heat is different, it's a lot... you don't sweat as much if you're away on holiday, whereas over here... you do.... so I just think it's sort of different” (Molly, age 51, Skin Type 2)

“And I don't think you can compare the strength of the sun here... to the sun abroad sometimes... where it's so much hotter and intensive” (Eva, age 61, Skin Type 3)

The women did not perceive there to be many drawbacks associated with using sun protection, and they generally agreed that sun protection was a good thing, and that they should be using more than they were currently doing:

“I know I should...(.) But I wouldn't all the time” (Eva, age 61, Skin Type 3)

To counter this, they employed a number of strategies to bridge this cognitive gap, including a self-attributed laziness and a tendency to forget, which emphasised contradictions between their attitudes and behaviour:

“I get it wrong all the time like I forget” (Harper, age 55, Skin Type 2)

“I'm a bit lazy; I don't always put it on as soon as I should” (Naomi, age 51, Skin Type 2)

The women also indicated that they were happy with their current level of sun protection, or perhaps that it was ‘good enough’ (whilst simultaneously identifying gaps or demonstrating situations that could objectively be perceived as high-risk), particularly through health-related downward comparison with smokers and ‘sun-worshippers’. This resulted in the women at times contradicting themselves, further

emphasising the conflicting nature of their attitudes to UV exposure and sun protection:

“I don't really sit in the sun like a sun worshipper so I... I'll probably be alright” (Toni, age 46, Skin Type 2)

“I've never smoked” (Sadie, age 48, Skin Type 3)

Relating to the above, this was also achieved through extreme case formulation where they justified their current level of UV exposure by formulating a hypothetical, extreme-case scenario with which to compare their relatively less extreme behaviour:

“I don't go on the sunbeds every week and I don't lie out in the sun with nothing on anyway” (Judith, age 44, Skin Type 3)

Theme Two: Change and Continuity

The women's attitudes to UV exposure were dynamic, and many of them felt that their attitudes had changed as they aged, something that is likely to be specific to the older sample:

“Cos wrinkles are mainly the main thing isn't it...from being in the sun... but no... put me off [sunbathing] a couple of years ago” (Kristin, age 53, Skin Type 3)

“I think as you get older you realise that it's not worth (laughter) - you don't want to burn at all!” (Eva, age 61, Skin Type 3)

Many had experienced significant life-events that had served to change, and in some cases reinforce, how they perceived sun protection and spending time in the sun; again, this is likely to be a difference between this sample and those younger than 35 years. Life events were evident among both younger and older women in the sample,

and included experiencing severe burns or knowing someone who had been diagnosed with skin cancer:

“I suppose I've thought about them [drawbacks of UV exposure] more I've got burnt...the more I've gone: oh I better wear something" (Toni, Age 46, Skin Type 2)

“I think... I've become more aware as I've got older of the... (..) potential risk and having known people who've actually developed skin cancer” (Alice, age 35, Skin Type 2)

There was a general sense among these women of an increased awareness of the dangers of UV exposure, both due to an increased self-awareness and a shift in priorities (e.g., having children) resulting from the general ageing process, but also because they felt that there was more information available to them now, than there was earlier in their lives. There was a definite sense of a ‘previous self’ for these women, who they refer to as more risk-taking than their current self, for instance in using tanning booths, lacking in sun protection use, and even in using olive oil whilst sunbathing:

“We used sort of like olive oil and different... things to... to... help us get a better colour” (Laurie, age 56, Skin Type 3)

“I think when you're young (.) you know when you're going on holiday (.) you're quite naive about the sun, you just think oh I'll look much better with a suntan, I'll go out in the sun, get myself a suntan” (Eva, age 61, Skin Type 3)

Important information sources had impacted on the process of change; these can be broadly categorised into personal and public sources. Aside from the aforementioned life events,

these women cited having children as one of the main factors in developing a more careful approach to UV exposure:

“Because you become aware when you're a mother that you got to have your baby covered up from that, from the sun, so you're covering them up and putting them in them safe suits um and things like that and t-shirts on hats on um so yeah (.) you're more aware of the sun and what it can do”

(Naomi, age 51, Skin Type 2)

They also cited public information sources such as the media as a key influence in being more careful in the sun, and generally agreed that there is more awareness about the dangers of UV exposure today, compared to when they were younger. This was evident among both older and younger women in the sample, indicating similarities in the impact of information campaigns. This suggests that although older women may not have had the same access to information in their youth as younger women have had, the information presented to them throughout their adult years has increased their knowledge on the dangers of UV exposure:

“We're probably going back about 20 years ago where it wasn't as (.) shall we say publicised (.) some of the impact that it would have on your skin (.) um (.) and so it was probably around (.) you know a certain campaign that happened at that time that sort of raised my awareness” (Maya, age 40, Skin Type 4)

“I just think that it's... I've just read so much about them [indoor tanning booths] over the years” (Kristin, age 61, Skin Type 3)

As a result of this, indoor tanning booths were viewed with particular negativity and most of the women were vocal about never wanting to use one again:

“I don't go on sunbeds; I did do but like... when you see all these reports now I don't” (Marie, age 53, Skin Type 3)

“In sort of my late teens, early twenties, um occasionally I would go on a sunbed (.) but it isn't something that I would do now” (Maya, age 40, Skin Type 4)

It should be noted that there was a sub-group of women in the sample who described themselves as extremely pale or with sensitive skin, and they all identified with having Skin Type 1, e.g., “I look like a milk bottle and I'm quite happy” (Emily, age 40, Skin Type 1). As the quote indicates, these women were generally content with their skin colour, and did not attempt to alter it by tanning. Their attitudes to UV exposure appeared to have remained relatively static throughout their life; they had consistently employed rigorous sun protection strategies such as using factor 50 sunscreen or avoiding the sun altogether:

“I burn... and...um... I just don't enjoy it; I get really hot really quickly... and I can feel my skin prickling... so I would never lie in the sun, but I'm outdoors quite a lot... but I would always put factor 30 or 50 on” (Sylvia, age 40, Skin Type 1)

“I try and avoid the sun as much as possible!” (Emily, age 40, Skin Type 1)

Theme Three: Shock, Surprise, and Negative Reactions to UV Photo

The three key aspects of the women's reactions to the facial morphing intervention were shock, surprise, and negative feelings towards the UV photo, as compared to the non-UV photo. Older and younger women were equally shocked, and this was conveyed through dramatic language such as “Oh bejesus!” (Naomi, age 51, Skin Type 2) and “Oh my Gosh!” (Alice, age 35 Skin Type 2) throughout the morphing process. Shock and surprise appear to link with group's partial confusion

about the dangers of UV exposure as outlined above; it is possible the women thought they were more aware of the dangers than they turned out to be, thus being surprised when faced with the level of skin damage that the sun can cause:

“Oh that's shocking!” (Molly, age 51, Skin Type 2).

“I am surprised, even I'm surprised by the level of damage (.) I'm surprised by the visible level of damage yes (.) even though I know that going out in the sun's not good for you, I still find that difference quite startling” (Doris, age 54, Skin Type 1)

There was a general consensus that the photo that had been aged as if they had been exposing their skin to UV rays without using sun protection (the high-UV photo), looked worse than the naturally aged photo, and this was mainly commented on in terms of the skin looking more aged:

“You look haggard on that right one! It's horrible. It's mainly the skin isn't it” (Marie, age 53, Skin Type 3)

“Oh good God. That really bad on the right” (Virginia, age 47, Skin Type 1).

The main features of the UV exposed photos that were commented on were “skin colour, skin pigmentation” (Eva, age 61, Skin Type 3), “level of the skin damage” (Simone, age 43, Skin Type 2), and that the skin was “really wrinkled” (Sadie, age 48, Skin Type 3). Participants were encouraged to compare the two photos; providing the participant with two photos presented side by side is a key advantage of this type of intervention, and the difference between them was described as “striking” (Sylvia, age 40, Skin Type 1) and “remarkable” (Alice, age 35, Skin Type 2). This, according to the women, will be a crucial factor in prompting behaviour change: they wished to avoid looking like the high-UV photo and suggested ways to achieve this, including staying in the shade and using sun protection. The women

mainly focused their attention on the high-UV photo; this was expected as this photo normally demonstrates significantly more changes to the current self than the photo aged naturally. The women felt that the high-UV photo looked unnatural (comparing it to fictional characters) and older, and provided colourful imagery to illustrate this:

“Good Grief, that’s awful! (.) I look like Yoda!” (Emily, age 40, Skin Type 1)

“The skin looks really wrinkled and leathery and (.) yeah (.) just (.) much, much older than the one on the left (.) much (.)” (Virginia, age 47, Skin Type 1)

Some of the women felt that the high-UV photo resembled older relatives, suggesting that the results of facial morphing are perceived as realistic by participants, a key benefit of this type of intervention:

“Oh! Oh God... I look like my nana” (Amanda, age 50, Skin Type 3).

“I do look like my aunt Jess” (Virginia, age 47, Skin Type 1)

The importance of the information being visual was highlighted by several women, specifically in how they perceived the facial morphing intervention’s efficacy. This was evident across different ages and Skin Types:

“I know they say it, but until you actually see your picture - what you actually look like - I think it hits home to you, doesn't it really, that's what you could look like... if you keep going out in the sun” (Kristin, age 53, Skin Type 3)

Sometimes they compared the impact of visual information to theoretical knowledge about the dangers of UV exposure, again suggesting that this type of intervention can convey health messages in a novel and convincing manner:

“Well it's the visual representation isn't it; you say to people you shouldn't do it, people know you shouldn't do it... but... when you see it applied to your face... and your features... you think well er yeah, you really shouldn't do it”
(Sylvia, age 40, Skin Type 1)

The intervention also appeared to provide them with a sense of self-efficacy, as they had two clear options for their future appearance:

“I'm fully aware that... sun damage and overexposure is bad, but it's just seeing it kind of makes you think... you know, they're the two options”
(Alice, age 35, Skin Type 2)

An important feature of this type of intervention is its ability to personalise the issue of skin cancer, by demonstrating potential damage to participants' own faces. This was directly commented on by the women, and they regarded this as an important factor in increasing susceptibility to the negative consequences of UV exposure:

“It's not... It's not something remote. It's something very personal then. That makes you think about it as well” (Margaret, age 51, Skin Type 2)

“I think it's really powerful to see your face” (Harper, age 55, Skin Type 2).

Theme Four: Positive Outcomes of the Intervention

Within the reactions to the facial morphing interventions, there were also positive outcomes to be found; these included positive reactions to the naturally aged photo and motivations to change behaviour, or motivations to continue with behaviours already in place. That participants' experiences of the facial morphing process were largely positive suggest that this type of intervention can be an empowering experience for women of this age group. The women described the experience as “interesting” (Sadie, age 48, Skin Type 3) and “powerful” (Harper, age 55, Skin Type 2), noting that they were “amazed” (Maya, age 55, Skin Type 4) at

what they had seen. Although commenting extensively on the photo aged with UV damage, the women also focused their attention on the naturally aged photo. They were overwhelmingly content with the natural ageing process, describing the photo aged without UV exposure as “fresh-faced” (Virginia, age 47, Skin Type 1), making them feel “pleased” (Sanne, age 55, Skin Type 4). They did in some cases express surprise at looking better than they had anticipated, something that is an encouraging outcome of the intervention as it has the potential to positively influence women’s body image and perceptions of ageing:

“I’m amazed that I can actually look that good when I’m that old” (Toni, age 46, Skin Type 2)

“I really am pleased with the one on the left-hand side as I look at it”
(Maya, age 55, Skin Type 4)

Combined with the aforementioned negative reactions to the sun damaged photo, this fed into their motivation to either change, or maintain their current level of sun protection, where the comparison aspect between the two photos appears to be a crucial mechanism behind this. Motivations were reflected throughout different ages and Skin Types, and could be broadly classified into two types: motivation to change behaviour, and motivation to continue with already high levels of sun protection use. Where gaps in sun protection were identified, the women wanted to increase their level of sun protection

“I’ll be using my sunscreen even more!” (Sadie, age 48, Skin Type 3)

“I’ll probably wear it [sun protection] more often now... even when I think it might not be sunny but there's a possibility” (Toni, age 46, Skin Type 2)

“I will be a bit more proactive in doing that now...when my grandson's around cos he'll probably have stuff and I might borrow his” (Soraya, age 58, Skin Type 3)

The information obtained through facial morphing was often regarded as valuable feedback, giving them control over the choices for their future. This suggests that this type of intervention can increase self-efficacy surrounding sun protection use:

“I'm not sad, I sort of look at it and I think I can do something about it and I'm happy I came today... so I can do something about it hopefully”
(Laurie, age 56, Skin Type 3)

The women commented on the intervention increasing their personal awareness of the dangers of the sun, which was regarded as something positive and useful. This would suggest that participants are willing to rectify the aforementioned confusion and unawareness of certain sun safety recommendations, and are open to new information:

“It's a bit of an eye-opener” (Toni, age 46, Skin Type 2)

“Makes me realise I want to take that knowledge and show my friends! Don't keep going out in the sun! Gosh... that's amazing” (Marie, age 53, Skin Type 3)

Among the group of women who already employed rigorous sun protection (primarily women with sensitive or pale skin) this translated into a feeling of already having the right course of action. This increased motivation to continue current levels of sun protection:

“Yeah I mean, think I've got a highly motivated anyway but that has made me... I think... that's increased my degree of motivation” (Doris, age 54, Skin Type 1)

“It definitely makes me feel like I'm gonna continue putting on my sunblock” (Margaret, age 51, Skin Type 2).

It is, however, difficult to establish whether these motivations would be translated into action without implementing post-intervention measurement, as it is possible that the women’s mental defences (i.e., self-attributed laziness and downward comparisons) might reactivate barriers to sun protection given time. This is further discussed below.

Discussion

This study provides a unique insight into motivations and barriers for UV exposure and sun protection, as well as reactions to a facial morphing intervention, among 25 women aged 35 years and older. Through qualitative analysis of individual interviews, a number of relevant themes were found which are informative in enabling an understanding of attitudes to UV exposure and sun protection among this population, and how women aged 35 years and older react and relate to one particular facial ageing intervention to reduce UV exposure.

Attitudes to UV Exposure and Sun Protection

Although public knowledge about the dangers of UV exposure is generally on the rise (Miles *et al.*, 2005), the women experienced substantial confusion about tanning and sun protection, being simultaneously aware of costs and benefits of sun exposure. The most prominent confusion was that sun in the UK did not warrant sun protection, a belief refuted by NHS (2016b) recommendations about sun safety. It is highly likely that the UV tanning industry itself contributes to this confusion by distributing contradictory messages about the benefits and drawbacks of UV exposure. Following thematic analysis of advertisements and media messages, Prior and Rafuse (2016) argue that the tanning industry itself perpetuates the idea that UV

exposure (without distinguishing between natural and artificial sources of UV) is safe and promotes well-being. This could also be enhanced by media reports about the rise of vitamin D deficiency (as further outlined in Chapter Two, on page 12), which possibly contribute to the erroneous belief that one is to spend a significant amount of time in the sun without wearing sun protection (NHS, 2018).

Relatedly, the women negotiated their UV exposure in terms of perceived costs and benefits that were at times more or less salient, and appeared to influence whether or not they used sun protection. The notion of perceived costs and benefits associated with sun protection and UV exposure is supported by previous qualitative research, which has indicated that sun protection is associated with perceived short-term drawbacks, for instance inconvenience and how it does not feel nice on the skin, and long-term costs such as hindering the development of a tan (Leske *et al.*, 2014; Rodrigues *et al.*, 2017). Simultaneously, people also consider there to be drawbacks of not using sunscreen, such as immediate discomfort and long-term risk of skin cancer. Tanning itself is also viewed as involving immediate benefits to physical appearance, but long-term costs to personal health (Dodd & Forshaw, 2010). This can be further understood in the context of temporal perspective of consequences, where health-related behaviours involve both immediate and distal consequences, influencing people's behaviour to varying degrees (Hall & Fong, 2007; Orbell & Kyriakaki, 2008). Finally, appearance concerns were at times encouraging the women to sunbathe (e.g., to achieve a tanned appearance) and at times dissuading it (e.g., concerns about skin ageing), which is similar to past research noting that appearance can be both a motivator and a deterrent to UV exposure (Cafri *et al.*, 2006; Jackson & Aiken, 2006)

Interestingly, the women in the current study did not perceive there to be many drawbacks associated with the use of sun protection, which contrasts with findings of previous research. It is possible that this is a result of the sample being older, and consequently has more experiences of the negative effects of not using sun protection, such as skin damage resulting from overexposure. This was evident in the material, where women frequently detailed burns they had suffered as a result of unprotected UV exposure, and how this had impacted their current attitude to sun protection. Women were however more conflicted about the costs and benefits of UV exposure, where they outlined both short and long-term costs of spending time in the sun. In addition, that the women cited appearance as a reason to tan, as well as not to tan is in line with previous findings on UV exposure motivations, suggesting that it is a highly complex behaviour, with appearance factors at times encouraging it, and at times dissuading it (Cafri *et al.*, 2006). Braun and Clarke (2006) note that illustrating contrasts and conflict between interview statements is a benefit of utilising thematic analysis; something that applies well to this particular finding.

It was evident from the analysis that the women did take precaution in the sun in scenarios where harmful UV exposure was made salient (i.e., sunbathing abroad in a high-sun country). The women generally believed that sun protection was mainly needed outside the UK because the weather is warmer than in the UK, despite current sun safety recommendations noting that there is not an association between temperature and strength of UV rays (Dillner, 2012). The analysis also indicated that there was a degree of self-deception involved in failing to use sun protection, i.e., downward comparison (with smokers or ‘sun-worshippers’) or mental barriers (e.g., information avoidance) to accepting the sun in the UK as harmful. Interestingly, downward comparison has been found to completely negate

any benefits of an appearance-focused intervention to reduce UV exposure. Mahler, Kulik, *et al.* (2010) found that a UV photo/photoageing information intervention increased intentions to use sun protection, but that adding a downward comparison in the form of a person with more severe skin damage than the participant counteracted this. This therefore suggests that the current findings are in line with previous research, and that these belief systems will need to be counteracted to ensure efficacy of any intervention to reduce UV exposure.

Goal-Directed Behaviour

It is relevant to consider goal-directed behaviour theory (Carver & Scheier, 1982, 1990) in the context of the situations where the women failed to use sun protection. It appears that, in line with this theory, the goal of sun protection was not sufficiently strong or salient in some of the situations, resulting in the women failing to monitor their sun safety behaviour, something that is an essential part of goal-achievement (Carver & Scheier, 1982, 1990). Gollwitzer and Sheeran (2006) posit that getting derailed, or failing to pay attention to the goal in question, is a main obstacle to goal achievement. As noted by Hostler (2017), simply forgetting to perform an action is a major hindrance to goal achievement, something that was evident in the current sample, where women stated that they often forgot to use sun protection. It appears that in some of these situations, the women's goal achievement is hindered by distracting stimuli or events, such as wanting to spend time with friends in the garden, or being asked to go for a walk (Orbell *et al.*, 1997). This further relates to the 'ostrich problem' (Webb, Chang, & Benn, 2013), where these women are possibly avoiding seeking out definitive information about when to use sun protection, partly because the issue is confusing (see for instance BBC News

[2015] for an overview of the UK public's confusion about sunscreen labelling), and partly to avoid having to make a decision regarding behaviour change.

In contrast, the sub-group of women with self-described pale or sensitive skin, reported employing rigorous sun protection strategies, such as staying in the shade at all times and using SPF 50 nearly every day. For these women, the goal of reducing UV exposure was salient at all times, and as such they were already highly motivated to monitor their behaviour to avoid sun burn. The reason that goal-monitoring is an essential part of goal achievement, is that a lack of it makes it difficult to adjust behaviour according to current goal progress, as discrepancies are unlikely to be detected (Benn *et al.*, 2014; Carver & Scheier, 1990; Webb *et al.*, 2013). It could be argued that the aspect of goal-monitoring was also easier for this group, as even the slightest degree of sun exposure resulted in immediate discomfort on the skin, thus making goal-related feedback immediately accessible - a form of passive feedback (Webb *et al.*, 2013). This may not be the case for women with darker skin who tan with ease; to obtain feedback on their progress in reducing UV exposure they would have to actively seek out feedback, e.g., by visiting a medical professional who could give information about their current level of skin damage and what precautions they should be taking in the sun. It is worth noting that if there are high levels of dissonance between their current behaviour and what they expect to obtain, people are likely to simply avoid seeking out this information (Frey, 1982; Northcraft & Ashford, 1990). Controversially, this could even suggest that the recent publicising of the dangers of skin cancer has resulted in some people becoming even more avoidant in seeking out feedback on their current skin health, as they expect the level of dissonance to be high.

In light of the above, it would therefore seem relevant for future interventions to take these aspects into account and increase the number of situations where sun protection is highly salient, and therefore increase the likelihood of reducing UV exposure. This could for instance be achieved by including aspects of implementation intentions in appearance-focused interventions, e.g., “When the weather is sunny and I go for a walk outside then I will wear sun protection” (Armitage, 2004). Implementation intentions may also be useful in improving prospective memory, thus overcoming forgetfulness about sun protection use (Hostler, 2017). To encourage and facilitate effective self-monitoring, recommendations on sun safety should be further clarified, thus reducing potential for confusion, and making information avoidance less likely.

There also emerged what appeared to be sample-specific characteristics in regard to these women’s attitudes to UV exposure; there was a sense of a dynamic process with key events that had served to change or reinforce their attitudes and behaviours. Although public information sources such as media campaigns evidently only go some way towards prompting behaviour change, women of all ages cited these as having had a profound effect on their sun protection use, particularly in their perception of indoor tanning, which was overwhelmingly negative. This suggests that health information can prompt behaviour change, albeit up to a certain point; there might be a threshold when people have the available information but still do not have the motivation to increase health-conscious behaviour, a common criticism towards health promotion strategies (Hardeman *et al.*, 2002). This is also in line with the intention-behaviour gap (Sheeran & Webb, 2016), which posits that people’s intentions are not consistently predictive of their actual behaviour. Hardly surprising, personal information sources such as friends or family getting skin cancer were cited

as important reasons to take precautions in the sun. This is supported by previous research, which has found that a skin cancer diagnosis can in some instances increase subsequent sun protective behaviour (Meyer, Pruvost-Balland, Bourdon-Lanoy, Maubec, & Avri, 2007; Soto *et al.*, 2010).

Reactions to the Facial Morphing Intervention

It was evident that participants felt that the facial morphing intervention personalised the consequences associated with spending time in the sun, by demonstrating hypothetical future damage to their own faces, thus increasing susceptibility to the threat of skin cancer; this mirrors previous findings from qualitative research into facial morphing with younger women (Williams *et al.*, 2012). Results from a meta-analysis and review by Usher-Smith, Silarova, Sharp, Mills, and Griffin (2018) found that personalised skin cancer information has a positive effect on sun protection practices, skin self-examination, and in reducing tanning bed usage. This suggests that a facial morphing intervention could reduce several behaviours associated with harmful UV exposure, partially by limiting unrealistic optimism about susceptibility to skin cancer (Weinstein, 1982).

Also similar to findings on younger women (Williams *et al.*, 2012) is the current sample's shock and surprise at the visible ageing of the UV photo, which was reflected through dramatic language during the morphing process. The shock and surprise at the level of skin damage caused by the sun suggest that public information campaigns about the dangers of UV exposure still have some way to go towards fully educating the population. This is particularly relevant as prior to being morphed, the women stated that they felt generally aware of sun safety recommendations. This is supported by findings from a study by Hoffman *et al.* (2016), who found that people aged 40 years and older perceive themselves to be

well-informed about skin cancer and skin screening procedures, but perform poorly on actual knowledge tests, suggesting a general discrepancy between perceived knowledge and actual knowledge. This also highlights a key benefit of the methodology of the current study; the order of the questions (i.e., focusing on general attitudes to UV exposure prior to delivering the intervention) enabled the discovery of this particular finding.

The women reacted overwhelmingly negatively towards the UV photo, and expressed how they did not want to look like that when they were older. This highlights that appearance is still a key concern among women of this age group, in line with the large body of previous research into the relationship between ageing and appearance concerns among women in mid-life (e.g., Grogan, 2016; Lewis-Smith, 2014; Pliner, Chaiken, & Flett, 1990; Tiggemann & Lynch, 2001). Interestingly, as compared to qualitative research on younger women, these women did not appear to be concerned about their appearance for the sake of significant others; however, they did express a similar motivation to change their behaviour (Williams *et al.*, 2012).

The sub-group of paler women expressed feelings of having made the right choices to be careful in the sun and subsequently, motivations to continue with their current levels of sun protection, suggesting that they too wanted to avoid looking like the high-UV photo. It could be argued that the high-UV photo serves as an avoidance-type goal (Elliot & Harackiewicz, 1996), i.e., a future outcome that participants want to avoid. Relatedly, it can also be viewed as a type of fear appeal, i.e., a form of message that arouses fear by highlighting the potential danger (extensive facial ageing) of a particular behaviour (UV exposure). A meta-analysis of 248 independent samples by Tannenbaum *et al.* (2015) found that fear appeals are

generally effective in promoting behaviour change in response to a wide array of unhealthy behaviours, and may be particularly effective when they also increase self-efficacy. This is relevant for facial morphing, as the analysis revealed that being provided with two potential future choices made the women feel empowered, potentially increasing self-efficacy.

A contributing factor to the potential success of a facial morphing intervention is that women can compare the sun damage to a photo that has aged naturally (Williams *et al.*, 2012). This is particularly relevant as a number of the women expressed being content with the naturally aged photo, and in some instances, surprised at how good they looked when they were older, potentially providing them with an appearance-related approach-type goal. Goal achievement theories define an approach-type goal, as opposed to an avoidance goal, as directed at achieving a positive outcome, rather than avoiding a negative one (Elliot & Harackiewicz, 1996). In line with regulatory fit theory (Higgins, 1998), it has been argued that personality characteristics could be a factor in determining whether people are persuaded to change behaviour when faced with positive or negative consequences, i.e., whether they are promotion-focused or prevention-focused (Higgins, 1998; Lockwood, Jordan, & Kunda, 2002). Essentially, this suggests that a facial morphing intervention could work by targeting both groups; it is possible that prevention-focused individuals will be persuaded by the high-UV photo, and promotion-focused individuals will be persuaded by the low-UV photo.

Finally, many women found the facial morphing experience interesting and informative - a key benefit of this type of intervention. If facial morphing booths were installed at airports or hospital waiting rooms, there is a strong possibility people would engage fully as they are likely to find the experience rewarding. This

suggests that a facial morphing intervention does not only emphasise ageing and appearance in a negative way, but can also be a tool to promote positive body image among older women, an issue that is increasingly in the focus of body image research (Grogan, 2016).

Strengths

There are several strengths of this study. First, it benefitted from a relatively large sample size, including women of varying ages and Skin Types, with varying attitudes to UV exposure (e.g., sun-seeking and sun avoidant); this increases the potential for the findings to be somewhat generalisable to the UK population as a whole. This is particularly important as the findings from this study are used to inform the design and implementation of an experimental study into the effectiveness of facial morphing to reduce UV exposure; it is crucial that this information is valid, otherwise the quality of the quantitative study may be negatively impacted. Care was taken to include quotes from as many of the women as possible, and to have an even spread of ages and Skin Types across the themes.

Second, the study was designed to have careful sampling and methodology in order to appropriately answer the pre-set research questions, thus increasing validity of findings (Malterud, 2001). An example of this is how the order of the questions was presented, so that the women's attitudes relating to their knowledge about the dangers of UV exposure could be contrasted before and after the intervention.

Third, the research process adhered to the principles of scientific rigour (e.g., anchoring themes in raw data, sharing the data set with multiple researchers, documenting the research process, etc.), therefore maximising the potential for confirmability of findings. This was partially ensured by the careful study of existing literature during the systematic review and meta-analysis discussed in Chapter Two;

the design of the study was undertaken with previous studies' strengths, limitations, and findings in mind. As discussed in greater detail in Chapter Three, rigour was also achieved through the use of a qualitative data analysis software. This further aligns with the epistemological position of this PhD as a whole – critical realism (as outlined in Chapter Three on page 50) – as it strives for a level of objectivity in the findings, albeit with acknowledgement of social realities and contexts. Finally, the women appeared comfortable speaking to another woman about their UV attitudes and their experiences of the facial morphing intervention, disclosing a great deal of detailed, personal information. Although much of this material was not included in this chapter (as it was unrelated to the research questions), this included distressing childhood events and experiences of loss in adulthood.

Limitations and Future Directions

Limitations of this study also need to be acknowledged. All women were UK-based, so results need to be generalised to other countries with caution. There was also a relatively wide age span (26 years) among the sample, which resulted in a more extensive morphing of the younger women than those who were older. It is therefore possible that individual differences in reactions to the intervention could be partially attributable to these variations. However, the analysis did confirm a general spread of responses throughout the ages, suggesting that reactions are similar despite variations in years aged.

Relatedly, it was evident that the types of motivations expressed by the women varied according to their already formed attitudes to UV exposure and sun protection, and the importance they placed on appearance, particularly in relation to long-term consequences to personal health. This highlights the importance of investigating additional sample characteristics (e.g., investment in appearance,

importance placed on distal or proximal consequences), as the efficacy of any intervention to reduce UV exposure will be impacted by these (Vollrath, Knoch, & Cassano, 1999). Future research into this area should therefore consider the moderating impact of personality variables such as appearance concerns, and temporal perspective of consequences. In addition, although there was a representation of Skin Types 1 to 4 (thus ensuring some degree of diversity), a key methodological limitation of the current study is the lack of darker skin tones (none of the women identified as having Skin Type 5 or 6). Future research would therefore benefit from the inclusion of a more diverse sample, particularly as it has been noted that BME groups are more vulnerable to a late diagnosis of skin cancer, resulting in elevated mortality levels (Oyebanjo & Bushell, 2014).

Furthermore, as men may be more prone to a skin cancer diagnosis than women, future investigations into attitudes to UV exposure and facial morphing would also benefit from including older men, and the next chapter outlines the findings from a similar qualitative study into this particular participant group. Finally, although snowball sampling ensured some diversity in educational qualifications and income levels, many of the women were employed at a British university. Depending on exact job description, university employees are currently categorised in the top two groups (1-2) of the Office for National Statistics' (ONS, 2010) socio-economic classification system, meaning that the current sample has a skew towards including people of higher socio-economic status (SES). It is widely noted that lower SES is associated with a higher prevalence of health-damaging behaviours and poorer health outcomes (e.g., Michie, Jochelson, Markham, Bridle, & Health, 2009). This pattern is similarly reflected in the context of sun protection, where lower SES is associated with riskier sun exposure, and less sunscreen use (e.g.,

Falk & Anderson, 2013; Gavin *et al.*, 2012). Future research should therefore aim to include participants from a wider range of socio-economic backgrounds, and SES should also be consistently included as a moderator in any quantitative research projects in this area.

Reflexive Analysis

As per the recommendations by Braun and Clarke (2006) and Malterud (2001), reflexivity was engaged in throughout the process of thematic analysis, to further adhere to the principle of scientific rigour. In thematic analysis, the researcher is generally considered to be part of the research itself; it is thus imperative to make this person, and their motives for research, visible (Finlay, 2003). Below is a discussion of the major points of this reflexivity, specifically focusing on those that might have impacted the reading of the data, namely prior assumptions of the research topic and values and life experiences (Clarke & Braun, 2013).

As a researcher I have done my best to represent the women's accounts objectively and fairly, but there are several issues to note about myself as a person, and my attitudes and values that may have impacted on the manner in which I engaged with the material. I am a PhD student in Health Psychology, with a personal interest in body image and behaviour change, and I am currently in my mid-twenties. I also identify as a feminist, with a strong interest in the socialisation of gender roles in society. I have a limited interest in appearance, and no interest in tanning; I do not engage in beach type holidays, and I consistently use sun protection with high SPF on exposed areas. I have experienced the facial morphing intervention in the context UV exposure myself, and I have attempted to reflect upon my attitudes to UV exposure and sun protection, and how these might interact with my engagement with

the material. My motives for this research are to further the understanding of appearance-focused interventions to reduce UV exposure, and ultimately to assess whether facial morphing can be a viable option for eliciting behaviour change.

The first issue to note is the difference in age between myself and my participants, which is likely to have impacted on my understanding of the material I was presented with. Parts of the themes relate to how the women's attitudes have changed and adapted throughout their life, and the significant life events that impacted this. These events included, among others, experiencing severe burns, having children, and knowing someone who had been diagnosed with skin cancer. I have only experienced the first of these, so my understanding of the personal impact of the other two is, by all accounts, limited. Although this will admittedly only go some way, I have attempted to rectify this knowledge gap somewhat by reading around these issues, and how they might impact on UV exposure-related behaviour.

In addition, the age gap is also likely to contribute to different understandings of the facial morphing intervention, as this is based on ageing someone's face a certain number of years, depending on how old that person already is. Thus, my experience of this intervention is being aged a greater number of years than even the youngest of my participants; I was aged 46 years compared to the youngest participant, who was aged 37 years. My supervisors do however fall in the age category of my recruitment group, and I have discussed their experience with them in an attempt to gain a greater understanding of this issue, but nonetheless, this can be considered a limitation of my research. Finally, it is also possible that the women may have reacted differently to the intervention, as a result of the interviewer being a younger woman, which is also a limitation of the study. As there is no comparison

group available, it is not possible to establish if participants would have behaved differently if the interviewer was older.

The second issue to note is the impact my personal attitudes to UV exposure and sun protection might have had on my interactions with the participants, and my engagement with the raw data. Because I am averse to tanning and beach holidays, I struggled to understand some of the women's desires to achieve a tanned appearance, and the meanings they attached to the sunny weather. This further ties in with my feminist ideology, where I tend to place little importance on women's appearance, including my own. Although I do of course strive to look my best, I do not agree with the cosmetic altering of the female body in line with societal trends, particularly not at the expense of personal health. This is very relevant to indoor tanning, to which I categorically object, to the degree that I think it should be illegal. It is therefore possible that these attitudes impacted on my interaction with the participants, and my reading of the subsequent data. To counter these views, throughout the research process, I reminded myself that I also engage in questionable practices aimed at improving my appearance (e.g., wearing make-up) in order to enable me to understand the women's motives behind tanning.

Relatedly, I do not enjoy spending time in the sun, and I much prefer to sit in the shade, or even indoors. It was therefore difficult for me to fully comprehend the importance these women placed on spending time in the sun, and how many of them desired to go on beach holidays during the winter. It was easier for me to relate to the sub-group of pale women who employed rigorous sun protection strategies. Moreover, despite attempting to remain neutral at all times, as someone who regularly uses sun protection with high SPF, it is possible that my unconscious reactions to some of the women's confessions of not using sun protection could have

impacted their responses. In line with feminist reflexivity theories (England, 1994; Finlay, 2003), I recognise this as a potential power imbalance between myself and my participants, where not only am I the researcher, but my attitudes also align with those currently sanctioned by society (i.e., to wear sun protection and to avoid tanning).

Finally, I have no personal experience of skin cancer. Although it can be argued that this limits my understanding of the issue at hand, it is also possible that this enabled me some emotional detachment from the topic, which would have facilitated a level of objectivity (Finlay, 2003).

Conclusions

This chapter has outlined the design, implementation, and resulting findings of a qualitative study into attitudes to UV exposure, sun protection, and a facial morphing intervention in women aged 35 years and older. Through individual interviews subjected to inductive thematic analysis, this study provides a unique insight into attitudes to UV exposure and sun protection among women aged between 35 and 61 years. It has explored the specific barriers and motivations of this group to adopt safer behaviour in the sun, as well as their reactions to a facial morphing intervention. Past studies into UV exposure have tended to focus on attitudes and intervention efficacy among younger samples, specifically recruiting student populations (Persson, Benn, *et al.*, 2018). However, this chapter has demonstrated that attitudes to ageing and appearance are dynamic and may vary throughout a person's life (Grogan, 2016), suggesting that older age groups need to be specifically included in research into UV exposure, as this is a behaviour that is primarily motivated by appearance concerns (Dodd *et al.*, 2013; Mingoia *et al.*, 2017). It is therefore unlikely that a 'one size fits all' approach will be successful in

skin cancer prevention, thus demonstrating the relevance of this specific study, as well as the PhD as a whole.

As such, this study has contributed to the achievement of the overall aims of this PhD, where findings will be utilised for the design and implementation of the subsequent quantitative research project. It therefore also adheres to the ‘fundamental principle of mixed-methods research’ (p.18; Johnson & Turner, 2003), where care is taken to ensure methods of sampling and analysis complement one another so to maximise the benefits of both approaches. Finally, although this study specifically focuses on age-appearance facial morphing as a tool for possible behaviour change, the exploration of general attitudes to UV exposure means that the findings of this study can serve as a tool for other researchers in this area, thus informing overall strategies to reduce skin cancer levels among the population.

Chapter Five: A Qualitative Study of Attitudes to UV Exposure, Sun Protection, and a Facial Morphing Intervention in Men 35 Years and Older

The present chapter will outline the findings from a qualitative study examining attitudes to UV exposure and a facial morphing intervention in men aged 35 years and older. The study consists of semi-structured interviews with 25 men aged between 35 and 61 years, and the resulting data were analysed using inductive thematic analysis. The chapter will also outline the rationale behind the study as well as the study design; this includes details on the specific participant group and how the study was implemented. Then, the themes that were revealed will be explored, and will be put in the context of previous research into similar and related areas. As with the qualitative study on women (Chapter Four), the current study addresses both the first and second overall aims of this PhD; to examine attitudes to UV exposure and a facial morphing intervention, as well as to signpost directions for the design and implementation of the upcoming experimental study. By including men aged 35 years and older - a particularly under-researched group in the context of UV exposure - the current study makes a novel contribution to the overall knowledge into how skin cancer can be most efficiently prevented in this population, thus contributing to the final objective of this PhD.

Background

In the UK, 68,387 men are diagnosed with skin cancer each year; this number has increased continuously since the 1970s, and is expected to rise further until 2035 (Cancer Research UK, 2018c). As discussed in Chapter Two, the main cause of skin cancer is UV radiation, which can be behaviourally prevented (Cancer Research UK, 2018a). As both men and women cite appearance improvement as a

main motivation behind sunbathing (e.g., Dodd *et al.*, 2013; Gambla *et al.*, 2017), it seems relevant to examine how appearance concerns can be used to deter people from dangerous exposure to UV radiation. As outlined in previous chapters of this thesis, qualitative and quantitative research on facial morphing techniques, which allow participants to see their face aged up to 72 years of age with or without UV damage, has indicated that this intervention can personalise the skin cancer threat and increase intentions to reduce UV exposure (Owen *et al.*, 2016; Persson, Grogan, *et al.*, 2018). Relevant to the current study, facial morphing to reduce UV exposure has been previously explored using a qualitative methodology with younger men - age range 18-34 years - (Owen *et al.*, 2016), and older women, aged 35 years and over (Persson, Grogan, *et al.*, 2018). The research conducted on younger men indicates that although this group may be sceptical about this type of software, they remain shocked by the visible appearance effects of UV damage, prompting motivation to change behaviour and increase sun protection use (Owen *et al.*, 2016).

The previous chapter outlined findings from a qualitative study of women aged 35 years and older, which suggested that this group experiences age-specific attitudes to UV exposure and sun protection (Persson, Grogan, *et al.*, 2018). Participants indicated that their primary motivation for sunbathing was not to achieve a tanned appearance, but to enjoy recreational time and reap perceived health benefits of the sun. Thematic analysis further revealed that the facial morphing intervention increased or reinforced motivations to adopt safe behaviour in the sun, by demonstrating the appearance-related costs of UV exposure and contrasting this with a positive, approach-type goal (i.e., the naturally aged photo). Considering that this age group appears to have somewhat different motives for UV exposure than those aged under 35 years, and that facial morphing to reduce UV

exposure has not previously been examined with men aged 35 years and above, this provides a strong rationale for the current study.

Participant Group

The majority of research into appearance-focused interventions to reduce UV exposure has utilised female participants (Persson, Benn, *et al.*, 2018), mainly because women are more likely than men to engage in risky behaviours such as sunbathing or indoor tanning (Choi *et al.*, 2010; Stapleton *et al.*, 2015). However, research indicates that men are less likely than women to use sun protection, and are also less aware of skin cancer warning signs (Holman *et al.*, 2015; Julian *et al.*, 2016; Skin Cancer Foundation, 2016a). For instance, a systematic review of 91 studies by Kasparian *et al.* (2009) found that being male was negatively associated with adherence to sun protection and screening recommendations. Men are also less likely to seek medical assistance for any health problems, including those involving the skin (Courtenay, 2000). This is in line with what the World Health Organization (WHO) (Baker *et al.*, 2014) refers to as the ‘men’s health gap’, where, despite overall social power in society, men’s health globally is significantly worse than that of women. In the UK specifically, deaths from all major causes of mortality are more common among men than women (Robertson & Gough, 2010; Sloan, Gough, & Conner, 2010). This is broadly attributed to men’s riskier lifestyle (leading to initial illness), and their responses to subsequent diagnosis, which include lowered risk-perception and fewer visits to medical professionals (Courtenay, 1998, 2000; Galdas *et al.*, 2005; Sloan *et al.*, 2010).

Consequently, it is not surprising that men aged over 55 are the most common demographic diagnosed with skin cancer, and that the peak age for skin cancer diagnosis for men in the UK is 69-75 years (Cancer Research UK, 2018c;

Skin Cancer Foundation, 2016a). As was recently reported in *The Guardian*, deaths rates from skin cancer have seen a particular increase in men as compared to women, and this is possibly related to that men are less likely than women to protect themselves in the sun, or adhere to general health advice (Agence France-Presse, 2018). This therefore provides a strong rationale for including men, and particularly those of an older age, in future research into any intervention aimed at increasing awareness of skin cancer and reduce UV exposure.

Men's risky health behaviours are generally thought to be in line with hegemonic masculinity (i.e., dominant norms for masculine behaviours), where men's health-related beliefs are a way of performing gender (Buchbinder, 2010; Courtenay, 2000). Traditionally, hegemonic masculinity prescribes men a discourse of self-reliance and detachment, as well as a rejection of health preoccupation, as this is construed as feminine (Buchbinder, 2010; Grogan, 2016; Lohan, 2010). The relationship between masculine identities and risky health behaviour is however not straightforward. It appears that that men can frame their engagement in pro-health behaviours in ways that do not threaten masculine norms, rejecting behaviours that are traditionally seen as damaging to one's health, e.g., smoking or unhealthy eating (Robertson & Williams, 2010; Sloan *et al.*, 2010). This further confirms the notion that masculine and non-masculine alike define some of their behaviour according to hegemonic masculinity, either through adherence to, or rejection of, typically masculine behaviour (Lohan, 2010; Sloan *et al.*, 2010).

Research into body image and appearance concerns has generally focused on younger people, particularly young women aged 18-35 years (Clarke & Korotchenko, 2011). This also holds true for research into behaviour change interventions to promote personal health, where older age groups have been

particularly overlooked (Golinowska *et al.*, 2016). The systematic review and meta-analysis discussed in Chapter Two further identified a limited inclusion of older participants (i.e., those aged 35 years and older) in past research into appearance-focused interventions to reduce UV exposure, and it is therefore highly relevant to specifically include this group in future research (Persson, Benn, *et al.*, 2018; Williams, Grogan, *et al.*, 2013a).

Men and Appearance

Generally, past research indicates that in line with Western beauty ideals, there is more pressure on women than men to retain a youthful appearance (Grogan, 2016; Jeffreys, 2014). This does not mean, however, that men are unconcerned about their appearance, and unconcerned about the impact of ageing; cultural values in Westernised societies are increasingly sanctioning one ideal male body type, which is slim yet muscular (Clarke & Korotchenko, 2011; Grogan, 2016). It should however be noted, that when men engage in practices intended to enhance personal appearance (e.g., personal grooming or wearing make-up), these behaviours still tend to be framed in a manner which do not threaten masculine ideals (Gough, Hall, & Seymour-Smith, 2014). A review by Clarke and Korotchenko (2011) examined research into body image and appearance concerns among older men (defined as those aged 65 and over) and found that most studies indicated that older men were less concerned about their appearance than women of similar ages (e.g., Demarest & Allen, 2000; Tiggemann, 1992), but that some studies reported that men experienced a decrease in self-esteem as they felt less attractive with age (e.g., Baker & Gringart, 2009). It has been suggested that the decrease in self-esteem is associated with older men's perception of their body as losing functionality, something that is supported by past research demonstrating that men are mainly concerned about what the body

can do, and not how it looks (Grogan, 2016; Halliwell & Dittmar, 2003; Kaminski & Hayslip, 2006). It is therefore possible that physical appearance is viewed as a representation of the body's functionality, and that ageing is seen as representing a reduction in functionality, something that would support the idea that interventions emphasising ageing and appearance could impact on men's behaviour.

In light of previous research, it therefore remains unclear how effective appearance-focused interventions can be with men in general, and with older men specifically. Previous research on UV photography and men has indicated that attitudes surrounding masculinity can impact on the effectiveness of appearance-focused interventions, in that men who exhibit higher levels of masculinity may be reluctant to engage with health improvement (Dwyer, 2014; Walsh & Stock, 2012). It appears that these types of interventions may need to be framed in a certain way (e.g., non-threatening to masculine norms and with a focus on personal choice) to be effective with men, particularly as males report being less concerned about the negative effect of the sun on appearance (Abroms, Jorgensen, Southwell, Geller, & Emmons, 2003). The studies on UV photography utilised college-aged men, so it remains unknown how masculinity might impact appearance-related interventions with older men. As noted by Davidson and Meadows (2010), older men have been largely absent in past research into how health behaviours may interact with masculine attitudes, further prompting relevance of the current research. This therefore suggests that interventions to promote safe UV exposure can have the potential to be effective with men, even within the context of hegemonic masculinity.

The Current Study

The current study aims to investigate men's general attitudes to UV exposure and sun protection, as well as their reactions to a facial morphing intervention. As facial morphing has not previously been examined with males aged 35 years and older, a qualitative methodology has the potential to examine factors that can impact on its effectiveness (e.g., prior attitudes to UV exposure), and ensure its effectiveness with a highly specific participant group (Dugdale *et al.*, 2017; Epton *et al.*, 2015). As it appears that men's health-related attitudes, as well as their positioning in relation to hegemonic masculinity, will impact on their engagement with any intervention to reduce UV exposure, it is relevant for the current study to consider both these areas. No research to date has assessed the effectiveness of this type of intervention, or barriers and motivations for sun protection use, among men aged 35 years and older. Interviews are a useful tool to understand how men react to the experience of seeing their face morphed, and can be used to obtain an in-depth understanding of the barriers and merits of employing this type of intervention whilst allowing for the recording of unexpected responses. In line with the overall aims of this PhD, the current study therefore aims to address the following questions:

1. What are the attitudes to UV exposure and sun protection among men aged 35 years and older?
2. How do men aged 35 years and older react and relate to a facial ageing intervention to reduce UV exposure, and what impact (if any) does it have on their motivations to use sun protection?

Method

The current study utilised a qualitative approach, consisting of individual semi-structured interviews with men aged between 35 and 61 years. The interviews

focused on general attitudes to UV exposure, as well as reactions to a facial morphing intervention. As discussed in Chapter Three, this approach was chosen as facial morphing has not been previously examined in the context of UV exposure and older men, and the research can therefore be regarded as somewhat exploratory (Sofaer, 1999). This is particularly relevant as there has been a limited inclusion of men - especially those of an older age - in past research into appearance-focused interventions to reduce UV exposure. In line with the overall aims of the PhD, it is also considered important to assess what processes are involved in this type of intervention, particularly in the context of previous findings into how health behaviours are influenced by personal values and attitudes (Dugdale *et al.*, 2017; Sofaer, 1999). This, in turn, will inform the subsequent quantitative study (Chapter Six) into the effectiveness of facial morphing with both men and women aged 35 years and older. In addition, participants were also asked about their general attitudes to UV exposure and sun protection, as this would generate knowledge into what, if any, moderating variables would need to be considered for the experimental study. Individual semi-structured interviews were chosen as they result in rich data, allowing participants to answer the questions in an in-depth and personal manner (Willig, 2013).

The interviewer (the author of this thesis) was a female PhD researcher in her mid-20s, Fitzpatrick (1975) Skin Type 3 (cream white: sometimes mild burn). The supervisory team were three women in their 30s (Skin Type 2: white, fair; usually burn, tan less than average - with difficulty), 40s (Skin Type 3) and 50s (Skin Type 2). The interviewer engaged in reflexive analysis throughout the process of analysing and interpreting the data, following Finlay and Gough (2003). A detailed account of this reflexive analysis can be found at the end of this chapter.

Participants

This study specifically recruited male participants aged 35-61 years. The lower limit (35 years) was chosen based on the observation that older participants are under-represented in research into appearance-focused interventions to reduce UV exposure (Persson, Benn, *et al.*, 2018), and facial morphing has not previously been investigated in a UV exposure context on men aged 35 years and older. The upper limit (61 years) was chosen as the facial morphing software can only ‘age’ a person up until 72 years of age; trial morphing prior to the study informed the decision that participants should be morphed at least 10 years to see a noticeable difference between their current and future image. The study focused exclusively on men, as women were the focus of the study described in Chapter Four.

The median age of participants was 47 ($M = 46.80$, $SD = 6.95$). The most common Skin Type (Fitzpatrick, 1975) was 2 (32.0%), followed by 3 (28.0%). Twenty percent of participants were Skin Type 4 (brown; rarely burn, tan with ease), and eight percent described themselves as having Skin Type 1 (white, very fair; always burn, never tan) or Skin Type 6 skin (black; never burn, tan very easily), and four percent as having Skin Type 5 (dark brown; very rarely burn, tan easily). Number of participants was based on reaching data saturation (Guest *et al.*, 2006), i.e., when little or no new information is presented in the interviews, as well as considerations of information power (Malterud *et al.*, 2016). It was further guided by previous work in this area with younger men (Williams *et al.*, 2015), and was informed by the study on older women outlined in Chapter Four. Participants were initially recruited by approaching people at a British university, and from this a snowball recruitment approach was used. All men spoke fluent English.

Apparatus

A laptop and web camera with the APRIL® software installed and an audio recorder (mobile telephone) were used in this study. Full details on the APRIL software can be found in Chapter Three on page 51.

Materials

An interview protocol was utilised. A detailed discussion on the content and development of this can be found in Chapter Three (on page 54), and the full interview protocol can be found in Appendix E. It should be noted that the questions were identical to those asked to female participants; this was to ensure that any gender differences in responses would occur naturally, and not be influenced by selective questions.

Procedure

As with the previous study on women (Chapter Four), the current study mostly took place at a British university, but also in participants' homes if the interviewer previously knew the person facilitating their recruitment. University lone working policies were followed (Manchester Metropolitan University, 2006). All sessions took place in a private space to allow for an element of participant-researcher confidentiality. Participants were first given the study information sheet, and were asked to sign consent forms. They were then asked to identify their Skin Type according to the Fitzpatrick (1975) test. Following this, the interviewer gave a brief introduction of the structure of the session, which was as follows: initially participants had their photo taken, and a few personal details noted to set up the software. As this stage, the session was not recorded, and it was used as an opportunity to familiarise the participant with the interviewer, to create rapport. This is in line with guidelines by Ritchie *et al.* (2013) who recommend that interviewers

establish familiarity with the interviewee before asking questions relating to the interview topic. Once the software was set-up, the audio recorder was turned on, and participants were asked about their general attitudes to UV exposure, e.g., “Do you use sun protection?” and “Do you sunbathe?”. This was before any facial morphing took place, to enable capturing participants’ attitudes unaffected by the intervention. The rationale behind the order of the questions is outlined in Chapter Three, on page 50.

After these questions, the basics of facial morphing were explained (e.g., that the right-hand photo viewed on the computer screen would be with UV exposure and the left one without). Participants’ faces were then morphed and displayed on the computer screen. Verbal natural reactions to this process were recorded, initially without asking any specific questions. Following this, participants were asked specific questions about their reactions to the facial morphing, e.g., “Is there anything in particular you notice about the photo on the right?” and the impact the image may have on their future intentions, e.g., “Does this photo make you motivated to change your behaviour?”. Subsequent questions asked were based on participants’ responses to the initial questions, ensuring that topics considered important by participants were covered. Finally, participants were asked if there was anything they would like to add, to ensure no crucial information was overlooked. The recorder was then turned off, and participants given a debrief sheet and thanked for their participation.

Ethical Considerations

The study had gained university ethical approval, and was conducted in accordance with The British Psychological Society (2018) guidelines; participants gave informed consent, were fully debriefed following the study, and data were

anonymised by assigning pseudonyms to each participant. Full details on the ethical approval can be found in Appendix F.

Data Analysis

The audio-taped interviews were transcribed verbatim, and the data were analysed through inductive thematic analysis (Braun & Clarke, 2006) using NVivo Qualitative Data Analysis Software (QSR International Pty Ltd., 2016). The epistemological position of the research process, as well as the rationale behind employing thematic analysis utilising NVivo, is discussed in detail in Chapter Three. The six stages identified by Braun and Clarke (2006) were followed, including reading through the interviews and identifying words and concepts that appeared frequently, developing these into themes, reviewing these with the supervisory team, and selecting the most prominent themes based on how meaningful they were. Transcripts were initially read, and interesting points were noted. Transcripts were then re-read, and coded line by line. Finally, these codes were analysed further and organised into themes with a more abstract meaning. Codes were usually short, and based on words participants had said (e.g., “getting older”, “quite a difference”, “sun protection”). Coding and themes were discussed and agreed upon with the supervisory team, to ensure that themes were not subjectively created by one researcher. Inductive thematic analysis was chosen as it allows rich themes to emerge from the data, thus linking them strongly to the information provided by participants (Patton, 1990). In the quotes below, pseudonyms are used to identify participants, Skin Types and ages are indicated in parentheses to provide context, and (.) is used to denote a pause.

As outlined in Chapter Three, this research was carried out with the standards of relevance, validity, and reflexivity in mind, as proposed by Malterud (2001).

Themes were checked by PhD supervisors, to ensure they were not the product of one researcher. In addition, the study was written up for publication, and is currently under revision in *Psychology & Health* (Persson *et al.*, *under revision*). The draft received peer-review feedback, and findings have therefore been checked by a significant number of other researchers, ensuring validity and confirmability of themes.

Results

Three interconnected themes carried most meaning in the discussions. The first two were primarily concerning general attitudes to sun protection and UV exposure and the third one directly related to the facial morphing intervention. The thematic matrix in Figure 5.1 illustrates the relationship between the themes (including sub-themes). Quotes below are reported verbatim, with pseudonyms, ages, and Skin Types in parentheses to provide context. The themes that were found were as follows:

1. Activity and detachment
2. Gendered appearance
3. Motivations, health concerns, and scepticism

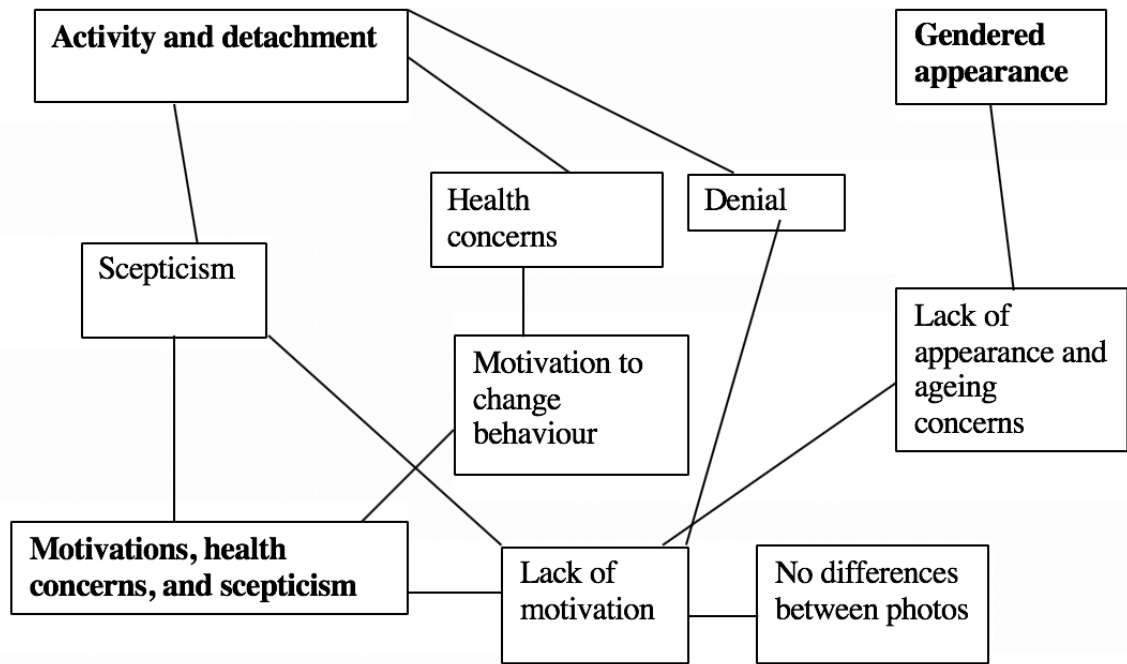


Figure 5.1. Thematic Matrix for Male Study.

Theme One: Activity and Detachment

Through discussions about motivations for being in the sun, it became clear that these men experienced what could be described as activity-based UV exposure, i.e., that they mainly spent time in the sun during physical activity, without the intention of achieving a tan. The men listed a wide array of activities they associated with spending time in the sun, and examples included: “playing tennis” (Oscar, age 52, Skin Type 2), “going to the farm” (Rudy, age 40, Skin Type 6), “football... outside in the sun” (Alfie, age 49, Skin Type 6), “cycling” (Noel, age 54, Skin Type 2), and “climbing or mountaineering, or biking in the outdoors” (Trevor, age 46, Skin Type 2). This pattern was found across ages and Skin Types, and men of lighter skin tones generally enjoyed the sun as much as those with darker skin tones, as can be seen in the above quotes. It was clear that these activities were enhanced by sunny weather:

“I like the sun and I want to go where the sun is on holiday especially, but I wanna be active in this... you know... I wanna be doing something, like walking or some kind of sport” (Paul, age 36, Skin Type 3)

As for sunbathing with the intention of achieving a tan, the men appeared to find this a tedious and often unnecessary activity, and it seemed that they did not particularly desire to have a tan, e.g., “I don't sunbathe... as a means of tanning” (Jakob, age 49, Skin Type 5). At times, this appeared to link to the men's notion of not needing to improve physical appearance through cosmetic means, and they were keen to emphasise their relative contentment with how they looked, something that was evident among lighter and darker skin tones:

“I'm not that interested, I'm not that bothered... about being bronze or brown or... I'm just happy enough as I am” (William, age 27, Skin Type 3)

“I'm just white, and I'm quite happy to sort of stay that way” (Alistair, age 45, Skin Type 2)

Sunbathing was perceived as a “pointless and vain activity” (Oscar, age 52, Skin Type 2) and “a waste of time” (Mats, age 41, Skin Type 4). Interestingly, it further appeared that the men did not want to be seen to actively sunbathe, possibly because of the association between cosmetic improvement and femininity, with one participant commenting that “I feel like everyone would judge me” (Paul, age 36, Skin Type 2). A tanned appearance was sometimes commented on as a “nice by-product” (Louis, age 49, Skin Type 4) of undertaking other activities in the sun, but not a primary motivation:

“I get bored easily I guess but I wouldn't go just... to get a suntan, I wouldn't go for the sunbathing, I would go maybe to play rackets you know on the beach or... volley, beach volley but... or swim but not necessarily to... on purpose to sunbathe” (Martin, age 41, Skin Type 4)

As time spent in the sun was mainly perceived in terms of activities that were undertaken, and not with the motivation of achieving a tanned appearance, these men largely failed to identify personal gaps in sun protection, e.g., asserting that they have “a complexion that can sort of take... the sun” (Lyle, age 44, Skin Type 4) and “I don't think the sun's that strong” (Bob, age 53, Skin Type 3). It is possible that this was because sun damage was associated with actively sunbathing with the intention of achieving a tan, which they did not do, although this is difficult to establish for certain.

The men discussed sun protection and sun safety recommendations with a level of objectivity and detachment, demonstrating awareness of some sun safety recommendations, but not perceiving themselves to be particularly susceptible to skin cancer. Although these men simultaneously described situations that could objectively be perceived as high-risk in terms of sun exposure, e.g., “I've been fairly relaxed and blasé about the risks” (Jakob, age 49, Skin Type 5) and “When I'm on holiday [I] go and lounge by the pool and by the beach from like... early in the morning to 6 o'clock” (Lyle, age 44, Skin Type 4), they failed to acknowledge this as being problematic:

“I would never dream of putting suntan... lotion on in this country, in the summer” (Bob, age 53, Skin Type 3)

The men did, in many instances, deny that their lack of sun protection use could pose a problem for their health. They appeared to perceive their UV exposure to be

less damaging than traditional sunbathing, possibly because it was centred on physical activity (see quote from Paul below), and largely denied the harmful effects of the sun. They also considered other healthy lifestyle options they had chosen as a reason to believe they would not be at risk, even if these behaviours were not associated with reducing the threat of skin cancer. It is possible that they did not genuinely believe this, but employed a sense of positivity to avoid unwanted worry:

“I think no I'll be fine, I'll be fine; I think I'm sort of quite an active person, I've always been quite healthy and kind of think I'll be fine you know, I won't be the person... that gets skin cancer or anything like that, I'll be okay” (Paul, age 36, Skin Type 3)

Detachment was also evident in how these men discussed their UV exposure and sun protection use, where they did not appear to attach a large amount of personal meaning to these behaviours. This was evident in how the men discussed pros (e.g., “to feel healthier”; Miles, age 61, Skin Type 3) and cons (e.g., “skin cancer and... melanomas, and things like that”; Trevor, age 46, Skin Type 4) of UV exposure, which was similar across different ages and Skin Types. However, as previously outlined, they did not appear to consider the negative effects of UV exposure as a motivator to change their own behaviour; e.g., “I don't really think about it” (Mats, age 41, skin type 4).

The men were particularly interested in technicalities around sun protection application and the market for sun protection products, without necessarily applying it to their own lives and behaviours. UV protection was viewed as a “market there, that people can... be exploited for” (Louis, age 49, Skin Type 4), and it was contended that it would be impossible to determine which, if any, of the products were actually effective for use:

“Sun protection is not always great, there's a huge variety of products... and which one's the best, is anybody's guess” (Alistair, age 45, Skin Type 2)

Although these men are partially correct in that sunscreen products do indeed exist in a market economy with developers profiting from increasing sales, this does not mean that they are sold under false pretences. It is possible that the men used these rather simplistic arguments as a way of avoiding personal responsibility for the health consequences of UV exposure, i.e., if sun protection products only exist on a market that exploits people to buy their products, then it is justified to avoid using them. As the European Commission has clear guidelines on regulations for sunscreen labelling (European Commission: Growth, 2018), it is indeed possible to determine which products will protect most effectively against the sun, although some evidence suggests that the UK public may find this confusing and difficult to navigate (BBC News, 2015). The attitude of not being able to rely on sunscreen products combined with failing to acknowledge gaps in sun protection use appeared to create a sense of unrealistic optimism (i.e., perceiving themselves to be less at risk from sun damage than they actually were) about their prospects:

“I guess in acceptance that [sun protection] is the right thing to do, um... but I don't... I don't worry about it myself particularly” (Ashton, age 38, Skin Type 2)

It can be argued that this sense of optimism regarding future sun damage is unrealistic as the increasing skin cancer mortality rates for men as previously discussed should warrant them to ‘worry’ about sun protection use. When the men did use sun protection, it was mainly during specifically selected activities, which suggests that protecting their skin was only salient in a small number of situations, e.g., sun protection being “non-existent apart from when I'm in the high mountains”

(Trevor, age 46, Skin Type 2), and “if I was going fishing then I’d apply sun protection before I went out” (Tom, age 54, Skin Type 3). This further supports the previously discussed notion that situation-specific cues may be important in prompting people to increase their sun protection use.

Theme Two: Gendered Appearance

It was evident that gender roles played a significant part in these men’s perception of UV exposure and sun protection, which tied in with general attitudes towards appearance and ageing. These attitudes were present across ages and Skin Types. This was sometimes explicitly commented on by the men, e.g., “I think for men it's a bit different” (Lyle, age 44, Skin Type 4) as in the case of sun protection, suggesting that they had mental scripts relating to gender and sun protection use. It appeared to be a convenient strategy for avoiding further consideration of gaps in sun protection use, where the men accepted gender stereotypes as a justification for not modifying their behaviours:

“Men don't like putting sun cream on because it feels really sticky... and I always hated putting it on because of that” (Daniel, age 35, Skin Type 1)

Participants generally did not perceive the appearance-related costs of UV exposure as particularly harmful to themselves or men in general, suggesting that societal attitudes towards ageing and appearance are noted by men and women alike, i.e., where women internalise the importance of combating ageing, men internalise a lack thereof:

“If I'm gonna think about the future, I think about them [important life events] rather than... what my skin looks like” (Paul, age 36, Skin Type 2)

“I guess being male as well... there is an association in quite a lot of cultures with being older and craggier as having some sort of wisdom” (Mikael, age 57, Skin Type 1)

Discussing UV exposure and appearance-related costs of sun damage led these men to consider general attitudes to appearance, particularly in relation to a tanned appearance. They were keen to emphasise that appearance was not an important aspect of how they viewed themselves, and that they were happy with, or accepted, the way they looked, feeling no need to employ strategies such as tanning to improve their appearance, e.g., “I don't tend to have difficulty with my appearance” (Mats, age 41, Skin Type 4) and “I don't think cosmetically ever really um... (.) physical appearance isn't massively important to me” (Ashton, age 38, Skin Type 2). Being overly concerned about appearance was a practice that was largely viewed in negative terms, possibly because of its associations with vanity and femininity:

“I'm not that vain!” (Bob, age 53, Skin Type 3)

“It doesn't matter, you know there's worse things in life than the way you look...” (Oscar, age 53, Skin Type 2)

Although this lack of concern about personal appearance could reduce effectiveness of appearance-focused interventions and thus fail to impact UV exposure, it seemed as if these attitudes also protected some of the men from UV exposure to begin with, particularly as they regarded sunbathing as a vain activity:

“There's something about me wanting to avoid being overtly vain... you know about sun tanning so I wanted to kind of embrace not... sun tanning”
(Daniel, age 35, Skin Type 1)

It is, however, unclear whether this would translate into avoiding direct sun exposure altogether, or simply avoiding active displays of sunbathing.

Theme Three: Motivations, Health Concerns, and Scepticism

A majority (80.0%) of the men; younger, older and with a range of Skin Types, noticed a big difference between the two photos, describing it as “extreme” (Ashton, age 38, Skin Type 2) and “significant” (Tom, age 54, Skin Type 3). The main features of the UV damaged photo that were commented on were “the colouration of the skin” (Kurt, age 54, Skin Type 3) and “pronounced wrinkles” (Oliver, age 44, Skin Type 2). They generally agreed that the UV exposed photo looked worse than the naturally aged photo:

“The aged one with the sun does still look worse” (Noel, age 54, Skin Type 2)

“That one on the left is what I would expect to look like and that just looks like a horror movie sort of character (Kurt, age 54, Skin Type 34)

The men also commented on the importance of the comparison aspect between the two photos, a key advantage of the facial morphing software:

“For anybody who's looking at these two images to compare and see what might happen if you expose or if you don't expose yourself... so those are some are the positives that I could see from this um exercise which is good” (Rudy, age 40, Skin Type 6)

“Just because of the contrast (...) that's the most.... um.... (.) not to say alarming but certainly thought-provoking... visualization (Trevor, age 46, Skin Type 4).

This comparison aspect appeared to promote a sense of personal responsibility, as it presented the participants with two options of their future self, thus increasing self-efficacy surrounding sun protection:

“The fact that you know there is element of, you know, choice here... um... is... is obviously um compelling, it makes it much more vivid, and also a sense, gives you a sense of responsibility about it” (Jakob, age 49, Skin Type 5)

Interestingly, this did not always translate into a desire to avoid looking like the UV photo, which is likely associated with the general objectivity (i.e., objectively noticing the damage, but not applying this to themselves) with which some men viewed sun protection use and sun damage, enabling detachment from the issue:

“I'm not as motivated to... (.) change... my behaviour... to... pertain... an idea of a youthful appearance” (Mats, age 41, Skin Type 4)

This is possibly related to the fact that some men (even when they did notice objective differences between the photos) suggested that the UV damaged photo did not look considerably worse than the naturally aged photo:

“But even the one without sun protection and everything else isn't particularly horrific” (Alistair, age 45, Skin Type 2)

Relating to the previously discussed appearance acceptance and lack of concern about ageing, even when the men agreed that the UV photo looked worse than the naturally aged photo, some of them claimed to not particularly mind which photo they ended up looking like. This was not necessarily confined to the consequences of UV exposure, but part of a generally laissez-faire approach to personal appearance:

“If I'm honest it wouldn't necessarily bother me.... um.... which one I look like, I mean you know... I get up and wash my hair and let it dry and it falls how it falls” (Louis, age 49, Skin Type 4)

There was also a general lack of expressed contentment with the naturally aged photo. In fact, this photo was rarely commented on by the men, suggesting that they

did not regard this as a primary motivation for behaviour change. Among the men who expressed a distinct lack of motivation, it appeared that this was also driven by a desire to not appear vain, as well as a reluctance to change their lifestyle:

“I'm not about to go and ... and alter my behaviour to... try and retain an appearance of looking more youthful than I naturally might if I continue to behave as I do” (Mats, age 41, Skin Type 4)

A minority (16.0%) of the men described the differences between the two photos as “relatively small” (Rudy, age 40, skin type 6), or non-existent. All of these men were in their early to late 40s, suggesting that it was not a result of fewer years morphed. Worryingly, there appeared to be issues relating to skin tone in the level of differences that were perceived between the two photos; both of the participants with Skin Type 6 (black; never burn, tan very easily) commented on the lack of visible UV damage on the sun exposed photo. This suggests that facial morphing may not currently be effective across Skin Types, something that is a distinct limitation of this type of intervention:

“I can't see much difference there” (Rudy, age 40, Skin Type 6)

“I don't, I don't see very mu.. in.. much difference” (Alfie, age 49, Skin Type 6)

Some of the men were also sceptical about how well the software worked. It is possible that this scepticism together with the unrealistic optimism and lack of acknowledgement about gaps in sun protection use served a protective function: if the software is unreliable, then they would not have to consider changing their behaviour. It would also protect them from unwanted worry about the dangers of the sun:

“How's it doing that morphing...and... are they just thinking if we just stick some of these on anyway it will scare them to death and they will do something about it...” (Trevor, age 46, Skin Type 4)

“I don't believe either one of them, I I think they're so.... extreme” (Bob, age 53, Skin Type 3).

The UV photo also led the men to discuss general ways of living, and the lifestyle choices they were currently making within the context of long-term consequences. General ageing, or life-style choices resulting in a particular appearance, were not a cause of concern, but perceived as a natural result of a life lived in a certain way:

“I'm quite happy to live with the consequences of what... as... what I've done or what I, you know, or what the situations I've put myself in that's, that's part of life... (Mats, age 41, Skin Type 4)

Possibly relating to the perception of physical appearance as being associated with underlying life-style choices, the facial morphing process led the men to discuss “general health” (Rudy, age 40, Skin Type 6) in relation to UV exposure as well as other areas of life. It was clear that the main concern of the UV photo was the underlying health issues associated with the sun damage, not the physical appearance in itself. This suggests that facial morphing can prompt relevance of the issue of sun damage for men, but perhaps not through direct appearance concerns:

“I don't mind being ugly but I don't wanna have skin cancer” (Ashton, age 38, Skin Type 2)

“As a document of my... um... ability to...um... be healthy.. then I prefer the one on the left” (Oscar, age 52, Skin Type 2)

This attitude appears to be associated with the men's previously discussed lack of appearance and ageing concerns, and their emphasis on physical activity, where

attempting to alter one's appearance is regarded as vain and pointless, but spending active time in the sun is not.

The discussions about behaviour change following the facial morphing procedure were distinctly coloured by previous mentions of health importance and gendered attitudes about appearance. Motivation to change behaviour appeared to be less driven by appearance concerns and more by general health concerns; this is hardly surprising considering the previously discussed themes of health and activity focus, and lack of appearance importance, e.g., looking like the UV damaged photo would not be problematic “unless, it was you know, there was a medical reason” (Louis, age 49, Skin Type 2) and the low-UV photo looking “like a healthier person” (Paul, age 36, Skin Type 2). The photo aged with sun damage appeared to carry meaning mainly if it represented underlying health issues, both physical and psychological, which translated into a desire to change behaviour:

“I'm not bothered about the wrinkles and such things like that but those blemishes and marks look.... (.) they look like they could be nasty” (Trevor, age 47, Skin Type 4)

It is, therefore, possible that the distinct appearance focus of facial ageing interventions may in some cases deter men from engaging with behaviour change, as it activates gendered attitudes about appearance and vanity, but might have the potential to be effective if it can be reframed in terms of being relevant to personal health.

Discussion

This qualitative study provides an insight into attitudes of men aged 35 years and older towards UV exposure and sun protection, as well as reactions to a facial morphing intervention. Thematic analysis revealed three themes: activity and

detachment; gendered appearance; and motivations, health concerns, and scepticism. The study has contributed to the overall aims of this PhD by investigating older men's attitudes to a facial morphing intervention, thus producing findings that will inform the design of the upcoming experimental study. The study uniquely contributes to existing research by targeting a demographic group that has previously been overlooked; it therefore furthers knowledge into how skin cancer levels can be reduced across the entire population.

Attitudes to UV Exposure and Appearance

Similar to females of a similar age (Persson, Grogan, *et al.*, 2018), these men's main motivations for spending time in the sun were not about achieving a tan. However, whereas women's UV exposure was largely centred around relaxation, these men preferred being physically active in a sunny environment. A contributing factor as to why male participants are less utilised in research on UV exposure is that they generally do not fall into traditional high-risk groups such as sunbathers or indoor tanners (Stapleton *et al.*, 2015). However, research suggests that although men may not overtly engage in behaviours aimed at achieving a tanned appearance, their sun exposure is in some instances riskier than that of women, as they may have more intensive UV exposure and employ less sun protection strategies both on the face and on the body (Holman *et al.*, 2015; Julian *et al.*, 2016; Skin Cancer Foundation, 2016a). This was reflected in the current sample, where the men rejected behaviours traditionally associated with achieving a tan in favour of various forms of physical activity, which reflects men's general tendency to view the body in terms of functionality rather than display (Halliwell & Dittmar, 2003). Older men's rejection of activities regarded as vain in favour of physical activity has also been demonstrated by Liechty, Dahlstrom, Sveinson, Son, and Rossow-Kimball (2014).

Further, the rejection of risky sun exposure by representing the practice and those identifying with it as ‘vain’ is similar to research into why certain people reject indoor tanning practices (Taylor, Murray, & Lamont, 2017). It is also consistent with research demonstrating that men who engage in appearance-focused practices may frame these in line with traditional masculine discourse, to avoid appearing feminine and therefore vain (Gough *et al.*, 2014).

Although the men’s physical activities were preferably undertaken in a sunny environment, they were not perceived as warranting sun protection. In fact, where women of similar ages identified gaps in sun protection use (Persson, Grogan, *et al.*, 2018) these men largely failed to acknowledge this behaviour as dangerous or damaging to their health. Past research has found an association between physical activity and a lack of concern about the dangers of UV exposure, and less use of sun protection strategies, although this is not necessarily confined to men (Holman *et al.*, 2015; Lawler, Sugiyama, & Owen, 2007). It is possible that perceptions of the positive health outcomes traditionally associated with physical activity override the negative ones associated with UV exposure, or that people find it difficult to conceive that an activity can be both healthy and unhealthy at the same time. This is also in line with previous findings that men are generally less likely than women to perceive themselves to be at risk for health problems, thus reducing motivations for self-examination of the skin (Courtenay, 2000; Julian *et al.*, 2016).

Finally, although the majority of these men’s everyday physical activity was not perceived as warranting sun protection, there were a few highly specific activities that did, for instance fishing, mountaineering, and skiing. As discussed in the previous chapter, this suggests that, in line with goal-directed behaviour theory (Carver & Scheier, 1982, 1990), situation-specific cues have an impact on sun

protection use, and that the need to sun protect is made salient in certain situations, prompting the execution of this particular behaviour. This therefore suggests that UV exposure may be reduced if the number of situations where sun protection use is made salient increase, for instance through the use of implementation intentions (Armitage, 2004).

Masculinity

Some researchers argue that men's health-related behaviours must be understood in the context of hegemonic masculinity, as this will impact both on the causes of men's ill health, and also on their responses to subsequent diagnoses (e.g., Mahalik *et al.*, 2007; Nobis & Sanden, 2008; O'Brien, Hunt, & Hart, 2005). Despite this, Courtenay (2000) notes that health-related research, even when specifically highlighting health inequalities between men and women, regularly fails to consider the role of masculinity. In the current sample, it was evident that masculine attitudes impacted on attitudes to UV exposure and sun protection, which in some cases made the men more susceptible to the risk of skin cancer. This is in line with past research, which has found associations between masculine attitudes and behaviours leading to poorer health, such as unhealthier life styles, lack of adherence to health advice, ignoring of health symptoms, and limited engagement with health professionals (Courtenay, 1998, 2000; Galdas *et al.*, 2005).

In the current sample, the men discussed sun protective behaviours with a level of objectivity (i.e., being aware of sun safety recommendations), and detachment (despite awareness, not applying it to their own lives). A similar pattern has been found through interviews with younger men, where discussions around behaviour change and appearance have reflected a traditional discourse of masculinity centred on detachment and self-reliance (Grogan, 2016; Nobis &

Sanden, 2008). The men's detached attitude to sun protection is broadly similar to findings by Davidson and Meadows (2010), who suggest that like younger men, older men have a 'should care/don't care' approach to personal health, where they are aware of health advice (should care) but choose to not adhere to it (do not care). Relatedly, Courtenay (2000) argues that men experience significant social pressure to endorse and enact masculine health-related beliefs, such as men being independent, self-reliant, and robust. As compared to women, men also perceive themselves at lower risk of physical illness, and also underestimate the consequences associated with unhealthy behaviours (Courtenay, 2000; Gustafson, 1998). It therefore appears theoretically possible for men to be as aware as women are about the dangers of UV exposure, but to not act upon this, something that was evident in the current sample.

Qualitative and quantitative research suggests that older men may rely more on traditional discourses of masculinities than younger men do, as ageing forces a re-shape of identities; this includes rejection of behaviours traditionally regarded as feminine, such as preoccupation with health concerns (Courtenay, 1998; Thompson & Langendoerfer, 2016). This is broadly similar to qualitative research suggesting that in line with traditional masculine discourse, men who do seek medical advice may perceive themselves in terms of vulnerability and embarrassment (Jeffries & Grogan, 2012). However, O'Brien *et al.* (2005) suggest that older men who have experienced serious illness are forced to abandon masculine attitudes to help-seeking in favour of overcoming the illness. In sum, this suggests that older men, particularly if they have not experienced serious illness, may be at more risk for skin cancer than young men, further highlighting the relevance of including this group in future research.

The enactment of masculinity also involves the rejection of femininity, and behaviours regarded as feminine, as men are to a certain degree defined by not being like women (Courtenay, 2000; Mahalik *et al.*, 2007). An example of this is men's limited concern about physical appearance (as this is viewed as a traditionally feminine pursuit). A large body of qualitative and quantitative research indicates that men of all ages are less concerned about physical appearance than are women of similar ages, a likely result of women being judged more according to their appearance, in all areas of life (Grogan, 2016). It might therefore be that these men have made a rational choice in limiting their appearance concerns, as they are unlikely to be punished by society for this. This was reflected in the current sample where the men stated that they were happy with the way they looked, and that appearance was not a main concern for them. Interestingly, this appeared to at times protect them from unhealthy behaviours (e.g., rejecting sunbathing and indoor tanning, as these were perceived as vain and feminine activities), but also put them at risk of other unhealthy behaviours (e.g., not being motivated to increase sun protection use following the intervention). This observation suggests that both of these consequences relating to men's lack of appearance concerns need to be considered in future health-behaviour research.

Moreover, some of the men commented on sun lotion application as being something that men do not generally do, which appeared to be a convenient excuse for opting out. Previous research has suggested that men may view application of lotions and sun protection as un-masculine (e.g., Courtenay, 2000); this is likely to be a significant obstacle for interventions aimed at reducing UV exposure, as men concerned with masculinity may be reluctant to engage in practices they regard as feminine (Dwyer, 2014). It should however be noted that men can in some instances

re-frame behaviours traditionally seen as feminine (e.g., weight concerns or adopting a healthy diet) to suit masculine norms (Sloan *et al.*, 2010). It is therefore possible that the same could be done with sun protection use. In sum, it is likely that as long as gendered scripts for health behaviours still prevail in society, future campaigns to promote sunscreen use in older men may need to frame certain messages accordingly. However, as noted by Sloan *et al.* (2010) and Gough (2010), a main challenge to this will be to adapt this health advice to men, whilst also avoiding perpetuating the very stereotypes of masculinity that contribute to men's poorer health to begin with. In the long-term, a more sustainable solution would be to promote the redefinition of masculinity, and ultimately the reduction of gender roles in society, so that men and women alike can enjoy better physical health (Buchbinder, 2010). The ways in which facial morphing interventions can work in the context of masculinity, without further enhancing gendered scripts, are discussed below.

Reactions to the Facial Morphing Intervention

Similar to older women (Persson, Grogan, *et al.*, 2018) and younger men (Owen *et al.*, 2016), a majority of the men noticed significant differences between the two photos, and generally agreed that the UV damaged photo looked worse than the naturally aged photo. However, this observation did not always translate into motivations to adopt safer behaviours in the sun, as the men lacked general concern about the appearance-related consequences of ageing.

Men's lack of concern about ageing has been previously observed in in-depth interviews with older and younger samples where men view ageing in positive terms, and the ageing body as utilitarian (Halliwell & Dittmar, 2003; Liechty *et al.*, 2014). This reflects what has been referred to as 'the double standard of ageing' (Halliwell

& Dittmar, 2003), where men's ageing is viewed neutrally or positively by themselves and society, whereas women's ageing is viewed negatively. This pattern has also been observed in qualitative research on reactions to a facial morphing intervention among younger men, who generally lacked concerns about the consequences of UV exposure on ageing and appearance (Loosemore & Grogan, 2015). When the current sample did express motivation to adopt safer behaviour in the sun, this seemed to be motivated by the underlying health concerns of the UV exposed photo (e.g., the skin discolouration appearing cancerous), which again relates to men generally perceiving their bodies in terms of functionality rather than something to be displayed (Halliwell & Dittmar, 2003). This would also explain the gender differences among this older age group, as women are traditionally encouraged to objectify their own body in ways men are not (Fredrickson & Roberts, 1997; Grogan, 2016). Finally, some men commented on the importance of being provided with two options of their future self for potential behaviour change, suggesting that a facial morphing intervention can increase self-efficacy of sun protection use. Combined, this suggests that facial morphing can be effective in reducing UV exposure among men, but it is possible that efficacy would be greater if emphasis was put on the health implications of the visual information provided.

Some men expressed a lack of motivation for behaviour change following the facial morphing, a similar finding to qualitative research on younger men (Owen *et al.*, 2016). They did not, however, consider the sun damaged photo to look better than the naturally aged photo, which is different to the younger sample. The rationale behind the lack of motivation was also similar to that of the younger age group: appearance was not considered an important enough factor in prompting behaviour change. Furthermore, the software was in some instances viewed with scepticism.

This suggests that even when men have health-oriented motivations, they cannot be acted on at the expense of masculinity (Gough, 2006). This is in sharp contrast with women of a similar age, where appearance concerns were a main factor in behaviour change motivations, and the naturally aged photo construed as an approach-type goal to work towards. It is also likely that the men's sense of health invisibility and unrealistic optimism regarding their own prospects were contributing factors, suggesting that it is pivotal to consider gender as a factor in behaviour change interventions, particularly as men are more reluctant than women to adopt strategies aimed at improving personal health (Courtenay, 2000; Deeks, Lombard, Michelmore, & Teede, 2009). It is therefore likely that an intervention such as facial morphing will need to be adapted depending on the target demographic.

The role of masculinity and gendered scripts (i.e., that men do not wear sun protection) for certain health behaviours have been found to impact the effectiveness of general health interventions as well as those aimed at reducing UV exposure, suggesting that this will need to be taken into account when promoting behaviour change among men (Gast & Peak, 2011; Walsh & Stock, 2012). In research on UV photography, Dwyer (2014) suggests that promoting personal choice may enhance the efficacy of behaviour change interventions among men, as it does not challenge norms of masculinity; this point has also been argued by Sloan *et al.* (2010). It would be possible to further highlight the issue of personal choice in a facial morphing intervention, as the comparison aspect between the two photos was already commented on by some of the men as containing a choice, and creating a sense of personal responsibility. Moreover, Deeks *et al.* (2009) argue that older men may be more prone to requesting health preventative information than younger men, suggesting that a well-designed intervention to reduce UV exposure could be

received well by this age group. Finally, there appear to be similarities between the genders in regard to the importance of situation salience and information clarity, in that that men will use sun protection in particular situations viewed as high-risk, such as mountaineering or skiing; this is promising as it suggests that it is possible to counteract masculine norms regarding sun protection use by promoting goal salience. This could be achieved by combining a facial morphing intervention with implementation intentions, as these have shown great promise in prompting a wide range of health-related behaviour changes (Gollwitzer & Sheeran, 2006).

Strengths

There were several strengths of this study that should be highlighted. A key strength of the present research is the participant group, which included older men, a group that has been previously overlooked in past research into appearance-focused interventions to reduce UV exposure (Persson, Benn, *et al.*, 2018). This is particularly relevant given that men, and particularly those of an older age, can be a difficult demographic for traditional health interventions to reach (Davidson & Meadows, 2010; Robertson & Gough, 2010). The study also benefitted from a large sample size where varied ages and Skin Types were represented; this goes some way towards ensuring generalisability of the findings to a wider UK context. Importantly, care was taken to encourage the inclusion of darker skin tones in the sample, as this was an issue that was identified as a limitation of the previous qualitative study on women. People from Black and Minority Ethnic (BME) groups can get skin cancer, and this diagnosis is often associated with elevated mortality levels when compared with their White counterparts; despite this, people with darker skin tones are under-represented in past research into appearance-focused interventions to reduce UV exposure, and are sometimes actively excluded from samples (Oyebanjo & Bushell,

2014; Persson, Benn, *et al.*, 2018). The current study's inclusion of a number of participants of darker skin tones can therefore be considered a key strength of this project, as it accurately represents a diverse Britain. However, as outlined above, it appears that despite AprilAge Inc (2017) contending that the software does work with those with darker skin tones, the facial morphing process does not appear to display marked differences between the high and low-UV photo for these participants, which may limit its effectiveness with this group. This is considered a key limitation of this type of intervention, and should be considered by the software developers. Finally, the semi-structured interviews allowed for the men to expand on issues they felt to be important, and they appeared comfortable with the interviewer, as they disclosed a significant amount of personal information.

Limitations and Future Directions

There were also limitations with this study. It is possible that the interviewer being a young woman may have impacted on the information the participants shared, and how they attempted to present themselves; they could have been reluctant to appear less masculine than they would have been in front of a man of a similar age. However, whether this was actually the case remains unclear, and future work would benefit from comparing data collected from female and male researchers. Future research would also benefit from including measures on participants' masculinity, as this has been previously found to be a moderator in the effectiveness of health interventions generally, and appearance-focused interventions to reduce UV exposure specifically (Dwyer, 2014).

Another potential limitation is the varied level of morphing between participants; younger men's photos would have had significantly more years added to them than those of the older men. However, reactions and evaluations of the

photos were similar throughout the age span, and care has been taken for this to be reflected in the quotes that were included; this suggests that this particular issue is unlikely to have had a considerable effect on the experiences of the intervention. Moreover, all the men were UK based, and the vast majority employed at one British university, so results need to be generalised to other countries and contexts with caution. As with the qualitative study on women, the current sample therefore has a skew towards the top two socio-economic status (SES) levels, which include people employed within academia (ONS, 2010). Courtenay (2000) notes that traditional, dominant forms of masculinity are associated with lower educational level and household income, suggesting that the current sample may have adhered less to masculine norms than other groups. It would therefore be beneficial to include men of a wider array of socio-economic backgrounds, as lower SES is associated with poorer health outcomes, and also interacts with gender and ethnicity in a health context (Galdas *et al.*, 2005; Michie *et al.*, 2009).

Finally, a key limitation was that the current study did not document the sexuality of the men. Past research suggests that gay male subculture is significantly more ‘appearance potent’ than the dominant heterosexual male culture, and that gay men are more concerned about their appearance than their heterosexual counterparts (e.g., Grogan, 2016; Jankowski, Fawkner, Slater, & Tiggemann, 2014; Tiggemann, Martins, & Kirkbride, 2007). It is therefore possible that this impacted the men’s attitudes to cosmetic appearance improvement through tanning, and their reactions to the facial morphing intervention may have varied according to whether they were gay or heterosexual. This is particularly relevant as Courtenay (1998, 2000) notes that men’s enactment of masculinity (and by extension their health-related

behaviours) varies according to their sexuality, suggesting that heterosexual and gay men may negotiate the risks of UV exposure differently.

Reflexive Analysis

As per recommendations by Braun and Clarke (2006) and Malterud (2001), reflexivity was engaged in throughout the process of thematic analysis, to further ensure adherence to the principle of scientific rigour. It is generally considered important to make the researcher behind the study visible, as this person (including their attitudes and motives for the research) is in many ways a part of the research itself (Finlay, 2003). Below is a discussion of the major points that arise from this reflexivity, specifically focusing on those that might have impacted the reading of the data, namely prior assumptions of the research topic and values and life experiences (Clarke & Braun, 2013).

As a researcher I have done my best to represent the men's accounts objectively and fairly, but there are several issues to note about myself as a person, and my attitudes and values that may have impacted on the manner in which I engaged with the material. I am a female PhD student in Health Psychology, with a personal interest in body image and behaviour change, and I am currently in my mid-twenties. I also identify as a feminist, with a strong interest in the socialisation of gender roles in society. I am particularly passionate about research into toxic masculinity, and how masculine norms and attitudes impact the lives of both men and women. I have a limited interest in appearance, and no interest in tanning; I do not engage in beach type holidays, and I consistently use sun protection with high SPF on exposed areas. I have experienced the facial morphing intervention in regard to UV exposure myself, and I have attempted to reflect upon my attitudes to UV exposure and sun protection, and how these might interact with the engagement of

the material. My motive for this research is to further the understanding of appearance-focused interventions to reduce UV exposure, and ultimately to assess whether facial morphing can be a viable option for eliciting behaviour change for men of this age, and what potential barriers might need to be considered to facilitate this.

The main point of reflection for this study is around my gender and age, where I am a young woman who have interviewed and analysed data from older men. As previous research has indicated (and as outlined in the introduction to this chapter), there appears to be gender differences in how men and women negotiate their personal health, as well as in their attitudes to UV exposure and sun protection. It is therefore likely that I lacked a level of understanding in how these men felt in relation to the above, something that could have been reflected in the relevance of the follow-up questions I asked the men, and thus in the resulting data. It is also likely that my interpretation of the interview material was impacted by my lack of understanding of the issues facing older men in this area, and it is possible that I did not pick up on certain issues due to this. Here I would like to consider my feminist ideology and personal interest in the socialisation of gender roles as an advantage; I have a strong personal interest in these issues, and have taken the time to read about the ways in which masculinity and gender may impact on health intervention as well as attitudes to UV exposure. This should have hopefully awarded me a level of insight into these gendered processes.

Second, similarly to the issues noted through the reflexive analysis for the study described in Chapter Four, it is possible that my attitudes to UV exposure and sun protection impacted on my interaction with participants, as well as my reading of the data. As with the study on women, my positive attitudes to sun protection could

have impacted on how I reacted to some of the participants' disclosures of failing to use sun protection, and my lack of understanding as to why they would put themselves at risk of skin cancer could have made my subsequent analysis of the material less true to their original meanings. I attempted to somewhat account for this by remaining aware of my attitudes throughout this process, and to remind myself to be as objective as possible throughout the interview process. Interestingly, although my lack of interest in personal appearance may have limited my interaction with the female participants, it is possible that this worked to my advantage in the current study. I found myself relating to the men's notions of not valuing a tanned appearance, and not engaging in tanning, as this was seen as a vain and pointless activity; this is very much in line with my personal opinions on the matter. It is therefore likely that this similarity in attitudes was helpful in my posing relevant follow-up questions, as well as in my reading of the subsequent data.

Finally, I would like to consider my feminist ideology, as I believe this to have impacted on the data collection process as well as the subsequent reading of the material. As for the data collection process, my attitudes could have impacted on the manner in which participants responded to my questions, as it is possible they detected my unconsciously reacting to certain information they provided me with. It is also a possibility that my follow-up questions and probing were particularly focused on participants' displays of masculine attitudes, and therefore generated further data on this particular issue. To counter this, I tried to be as aware of this as possible throughout the interview process, to minimise its impact on the interaction with participants. This was aided by the decision to use the same interview protocol for men and women. Moreover, it is likely that my interest in feminism and masculinity impacted on my reading of the data, particularly as one of the themes

was concerned with the gendered aspects of appearance concerns. However, in line with the study's adherence to scientific rigour - notably validity and confirmability of themes - themes were read and agreed upon by all members of the supervisory team, thus ensuring that they were strongly anchored in the raw data and therefore somewhat objective. In addition, the study was submitted for publication in *Psychology & Health*, and is currently undergoing revision in line with the peer-review process, meaning that findings have been commented on by other researchers. Relatedly, the current study's findings on gender and appearance concerns mirror the large body of previous research on health behaviours and masculinity (e.g., Courtenay, 1998; Courtenay, 2000; Grogan, 2016; Kasparian *et al.*, 2009), further suggesting that the themes were not unduly influenced by my personal attitudes.

Conclusions

This chapter has outlined the design, implementation, and findings from a qualitative study into older men's attitudes to UV exposure, sun protection, and a facial morphing intervention, providing a unique insight into a demographic group that has been largely ignored in previous research on behaviour change interventions: men aged between 35 and 61 years. Crucially, the study considered how general attitudes to UV exposure, sun protection, and masculinity may impact the efficacy of appearance-focused interventions such as facial morphing. Through individual interviews, which were subjected to thematic analysis, three themes were found: activity and detachment; gendered appearance; and motivations, health concerns, and scepticism. Men's motivations for UV exposure were primarily associated with physical activity, and they were reluctant to identify gaps in their sun protection use. The men expressed gendered attitudes towards ageing and

appearance; mainly that they were unconcerned about physical appearance, and remained neutral about the consequences of ageing. These attitudes were directly related to the men's reactions to the facial morphing, where those who did express motivation to change their behaviour following the intervention were primarily motivated by health concerns rather than appearance, and those who were not motivated accepted the physical consequences of ageing and remained unconcerned about the dangers of UV exposure.

The use of a qualitative methodology enabled the examination of processes impacting on the effectiveness of the intervention, most notably masculine attitudes. The findings suggest that appearance-focused interventions can be successful in reducing UV exposure in this group, but may need to be adopted to account for gendered rules regarding sun protection use and masculinity. The current study therefore expands knowledge about skin cancer interventions with different groups, and contributes to the design of Study Four, where masculinity will be examined as a moderator. Finally, although this study specifically focuses on one particular intervention as a tool for possible behaviour change, the exploration of general attitudes to UV exposure and sun protection, and the role of masculinity, mean that the findings of the study are of relevance for anyone wishing to design a skin cancer prevention strategy, thus making a novel contribution to research in this field.

Chapter Six: A Small-Scale RCT of the Effectiveness of Facial Morphing Versus a Health-Focused Intervention to Reduce UV Exposure

The final study of this PhD was a small-scale Randomised Controlled Trial (RCT) designed to examine the efficacy of an appearance-based facial morphing intervention as compared to a health-focused intervention, on sun protective intentions, sun protective behaviour, and UV exposure. Measures were taken both immediately after morphing and up to 6 months afterwards. The effect of implementation intentions was also examined, alongside a number of moderators that included appearance concerns, consideration of long-term consequences (CFC), and masculinity (for men). Participants were 53 men and women aged between 35 and 61 years. This chapter details the design, implementation, and conclusions of this study, and considers the findings within the context of psychological theory. This study has therefore designed and implemented an experimental study into the effectiveness of one appearance-focused intervention (second overall PhD aim), and as such uniquely contributes to the existing knowledge on skin cancer prevention (third overall PhD aim).

Background

Given the strong link between UV exposure and skin cancer (Cancer Research UK, 2018a; Skin Cancer Foundation, 2016a), it is crucial to explore novel ways in which to encourage the general population to reduce risky UV exposure (i.e., indoor and outdoor tanning) and increase sun protection use. It has also been noted that older participants have been overlooked in past research into this area, despite the fact that targeting this age group may be more effective than targeting younger age groups (Olsen *et al.*, 2018; Persson, Benn, *et al.*, 2018).

Previous chapters have outlined the current evidence base for appearance-focused interventions to reduce UV exposure (including facial morphing) and concluded that they are effective (small-medium effect size) in increasing intentions to use sun protection, as well as in impacting on actual sun protective behaviour and UV exposure (Persson, Benn, *et al.*, 2018). Two qualitative studies (Study Two and Study Three) concluded that facial morphing can increase motivations to reduce UV exposure for both genders, but may need to be reframed to focus on the underlying health issues represented by the high-UV photo in order to be effective with men (Persson, Grogan, *et al.*, 2018; Persson *et al.*, *under revision*). Similarly to Williams, Grogan, *et al.* (2013a), the meta-analysis outlined in Chapter Two identified a number of methodological issues associated with previous research, including a lack of long-term follow-ups in studies examining appearance-focused interventions to reduce UV exposure. Combined, this provides a strong rationale for examining the long-term effectiveness of an appearance-based facial morphing intervention among a sample aged 35 years and older, as this also specifically contributes to the second aim of this PhD, namely to design and implement a facial morphing intervention and compare its effectiveness in increasing sun protection to a health-focused intervention.

The Current Study

The current study aims to quantitatively investigate the long-term effectiveness of a facial morphing intervention in increasing sun protective intentions (SPI) and behaviour (SPB), and in reducing UV exposure (UVE), by comparing it to a health-focused intervention. As the qualitative studies identified situation salience (i.e., regarding certain highly specific situations as warranting sun protection) as a variable of interest, the current study also aims to assess the

effectiveness of implementation intentions in conjunction with the original intervention. As the meta-analysis and systematic review identified a limited inclusion of long-term follow-ups, the current study examines intervention effects immediately following the intervention, as well as after four weeks, and six months.

The target population for this study is women and men aged between 35 and 61 years, thus adding to the existing knowledge in this area by considering how effective this type of intervention can be with an older age group. Based on previous literature as well as on findings from Study Two and Study Three, the study also examines the impact of a number of moderators: appearance concerns, consideration of future consequences, and masculinity (for men), on the intervention effects. The current study therefore aims to integrate and build on the previous findings detailed in this thesis, to ensure that each step of the PhD informs the subsequent ones. Although qualitative research has the capacity to explore an intervention and signpost relevant avenues for future research (Sofaer, 1999), experimental research is needed to further quantify these findings by measuring variables, and controlling for covariates and confounding factors (Babbie, 2010). This small-scale RCT is therefore a crucial addition to the previous research in this thesis, as it aims to establish the effectiveness of this type of intervention when compared to a health-focused intervention. It also contributes to this programme of research's adherence to 'the fundamental principle of mixed-methods research' (p.18; Johnson & Turner, 2003), where data collection and analysis methods should complement one other. By examining a previously overlooked participant group as well as by including a combination of moderators not previously analysed together, the current study contributes to, and expands the existing literature, thus achieving the third aim of this PhD.

The specific aims for this study are as follows:

- To examine the effectiveness of facial morphing in reducing UV exposure and increasing sun protective behaviour and intentions, both immediately and long-term among people aged 35 years and older
- To examine the effect of implementation intentions on the above, as well as how it interacts with the intervention effects
- To assess the moderating impact of appearance concerns, CFC, and masculinity (among men) on the above
- To assess whether gender is a significant covariate in any of the above

Given the paucity of published research on these interventions, directional hypotheses were not generated.

Method

Design

The study employed a 2x2 design. The first independent variable (IV) was type of intervention, where participants either received the facial morphing intervention, or the health-focused intervention (consisting of an informational leaflet in the form of a PowerPoint presentation; full details on this can be found in Chapter Three on page 64). The second IV was whether or not participants received implementation intentions; these conditions are fully outlined in Chapter Three, on page 65. Participants were randomly allocated to the conditions using an online block randomisation technique to ensure similar numbers in each condition. A flow-chart of the movement of participants through test stages and conditions can be found in Figure 6.1.

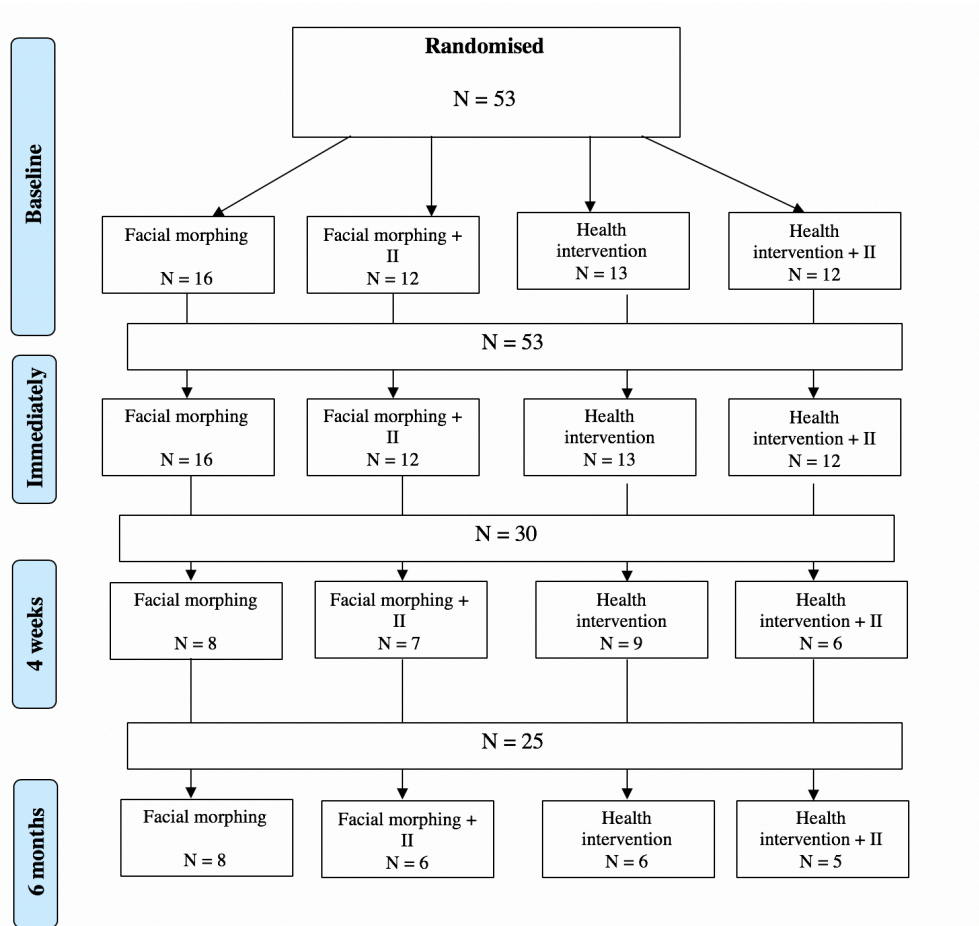


Figure 6.1. Flow-Chart of Participants Through Test Stages and Conditions.

Outcome variables were SPI, SPB, and UVE. SPI was measured at three time points after the intervention: immediately after the intervention, after four weeks, and after six months. SPB and UVE were measured at two time points following the intervention: after four weeks, and after six months. All these variables were also measured at baseline (i.e., prior to the intervention), to ensure that they could be controlled for in the main analyses. Moderator variables were appearance concerns (MBSRQ-AS), CFC (CFCS), and masculinity (CMNI-44). Due to a limited spread of responses, socio-economic status (SES) as measured by highest educational qualification was not included as a moderator, but treated as a covariate. Data

collection took place between early summer 2017, to early summer 2018; this ensured an equal spread of participant sun exposure across interventions throughout the year, meaning that the effects would not be unduly influenced by time of year.

Recruitment

As strongly recommended in any RCT (e.g., Clark et al., 2013; Jones et al., 2003), *a priori* power calculations were undertaken to determine the desired sample size. Power calculations are required to ensure that a study is sufficiently powered to detect an effect, whilst also avoiding unnecessary participant recruitment (Clark-Carter, 2009). For the current study, G*Power v3 (Faul *et al.*, 2007) was used to calculate sample size.

When accounting for the moderators, the power analysis suggested that a sample of 73 participants would provide 80% power to detect a large-sized increase ($f= 0.4$), with alpha set at .05, as previously found by facial morphing studies on short and long-term sun protection intentions (Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b). 179 participants would be needed to achieve 80.% power to detect a medium-size ($f= 0.25$), as found for implementation intention research (Gollwitzer & Sheeran, 2006) with alpha set at .05. The target sample of the current study is based on a mean value of these effect sizes. Therefore, a sample of 35 participants per group (total 140) would be needed to allow for participant attrition (10%) in each condition.

Participants were recruited via opportunity sampling through the following means: via several university mailing lists, by approaching people on campus at different university campuses, in two local gatekeepers' homes (i.e., people personally known to the researcher who facilitated recruitment of people in their community), and at one public engagement event in Northern Manchester. A

concerted effort was made to utilise recruitment strategies outside the university environment, allowing for a more inclusive participant group, as the previous chapters of this dissertation noted a skew towards higher SES among participants. Participants were eligible if they were between 35 and 61 years old and spoke fluent English. One participant was excluded at the beginning of the study (at their own request) as their English was not sufficiently fluent for them to understand the questionnaires. As reimbursement for their time, participants were offered the chance to enter into a price-draw to win a £30 high street gift voucher at the end of the final questionnaire (6 months follow-up).

The final sample size included 53 participants, thus not reaching the threshold set by the *a priori* power calculation. Underpowered samples are generally considered acceptable within exploratory research, where findings are used to guide further research in the field and determine the feasibility of an intervention with a particular group (Hertzog, 2008). The definition of an adequate sample size is therefore more subjective, as feasibility will play a major part in recruitment and implementation (Hertzog, 2008; Johanson & Brooks, 2010). As facial morphing is still relatively understudied in the context of UV exposure, particularly among older people and examined together with a number of moderators, the current project can therefore be considered somewhat exploratory, and findings relevant within the context of informing further, large-scale studies.

Materials

Below is an outline of the materials utilised for this study.

Demographic questions. Participants were asked a number of demographic questions, including their age, sex, ethnicity, highest level of education (ONS, 2010),

and previous experience with skin cancer (self or relative/friend). Full details on these questions can be found in Appendix I-K, Figures A6.2-4.

Moderators.

Full details on the moderators outlined below can be found Appendix L-M, Figures A6.5-7.

The Multidimensional Body-Self Relations Questionnaire (MBSRQ-AS)

(Cash, 2000). For the current study, 19 items measuring the sub-scales of appearance evaluation (seven items) and appearance orientation (12 items) were administered to participants. The additional sub-scales focusing on weight preoccupation and body part-specific concerns were excluded, as appearance concerns have been previously found to impact on the effectiveness of interventions aimed at reducing UV exposure (Dodd *et al.*, 2013; Stapleton *et al.*, 2017). The MBSRQ-AS consists of a number of statements, where participants indicate their agreement on a 5-point Likert-type scale, where 1 indicates a high level of disagreement (“definitely disagree”), and 5 indicates a high level of agreement (“definitely agree”). A higher score therefore indicates a higher level of appearance concern. An example item of appearance evaluation is “I dislike my physique” (reverse scored), and of appearance orientation: “I am self-conscious if my grooming isn’t right”. This scale was measured at baseline only, and the Cronbach’s alpha was .88.

Consideration of Future Consequences Scale (CFCS) (Strathman *et al.*,

1994). Measuring the extent to which an individual is concerned about distal versus proximal consequences, the CFCS consists of 12 items. The items are a series of statements, and participants indicate how characteristic each of these are for themselves. This is indicated on a 5-point Likert-type scale, where 1 indicates that a statement is highly uncharacteristic of them (“extremely uncharacteristic”), and 5

indicates that the statement is highly characteristic of them (“extremely characteristic”). A higher score therefore means a greater concern about future consequences, as opposed to immediate consequences. Example items include “I consider how things might be in future, and try to influence those things with my day to day behaviour” and “I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level” (reverse scored). The CFCS was measured at baseline only, and the Cronbach’s alpha was .73.

Conformity to Masculine Norms Inventory (CMNI-46) (Mahalik *et al.*, 2003; Parent & Moradi, 2009). The CMNI-46 was used to measure masculinity among the males in the sample; where a participant indicated that they were male, they were subsequently presented with this scale, while females were not. The scale consists of 46 items designed to measure traditionally masculine concepts: winning, emotional control, risk-taking, violence, power over women, playboy, self-reliance, primacy of work, and heterosexual self-presentation. The items are framed as statements and participants indicate their agreement on a 4-point Likert-type scale where 1 indicates a high level of disagreement (“strongly disagree”) and 4 indicates a high level of agreement (“strongly agree”). A higher score indicates higher levels of self-reported masculinity. Example items include “In general, I will do anything to win”, and “Women should be subservient to men”. The CMNI-46 was measured at baseline only, with a Cronbach’s alpha of .87.

Outcome variables. The outcome variables were largely derived from previous studies into appearance-focused interventions (e.g., Dwyer, 2014; Stapleton *et al.*, 2010; Williams, Grogan, *et al.*, 2013b). Full details on these questions can be found in Appendix O, Figure A6.8.

Sun protective intentions (SPI). These items were designed to assess the extent to which participants intended to protect their skin from the sun in the future. It was measured at four time points: baseline, immediately following the intervention, four weeks after the intervention, and six months after the intervention. The scale contained six items, including “I plan to get a tan from the sun or tanning booths” and “I plan to wear protective clothing (e.g., a wide-brimmed hat, long sleeves, and/long trousers) whenever I am in the sun”. Participants indicated their agreement to each statement on a 7-point Likert-type scale, where a 1 indicated a low level of agreement (“strongly disagree”) and a 7 indicated a high level of agreement (“strongly agree”). A higher score therefore indicated a greater intention to sun protect in the future. Cronbach’s alpha at baseline was .68.

Sun protective behaviour (SPB). Sun protective behaviour was assessed using four statements designed to measure the extent to which participants had been protecting their skin from the sun, and was administered at three time points: at baseline, and at four weeks, and six months following the intervention. Participants indicated their agreement to each statement on a 7-point Likert-type scale, identical to the one for SPI; a 1 indicated a low level of agreement (“strongly disagree”) or a less frequent behaviour (1 = “never”) and a 7 indicated a high level of agreement (“strongly agree”) or a more frequent behaviour (7 = “always”). A higher score therefore meant more frequent past sun protective behaviour. An example item included “I have been using SPF with at least SPF 15 for the last 12 months”. The Cronbach’s alpha at baseline was .81. Two items (“When spending time in the sun during the past 12 months, how often have you tried to seek the shade?” and “When spending time in the sun during the past 12 months, how often have you worn sun protective clothing; e.g., a wide-brimmed hat, a long-sleeved shirt, and/or long

trousers?") were deleted to allow for an acceptable level of internal consistency, resulting in a final two items.

UV exposure (UVE). UVE was measured at baseline, and after four weeks, and six months with two separate frequency items (one measuring indoor and outdoor tanning combined, and one measuring indoor tanning only), where participants indicated how often they indoor and outdoor tanned on a 7-point Likert-type scale. A 1 indicated a less frequent behaviour ("never" or "none") and a 7 indicated a more frequent behaviour ("every day" or "more than five times"). A higher score therefore suggested more frequent UV exposure. An example item was "How often have you spent time trying to achieve a tan from UV rays (e.g., sunbathing outside or using a tanning bed) in the past 12 months?"

Procedure

All sessions took place in a private space to allow for quiet and privacy during the intervention, as well as when participants were completing the questionnaires. Initially, participants were told what the study was about (i.e., a study investigating the impact of different types of UV information on UV exposure-related behaviour and intentions), and approximately how long it was expected to take (30 minutes for the initial session, and five minutes each for the long-term follow-up points). Participants then completed the baseline questionnaires before receiving one of the interventions (facial morphing or a health-focused intervention), which was followed by either receiving or not receiving implementation intentions instructions. After this, participants completed the immediate measures, before they were thanked for their participation, and told to expect an email with further questionnaires to be completed online after four weeks, and six months. For the follow-ups; after four weeks as well as six months, participants received an email

with a link to an online platform containing the questionnaires. At the end of the six months follow-up, participants were debriefed and offered the chance to enter into the prize draw where they would get a chance to win a high-street shopping voucher worth £30.

Ethical Considerations

The study was conducted in accordance with The British Psychological Society (2018) ethical guidelines and received ethical clearance from the Manchester Metropolitan University ethics board. Details on the ethical approval can be found in Appendix P. Participants gave informed consent; their responses were anonymised; and they were informed that they could withdraw without giving a reason at any moment during the study. At the end of the study, participants received information about skin cancer, and were told to consult the NHS website on skin cancer or consult their General Practitioner (GP) should they wish to undergo a skin examination. It should be noted that participants who did not complete the follow-up did not receive the debrief; due to the anonymity with which participants completed the questionnaires it was not possible to identify those who did not complete the final follow-up point.

Data Analysis

All analyses were conducted using SPSS v.25 (IBM Corp, 2017). For all the scales, Cronbach's alpha was calculated at baseline to determine internal reliability. Cronbach's alpha [α] (Cronbach, 1951) is a widely used measure of internal consistency, and although its usefulness has in recent years been debated (see Borsboom [2006] or Sijtsma [2009] on the limitations of Cronbach's alpha and how its popularity has been influenced by its inclusion in SPSS), it is generally considered a useful indicator of intercorrelation within a scale and whether items

collectively measure the same construct (Bland & Altman, 1997; Tavakol & Dennick, 2011). Likewise, there has also been some debate as to what an acceptable level of Cronbach's alpha is, with .70 or above generally being considered the threshold for an adequate level of internal consistency, although the scientific evidence for this is relatively scarce. The .70 threshold is widely misattributed to Nunnally and Bernstein (1994), and other authors (e.g., Tavakol & Dennick, 2011) have noted that the alpha level will depend on the number of items in the scale, allowing for a level of flexibility regarding alpha levels. A lower alpha level is generally considered acceptable in non-clinical populations (Bland & Altman, 1997).

For the main analyses, data from women and men were analysed together, and gender treated as a covariate. This was possible as men and women had been administered the same interventions, as well as given the same questionnaires pertaining to baseline variables, outcome variables, and moderators. There was one exception, where men were administered the CMNI-44 to assess masculinity; the impact of this moderator was therefore only examined with the males in the sample.

The effectiveness of the IVs on immediate levels of SPI was examined using one two-way analysis of covariance (ANCOVA), controlling for baseline SPI, gender, highest level of educational qualification, and previous skin cancer experience. An ANCOVA examines the main effects of two IVs (type of intervention and whether or not participants were administered implementation intentions), on one outcome variable (immediate SPI), whilst controlling for a number of covariates. An ANCOVA was used to allow for the inclusion of the full participant set ($N = 53$) at the assessment immediately after the intervention, as the later time points experienced significant attrition.

For the remainder of the time points (four weeks and six months after the intervention) three two-way multivariate analysis of covariances (MANCOVAs) were performed to examine the effects of the two IVs (type of intervention and whether or not participants had been administered implementation intentions) on SPI, SPB, and UVE, whilst also controlling for baseline SPI/SPB/UVE, gender, highest level of educational qualification, and previous skin cancer experience. A two-way MANCOVA examines the main effect of two IVs (intervention and implementation intentions) on multiple outcome variables (SPI/SPB/UVE) whilst also controlling for a number of covariates. As previous research in this thesis has examined the impact of facial morphing on women and men separately, gender was included as a covariate in the analyses. This is considered relevant as previous qualitative research has found that older men and women may interact differently with facial morphing (Persson, Grogan, *et al.*, 2018; Persson *et al.*, *under revision*).

The above analyses were chosen to allow for the inclusion of the participants in the immediate follow-up ($N = 53$) whilst also being mindful of issues surrounding multiple statistical testing (e.g., false positive rates) (Benjamini & Hochberg, 1995; Field, 2013). Combining one ANCOVA with three MANOVAs (rather than conducting close to 10 ANCOVAs, or only conducting three MANOVAs and therefore losing over 20 participants in the immediate follow-up) was concluded to be the most sensible approach to the current data set.

A number of moderation analyses were carried out, to examine under which circumstances and with whom the intervention was effective (Hayes & Rockwood, 2017). For these analyses, the Process macro v3 developed by Hayes (2012) was used to examine the main effects of the moderators (MBSRQ-AS, CFCS, CMNI-44) as well as their interactions with the independent variables on the outcome variables.

If either of the three effects are significant (i.e., main effect of the IV, main effect of the moderator, interaction effect between the IV and the moderator), the analysis then further probes where this effect is occurring, demonstrating the effect on the DV when the value of the moderator is either low, medium, or high (16th, 50th and 84th percentile, respectively). The analysis also allows for the controlling of a number of covariates (e.g., baseline levels of SPI/SPB/UVE). CMNI-44 was only examined as a potential moderator among men.

Results

Sample Characteristics

There were 53 (36 females, 17 males) participants. Please see Table 6.1 for full participant demographics, overall and separated by gender. The mean age of participants was 48.15 (median: 48, min: 35 years, max 61 years). Thirty-eight participants held a university degree (undergraduate or postgraduate). Because of the limited inclusion of participants in education category 1-4, this variable was not considered as a moderator, but was nonetheless included as a covariate. Forty-eight participants were White, and described themselves as White British. Overall, fourteen participants had personal experience of skin cancer (themselves and/or family/friend).

Table 6.1. *Participant Demographics.*

	Overall	Women	Men
<i>N</i>	53	36	17
Mean age (median, min, max,)	48.15 (48, 35-61)	47.86 (47, 35-61)	48.79 (49, 35-61)
Education			
No formal education	0%	0%	0%
Primary school	0%	0%	0%
GCSE	3.8%	2.8%	5.9%
A-levels	9.4%	11.1%	5.9%
Undergraduate degree	30.2%	22.2%	47.1%
Postgraduate degree	41.5%	47.2%	29.4%
Other*	15.1%	16.7%	11.8%
Ethnicity			
White British	90.6%	91.7%	8.2%
Asian/Asian British	3.8%	2.8%	5.9%
Black/Black British	3.8%	5.6%	-
Other	1.9%	-	5.9%
Skin Cancer			
Self skin-cancer	3.8%	2.8%	5.9%
Other skin cancer	20.8%	22.2%	17.6%
Self and other	1.9%	2.8%	-
No/do not know	73.6%	72.2%	76.5%

* Other category included foreign degrees and work-related diplomas.

Normality

Normality was examined using a variety of measures. As can be seen below, the data were assumed to be largely distributed normally, thus allowing for parametric testing.

Multivariate normality. By visually examining the data, SPI, SPB and frequency of outdoor/indoor tanning were determined to not be notably skewed, with an even spread of responses. The data for indoor tanning only was highly skewed; only 3.8% ($N = 2$) of participants reported using a sunbed twice in the past month, with the remainder reporting no sunbed use. There was also an even spread of responses for the moderators, with the MBSRQ-AS, CFCS, and CMNI-44 having an apparent normal distribution. In addition, and as recommended by Field (2013), the

data were statistically assessed for multivariate normality; this was achieved by examining Q-Q plots, as specified by Korkmaz, Goksuluk, and Zararsiz (2014). Q-Q plots are examined to assess the extent to which the observed data fit the hypothesized distribution, with the Q-Q points approximately laying $x = y$ (Korkmaz *et al.*, 2014). Data for all variables (SPI, SPB, frequency of outdoor/indoor tanning, MBSRQ-AS, CFC, CMNI-44) suggested multivariate normal distribution, but as expected, the data for indoor tanning did not. The item on indoor tanning only was therefore excluded from analysis, and henceforth UVE will be used to denote the indoor/outdoor tanning variable.

Heteroscedasticity. Heteroscedasticity is the violation of homoscedasticity, where error terms vary significantly across independent variables, thus violating the regression model (Coenders & Saez, 2000; Field, 2013). The presence of heteroscedasticity in the current data set was examined using the Bruesh-Pagan test, which tests whether the variance of errors are similar across the independent variables (Field, 2013). The test was found to be non-significant: $X^2 = (1)1.07, p = .30$, meaning that the data set could be considered to be homoscedastic, thus not violating the normality assumptions.

Outliers. Examining box plots for each of the moderator and dependent variables, there were no notable outliers in the data. For analyses of variance, Mahalanobi's distances (MAH) can be used as a method to detect outliers in the data, where each value measures the distance of each case from the variable mean (Penny, 1996). There is some debate as to what limit is appropriate to use to detect an outlier, and this generally depends on the critical value of the Chi-Square, the desired alpha level, and the sample size (Tabachnick & Fidell, 2007). Based on recommendations by Field (2013), where $p = .05$; the number of variables/DF = 7;

and a small-medium sample size, the critical value of Chi-Square would be approximately 15. None of the MAH values were, according to this cut-off point, cause for concern.

Multicollinearity. As generally recommended (e.g., Field, 2013; Morrison, 2005), the data were assessed for multicollinearity, which exists when the correlations between the variables are too large. For analyses of variance, these correlations should ideally not be more than moderate. Multicollinearity was assessed using the variance inflation factor (VIF), which should not be greater than 10, smaller than 0.20, and not substantially greater than 1 (Field, 2013). There was no multicollinearity.

Homogeneity of covariance matrices. Finally, Field (2013) suggests that when sample sizes are roughly equal, homogeneity of covariance matrices does not need to be tested for; as the sample sizes for each of the conditions were indeed similar, the data were therefore assumed to be robust.

Baseline Measures

Please see Table 6.2 for full details on baseline measures overall, and for women and men separately.

Table 6.2. *Sample Baseline Measures.*

	Overall	Women	Men
Condition (<i>N</i>)			
Facial morphing	16	12	5
Facial morphing & II	12	7	4
Health intervention	13	8	4
Health intervention + II	12	9	4
Outcome variables (<i>M, SD</i>)			
SPI	4.68 (1.05)	4.84 (1.18)	4.34 (.95)
SPB	2.91 (1.69)	2.91 (1.69)	3.79 (1.70)
UVE	1.96 (1.38)	2 (1.48)	1.87 (1.19)
Moderator variables (<i>M, SD</i>)			
MBSRQ-AS	3.06 (0.57)	3.12 (0.58)	2.92 (0.55)
CFCS	3.47 (0.50)	3.59 (0.39)	3.23 (0.61)
CMNI-44	-	-	2.24 (0.33)

Equivalence between conditions. A one-way MANOVA was carried out to assess baseline differences between conditions. There was no baseline difference on any of the outcome variables between any of the two interventions; SPI: $F(3,1) = .75, p = .52$; SPB: $F(3,1) = .44, p = .73$; UVE: $F(3,1) = .81, p = .50$.

Missing values. The full sample was not followed up; this was either due to attrition relating to non-completion, or project time constraints. Because of participant privacy (i.e., that they were not provided with an identification code, and time of data completion was not logged) it was not possible to distinguish between participants based on reason for not being followed up.

There was significant attrition between baseline ($N = 53$) and the follow-up points: 62.3% follow-up rate at four weeks ($N = 33$); 54.7% follow-up rate at six months ($N = 29$). To assess whether this varied significantly between conditions (i.e., whether participants were more likely to complete the follow-up in any of the conditions), two Chi-square tests were carried out on the two follow-up points,

demonstrating that there was no significant difference in follow-up rates between conditions at four weeks: $X^2 = (3, N = 33) 1.40, p = .70$; or at six months: $X^2 = (3, N = 29) 1.28, p = .73$. This therefore suggests that participants were equally likely to complete the follow-up regardless of which condition they had participated in.

To examine whether participants who were followed up differed significantly from participants who were not followed up, attrition analyses (a two-way MANOVA) were conducted on baseline measures on both follow-up points (four weeks and six months). There was no significant difference in any of the baseline measures (SPI, SPB, UVE) for participants who did or did not complete follow-up at four weeks: $F(3, 48) = .002, p = .99$ partial eta squared = $<.01$; or at six months $F(3, 48) = .125, p = .30$ partial eta squared = $.08$. This therefore suggests that participants were equally likely to complete the follow-up regardless of their baseline attitudes and behaviours relating to UV exposure and sun protection.

Between-Participants Differences

Please see Table 6.3 for full details on means and Standard Deviations across conditions.

Table 6.3. *Means and Standard Deviations Across Conditions.*

	<i>N</i>	Facial morphing	<i>N</i>	Facial morphing + II	<i>N</i>	Health intervention	<i>N</i>	Health + II	<i>N</i>
SPI (<i>M, SD</i>)									
Immediately	48	5.04 (1.28)	12	6.04 (.85)	12	5.18 (.98)	12	5.39 (.96)	12
4 weeks	25	5.02 (1.51)	8	5.92 (.40)	6	4.94 (.44)	6	5.97 (.97)	5
6 months	25	4.92(1.09)	8	5.47 (.81)	6	4.92 (.85)	6	5.87 (.82)	5
SPB (<i>M, SD</i>)									
4 weeks	26	3.25 (1.93)	8	2.75 (1.60)	6	3.17 (1.44)	6	3.25 (1.04)	6
6 months	26	3.56 (2.11)	8	2.83 (1.69)	6	2.58 (1.53)	6	3.33 (1.33)	6
UVE (<i>M, SD</i>)									
4 weeks	26	1.75 (.70)	8	1.00 (00)	6	1.83 (.98)	6	1.33 (51)	6
6 months	26	2.13(.91)	8	1.17 (.41)	6	2.00 (1.55)	6	1.00 (00)	6

Immediate follow-up. To assess the effect of the interventions on immediate levels of SPI, a two-way ANVOCA was carried out, with the two interventions as the IVs and immediate levels of SPI as the outcome variable. Covariates were baseline SPI, gender, highest level of educational qualification, and previous skin cancer experience. There was no overall effect of type of intervention on SPI; $F(1, 40) = .13, p = .64$, partial eta squared = .01. There was also no effect of implementation intentions on SPI; $F(1,40) = 1.19, p = .28$, partial eta squared = .03. Likewise, there was no interaction between the two IVs on levels of SPI: $F(1, 40) < 01, p = .91$, partial eta squared < .01. Unsurprisingly, the only variable that predicted immediate levels of SPI was baseline levels of SPI: $F(1, 40) = 41.00, p < .001$, partial eta squared = .50.

Four weeks and six months follow-up. Three two-way MANCOVAs were conducted to assess the impact of the interventions on SPI, SPB, and UVE after four weeks and after six months. Due to similar levels of attrition between the two-follow ups (62.3% follow-up rate at 4 weeks; 54.7% follow-up rate at 6 months), these time points were combined into one analysis. As recommended by Field (2013) when condition sample sizes are roughly equal, Pillai's Trace was used as the target test statistic. In these analyses baseline SPI/SPB/UVE, gender, highest educational qualification, and previous skin cancer experience were all controlled for.

There was no overall effect of type of intervention on SPI long-term; $F(1, 16) = 0.65, p = .55$, Pillai's trace = 0.06 There was also no effect implementation intentions on SPI; $F(1,16) = .2.51, p = .11$, Pillai's trace = 0.24. Likewise, there was no interaction between the two IVs on levels of SPI: $F(1, 16) = 0.42, p = .66$, Pillai's trace = 0.05.

There was no main effect of type of intervention on SPB long-term; $F(1, 17) = .090, p = .43$, Pillai's trace = 0.10. There was also no effect of implementation intentions on SPB; $F(1,17) = 0.17, p = .85$, Pillai's trace = 0.02. Likewise, there was no interaction between the two IVs on levels of SPB: $F(1, 17) = 0.24, p = .79$, Pillai's trace = 0.03.

There was no overall effect of type of intervention on UVB long-term; $F(1, 17) = 0.17, p = .21$, Pillai's trace = 0.17. There was also no effect implementation intentions on UVB; $F(1,17) = 1.14, p = .34$, Pillai's trace = 0.12. Likewise, there was no interaction between the two IVs on levels of UVB: $F(1, 17) = 1.92, p = .18$, Pillai's trace = 0.18. As with immediate levels of SPI, for all the above variables, the only significant predictor of future behaviour or intentions was the baseline measure.

Within-Participants Differences

Table 6.4. *Repeated Measures MANCOVA.*

	<i>N</i>	<i>F</i>	<i>P</i>	Partial eta sq
SPI				
Immediately	25	22.67	<.001	.67
4 weeks	25	14.61	<.001	.47
Six months	25	8.52	.01	.29
SPB				
4 weeks	25	0.87	.36	.04
6 months	25	0.56	.46	.02
UVB				
4 weeks	25	1.00	.33	.04
6 months	25	0.09	.77	< .01

Table 6.5. *Estimated Marginal Means for All Time-Points*

	Baseline	Immediately	4 weeks	6 months
SPI	4.72	5.51	5.41	5.25
SPB	3.38	-	3.31	3.10
UVB	1.60	-	1.48	1.64

To assess whether the non-significant differences were due to a general effect of any intervention (facial morphing or health-focused intervention) on the outcome variables a repeated measures MANCOVA was conducted with follow-up point (as compared to baseline) as the within-subject factor. As recommended by Field (2013), when condition sample sizes are roughly equal, Pillai's Trace was again used as the target test statistic. The overall model was significant; Pillai's trace = .51, $F(6,19) = 3.24, p = .02$. Upon examining the contrast effects, this effect was found for SPI only; this was significant for all time points, demonstrating that any intervention increased intentions to sun protect immediately, after four weeks, and after six months following the intervention. The effect on SPB and UVB was non-significant, meaning that receiving an intervention did not increase sun protective behaviour or decrease UV exposure. Please see Table 6.4 for full details on the repeated measures MANCOVA.

Moderator Analyses

Moderation analyses were conducted using the Process v3 macro (Hayes, 2012).

MBSRQ-AS. MBSRQ-AS was not a significant moderator at any time point (immediately, 4 weeks, and 6 months), for any of the outcome variables (SPI, SPB, UVE).

CFCS. The overall model on immediate levels of SPI was significant: $F(8,38) = 11.16, p < .001, R^2 = .70$. Thus, the full model (controlling for baseline SPI) explained 70.0% of the variation in immediate levels of SPI. There was no main effect of CFCS, but there was an interaction effect between the moderator and facial morphing only as compared to facial morphing with implementation intentions: $b = 1.06, t(38) = 2.68, p = .01$. For those with lower levels ($M = 2.89$) of CFC (i.e.,

considering proximal consequences more important than distal consequences), facial morphing with implementation intentions increased levels of SPI, but facial morphing only did not. This difference was not found among those with higher levels ($M = 3.92$) of CFC. The moderating effect on the remainder of the variables at the additional time points was not significant.

CMNI-44. Due to the follow-up attrition rates, it was only possible to examine the moderating impact of masculinity immediately following the intervention (on SPI), as the sample size would have otherwise been too limited to analyse meaningfully. Masculinity was not found to be a significant moderator.

Discussion

Summary of Results

The aim of the current study was to examine the effect of facial morphing as compared to a health-focused intervention on sun protective intentions, sun protective behaviour, and UV exposure behaviour, short-term (immediately following the intervention) and long-term (four weeks, and six months following the intervention). The study also examined the effect of implementation intentions as combined with the above. Through one ANCOVA and several MANCOVAs, the current study did not find main effects of type of intervention or the presence or absence of implementation intentions on any of the above. It also did not find an interaction effect between the two independent variables. Throughout these analyses, the only significant predictor of future behaviours or intentions was the baseline measure of the same variable (i.e., SPI/SPB/UV). A within-participants MANOVA demonstrated a main effect of time on SPI, meaning that any intervention was successful in increasing intentions to use sun protection, but not actual sun protective behaviour or in reducing UV exposure. Moderation analyses revealed that those with

less consideration for future consequences were more likely to increase SPI following facial morphing with implementation intentions as compared to facial morphing only. Gender was not a significant covariate throughout the analyses, and participants lost to attrition did not differ on baseline measures as compared to those who completed follow-ups.

Intervention Effects

Contrary to previous findings from the UK (e.g., Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b) and the US (e.g., Blashill, Rooney, Luberto, Gonzales, & Grogan, 2018a), the current study did not find that facial morphing increased behaviours and intentions associated with a reduction in UV exposure, as compared to a health-focused intervention. Similar to Owen *et al.* (2016) the analyses did reveal that both facial morphing and a health-focused condition increased intentions to use sun protection across all time points, but where the previous research found a long-term difference between conditions, the current study did not. Neither of the interventions appeared to impact on future behaviour, supporting the well-established argument in public health debates that behaviour is more difficult to change than intentions, and that intentions are not consistently predictive of behaviour, i.e., the intention-behaviour gap (Sheeran & Webb, 2016).

There may be several reasons as to why the current study did not detect a difference between the two intervention conditions (facial morphing versus a health-focused intervention). First, it is possible that appearance-related ageing remains less of a concern among older people, as priorities shift from physical appearance to physical health (Clarke & Korotchenko, 2011; Hurd, 2000). This has the potential to render facial morphing less demonstrably effective among this group than with a younger sample, as this type of intervention relies on appearance concerns. Previous

research has demonstrated that appearance remains a priority among older people, although less so for men than for women (e.g., Clarke & Korotchenko, 2011; Grogan, 2016). This was further evidenced in the qualitative findings detailed in Chapter Four (Persson, Grogan, *et al.*, 2018), where women showed significant appearance concern and stated that they did not want to look like the UV aged photo. It is however possible that health concerns remain a similarly important priority for older people, thus explaining why both conditions increased sun protective intentions over time. An indicator of this was also found among the findings on men as discussed in Chapter Five (Persson *et al.*, *under revision*) where health concerns (albeit prompted by the facial morphing) were considered a more important priority than appearance concerns. It is therefore possible that these types of interventions work differently with older people, and may need to be reframed as demonstrating underlying health issues associated with UV exposure, rather than relying solely on appearance.

Second, although past research has indicated that the UK population is relatively well-informed about the dangers of UV exposure (Miles *et al.*, 2005), the qualitative studies outlined in this thesis indicate that there still appears to be some level of confusion among older people about the benefits of using sun protection and the dangers of UV exposure; this is specifically noticeable around the issue of facilitating vitamin D production, and what brands of sunscreen actually protect against the sun (Persson, Grogan, *et al.*, 2018). Confusion about vitamin D production and a difficulty in navigating sunscreen labelling has also been demonstrated in past research (BBC News, 2015; NHS, 2016a). This could have impacted on the findings in two ways. First, it is possible that the health-focused intervention was more informative than the facial morphing, thus making it equally

as effective in increasing SPI immediately and long-term, as it increased participants' knowledge about the dangers about UV exposure. Second, as SPI was the only variable to be impacted by the interventions, it is possible that participants wanted to reduce their UV exposure, but did not have the necessary knowledge as to how to do this. The behaviour-related questions were based on medical advice in relation to UV exposure and sun protection, thus it is possible that participants failed to perform the desired behaviour as they were unsure about exactly what this behaviour was (e.g., always wearing sun protection outside, and not exposing any skin to the sun). It is therefore possible that facial morphing may need to be combined with general information about skin cancer prevention, to ensure that people are sufficiently well-informed in order to carry out the necessary behaviour.

Third, although the behaviour-related measures were derived from previously published research in similar areas (Dwyer, 2014; Stapleton *et al.*, 2010), internal consistency measurements revealed that several of the original items needed to be removed to allow for an acceptable Cronbach's alpha level, resulting in UVE being measured by one frequency item only, and SPB being measured by two items only. SPI, on the other hand, was measured with six items. It is therefore likely that the behaviour-related measurements were too limited, and as such not reliable enough to fully capture the extent to which people spent time in the sun, or how often they used sun protection. The behaviour-related items also heavily relied on participants estimating the frequency of past behaviour, something that can understandably be difficult to do after six months, or even four weeks. Future research aiming to measure behaviour of UV exposure and sun protection may therefore need to consider developing and validating context-specific scales to accurately capture the extent of people's behaviour, particularly as levels of indoor and outdoor UV

exposure vary considerably between countries and contexts (Blashill *et al.*, 2018a; Persson, Grogan, *et al.*, 2018).

Consideration of Future Consequences and Implementation Intentions

Among the moderators, CFC was found to interact with implementation intentions in the facial morphing condition, where those considering proximal consequences more important than distal consequences had stronger intentions to use sun protection following facial morphing with implementation intentions than those who received facial morphing only. This difference was not found among those with high levels of CFC. This is hardly surprising, as the high-CFC group would already be sufficiently concerned with future consequences, thus receiving additional prompting to consider long-term effects would have no further impact. This links with health behaviour models such as the temporal self-regulation theory (TST) proposed by Hall and Fong (2007), that argues that engagement with any health behaviour is highly dependent on temporal framing, something that has been largely ignored by previous behaviour change models such as the theory of planned behaviour (Cameron, 2010; Webb & Sheeran, 2010). The TST further posits that emotional valence (e.g., whether outcomes are perceived as positive or negative) interacts with temporal perspective to influence attitudes and behaviour (Evans *et al.*, 2017). As also noted within the CFC-framework, the TST proposes that ostensibly irrational choices involving the performance of unhealthy behaviours with significant prospects of long-term illness are indeed logical, when considering that most health behaviours involve short-term costs weighted against long-term benefits (Cameron, 2010; Hall & Fong, 2007; Orbell & Kyriakaki, 2008).

In the context of sun protection use, not only are the benefits generally delayed, but there is also an amount of uncertainty as to what the delayed consequences of not performing the behaviour will be, partially because of the benefits being in the distant future, but also because not everyone who expose themselves to the sun will get skin cancer (Cancer Research UK, 2018a; Chapman, 2005). Chapman (2005) proposes that time preference (e.g., whether someone considers the immediate or long-term consequences of their behaviour) is related to addictive behaviours, which some researchers (e.g., Stapleton *et al.*, 2017) would classify tanning as. Based on the qualitative findings outlined in previous chapters (Persson, Grogan, *et al.*, 2018; Persson *et al.*, *under revision*) this holds true for UV exposure, where participants appeared to negotiate perceived short-term benefits (e.g., a tanned appearance) and long-term drawbacks (e.g., risk of skin cancer) of sunbathing. If this perspective can be changed (i.e., shifting focus from proximal to distal consequences), the TST proposes that health behaviours can be improved (Orbell & Kyriakaki, 2008). It should be noted that the effect of CFC was only found among intentions, and not longer-term behaviour, suggesting that participants' intentions to sun protect do not translate into actual behaviour (but see discussion above about potential problems with the measures of behaviour). The TST proposes that self-regulatory abilities may predict the intention-behaviour gap, i.e., that those with better self-regulatory abilities are more successful in translating intentions to behaviour (Hall & Fong, 2010). This therefore suggests that future research may need to consider self-regulatory abilities as an additional variable when measuring both intentions and behaviour relating to UV exposure.

The recent meta-analysis on CFC by Murphy and Dockray (2018) specifically recommends that future behaviour change interventions should examine

the way in which CFC interacts with health communications, particularly those aimed at increasing long-term thinking. This is highly relevant for the current findings, as implementation intentions are, by their very nature, focused on prompting relevance of future behaviour, as they are concerned with planning a response-based future action (Gollwitzer & Sheeran, 2006). The use of implementation intentions to increase health-related behaviours (specifically through reducing self-regulatory ability demand by creating automaticity) has also been proposed by Hall and Fong (2010). Orbell *et al.* (2004) suggest that an individual's propensity to consider distal or proximal consequences will guide their behavioural intentions in a health communication setting, thus explaining the lack of main effect of CFC in the current sample, but rather how it interacts with implementation intentions. Finally, the effect of CFC/implementation intentions was not found in the health-focused intervention. This could be because facial morphing is in itself highly focused on long-term consequences (e.g., visually displaying future ageing), a feature that is possibly enhanced by implementation intentions. Although the health-focused intervention in the current study did indeed include information on UV exposure-related long-term consequences to personal health (to adequately match it to the facial morphing condition), previous research has indicated that facial morphing may be more persuasive long-term than interventions focusing on health (Owen *et al.*, 2016).

In sum, this therefore supports the notion that the effectiveness of any intervention may depend on the group it is implemented with, and an intervention may initially seem less effective in changing behaviour (e.g., lack of main effect of implementation intentions), before the moderating impact of the context in which it is being implemented is examined (Chapman, 2005; Orbell & Kyriakaki, 2008). It is

therefore highly recommended that future interventions to reduce UV exposure should consistently examine moderators such as CFC, as this is likely to impact of the effectiveness of the intervention, whilst also providing a context as to with whom and in what setting effects can be maximised. Finally, implementation intentions appear to be a valuable addition to facial morphing, as they increase the potential for effectiveness of the intervention, potentially by shifting focus from short-term consequences to longer-term consequences among those low in CFC (Hall & Fong, 2010; Webb & Sheeran, 2010).

Strengths

The current study had several strengths. It benefitted from the inclusion of moderator analyses, as this allows for a deeper understanding of the phenomenon at hand, as well as providing a context to an intervention, i.e., demonstrating under what conditions it can be most effective (Hayes, 2012; Hayes & Rockwood, 2017). Moderation analyses were a crucial part of the current PhD's objective of choosing complementary data analysis methods, to maximise the scope of the research (Malterud, 2001). The chosen moderators were well-anchored in psychological theory, and also based on previously outlined findings with similar participant groups (Persson, Grogan, *et al.*, 2018; Persson *et al.*, *under revision*). As has been argued in previous chapters, the understanding of intervention contexts and mechanisms behind potential effects is particularly important in exploratory research into relatively new interventions such as facial morphing, as well as when examining complex human behaviour (Cafri *et al.*, 2006; Sandelowski, 2000). This is highly relevant considering that facial morphing in a UV exposure context has not been previously implemented with those aged 35 years and older. Previous studies examining the effectiveness of facial morphing to reduce UV exposure among the

UK population have not examined moderators (Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b), further making the case for the relevance and novelty of the current research, thus significantly contributing to the overall aim of this PhD which is to build on and enhance past research in the area of skin cancer prevention.

A major strength of the current study was the demographics of the sample; this included those aged 35 years and older, as well as men; two participant groups previously overlooked in behaviour change research generally, and in appearance-focused interventions to reduce UV exposure specifically (Golinowska *et al.*, 2016; Persson, Benn, *et al.*, 2018; Williams, Grogan, *et al.*, 2013a). This therefore contributes to the existing knowledge into facial morphing, and how well it works with women and men respectively, as well as on non-student populations who are over 35 years. The participant group also contained a wide spread of ages, with participants ranging from 35 years to 61 years old. Hanel and Vione (2016) note that generalisation from student to non-student populations may be problematic when measuring attitudinal variables, which would presumably include attitudes to UV exposure as well as the moderating variables (i.e., CFC, MBSRQ-AS, and CMNI-44). Although this could potentially be explained by differences in age and level of education, it still prompts relevance for further research using non-student populations. As can be seen in participant demographics, the current study also included a significant minority of participants without a degree, something that is particularly important considering arguments presented earlier in this thesis about the interactions between SES and health outcomes. This was achieved through active recruitment outside the university environment, e.g., at a community event and via community gatekeepers. Although it was not possible to meaningfully analyse the moderation effect of highest educational qualification, the demographic spread still

allows for findings to be somewhat generalisable across the population, and the variable was still used as a covariate throughout the analyses.

Finally, as with previous stages of this PhD, the current study was designed with methodological rigour in mind. The study was designed based on findings from one systematic review and meta-analysis, as well as two qualitative studies. This ensured that limitations associated with previous studies (e.g., lack of power calculations, exclusion of non-significant results, only examining immediate effects of intervention, etc.) were not repeated, further ensuring that each step of the PhD informed the next. As the findings demonstrated that both facial morphing and a health-focused intervention increased sun protection intentions immediately and long-term, this further emphasises the previously argued point (please see Chapter Three or Karlsson and Bergmark [2015] for an overview of this) of consistently using an active control condition rather than a passive control condition. It is likely that a passive control would have rendered a significant difference between the conditions; a passive control usually overestimates the effect of an intervention, as a wait-list only condition is seldom effective in changing behaviour, whereas receiving *any* intervention often is (Karlsson & Bergmark, 2015). In the current context, these results would have been misleading. Because of the research undertaken prior to the design and implementation of the current study, this also ensured that variables measured were well-anchored in past research, and that the moderators were based on previous findings both generally and within this PhD. Attempts have also been made to link the current findings relating to these moderators with relevant psychological theory, e.g., TST (Hall & Fong, 2007, 2010). This therefore achieves the second aim of this PhD, which was to implement a well-designed study examining the effect of facial morphing on sun protective behaviour and intentions.

Limitations and Future Directions

There were several limitations with the current study, which one should bear in mind when interpreting the results.

First, the limited recruitment for the study meant that according to the *a priori* power calculation, the study did not have sufficient power to detect a medium-large effect size, as 140 participants would have been needed for this. Although this is indeed a major limitation, the study did detect an effect of time (i.e., that any intervention increased SPI immediately and long-term), and also detected an interaction effect between implementation intentions and CFC. That the sample had enough power to at least detect some effects suggests that the remainder of the results may also remain valid. As previously mentioned, there is a degree of flexibility regarding sample size in exploratory research, where findings are generally used to inform future research (Hertzog, 2008; Johanson & Brooks, 2010). As this is the first study conducted on facial morphing with people aged 35 years and older in a UV exposure context, findings can hopefully inform and guide future research in this area. Future studies should consistently aim to recruit participant numbers in line with *a priori* power calculations, however significant recruitment issues are likely to be encountered when accessing older age groups as the current study did (Cohen, 1992; Jones *et al.*, 2003). Finally, as the inclusion of power calculations allows for an interpretation of results within context, future research should report *a priori* power calculations even if the desired sample size is not achieved.

Relatedly, the limited recruitment was particularly pronounced among men, who were considerably more difficult to reach than women of similar ages. This somewhat limits the conclusions that can be drawn from the results on men, and the

findings on masculinity in particular should therefore be generalised with caution. Future research may wish to consider utilising specific recruitment strategies to target men, for instance by attending large events that regularly attract large numbers of men, such as football games.

A final limitation is the homogenous spread of ethnicities among the sample, where a significant majority of participants identified as White. This is problematic in terms of generalisability, as UK Black and Minority Ethnic (BME) groups traditionally experience poorer health and more barriers to healthcare uptake than their White counterparts, even when corrected for socio-economic differences (Szczepura, 2005; Szczepura, Price, & Gumber, 2008). Previous researchers have also noted elevated skin cancer mortality risks associated with BME groups, and that past public health campaigns to increase sun protection use have not been sufficiently effective among this group (Bradford, 2009; Oyebanjo & Bushell, 2014). Oyebanjo and Bushell (2014) suggest that the limited effectiveness of previous public health campaigns with BME groups could be due to socio-economic barriers to sun protection use and cultural inaccessibility of information. This therefore prompts relevance for future research to actively seek to include BME participants in studies examining the effectiveness to reduce UV exposure, particularly focusing on qualitative research as this may improve understanding on barriers to behaviour change.

Conclusions

The current study examined the effectiveness of facial morphing, as compared to a health-focused intervention on immediate and long-term levels of sun protective intentions, sun protective behaviour, and UV exposure. It also assessed the effect of implementation intentions on the above. The analyses demonstrated no

significant difference between the conditions, but did find that both interventions (facial morphing and the health-focused intervention) increased sun protective intentions immediately and long-term. Moderator analyses revealed that those who considered proximal consequences more important than distal consequences (low in CFC) had stronger intentions to use sun protection following facial morphing combined with implementation intentions, as compared to facial morphing only. Considering the results within the context of temporal framing and TST (Hall & Fong, 2007, 2010) the study therefore concludes that implementation intentions may be successful in shifting focus from immediate to long-term consequences among those normally unconcerned about future benefits of behaviours. It is argued that future research into facial morphing to reduce UV exposure should consistently examine theory-anchored moderators, to further understand with whom and in what context this type of intervention can be effective.

Although the study was designed following careful consideration of previous literature and the findings from the qualitative studies outlined in previous chapters, limitations regarding sample size and homogeneity of participant ethnicities may limit the results that can be drawn. Despite this, because of the unique participant group as well as the novel combination of moderator analyses and inclusion of implementation intentions, the current study makes a unique contribution to the literature on appearance-focused interventions to reduce UV exposure generally, and facial morphing specifically. It therefore achieves the second and third aims of this PhD, which was to design and implement an RCT examining the effect of facial morphing on UV exposure-related behaviour and intentions, as well as to contribute to skin cancer prevention strategies.

Chapter Seven: General Discussion

The current programme of research has, through a comprehensive mixed-methods approach, generated important findings concerning the use of facial morphing to reduce UV exposure specifically, and in relation to interventions to reduce skin cancer on a population level more generally. The combination of studies has, through complimentary methods of data collection and analysis, achieved the aims set out in Chapter One. This PhD incorporated four individual studies, though some of the individual findings appear to contradict one another, when combined the studies paint a picture of how well facial morphing can work with older age groups, particularly in terms of moderating variables such as consideration of future consequences (CFC). The current chapter outlines these findings and aims to contextualise them within some of the strengths and limitations associated with this PhD. Several implications of the findings for health practitioners are noted, and recommendations for future research are made. It is concluded that this PhD makes a substantive contribution to our understanding of how well facial morphing can work with those aged over 35 years, and as such, makes a novel contribution to the existing research in this field.

Summary of Findings

The research undertaken for this PhD had three overall aims. The first aim was to investigate attitudes towards a facial morphing intervention to reduce UV exposure, specifically among men and women aged 35 years and older. Based on the findings of Studies Two and Three, the second aim was to design and implement a small-scale experimental study comparing a facial morphing intervention to a health-focused intervention. Finally, the current PhD aimed to contribute to the existing body of research intended to increase awareness of the dangers of UV exposure, thus

improving strategies to reduce skin cancer. These aims were achieved through a series of individual studies with a linear structure, where the findings from each of the projects informed the next step in the research. The individual studies combined qualitative and quantitative approaches, and included a systematic review and meta-analysis; two qualitative studies; and one small-scale experimental study. It could therefore be argued that this PhD has been both theory and practice-driven, by incorporating psychological theory and practical findings into the conclusions of each of the chapters. The current programme of research therefore followed recommendations noted by Epton *et al.* (2015), where the development of complex interventions to improve population health should begin with formative and theoretical work prior to implementing experimental research.

As has been noted by previous reviews and meta-analyses (e.g., Dodd & Forshaw, 2010; Williams, Grogan, *et al.*, 2013a), appearance-focused interventions appear to be a promising strategy to encourage safer behaviour in the sun, as people may be more concerned about appearance-related consequences as compared to health-related consequences of UV exposure. The first study in this programme of research was therefore a systematic review and meta-analysis, to examine the current effectiveness of appearance-focused interventions to reduce UV exposure. The findings largely confirm those of previous studies, suggesting that appearance-focused interventions are associated with a small but positive effect on sun protective behaviours. As this study noted significant variation between research methodologies (also commented on by Dodd and Forshaw [2010]), it was concluded that future studies should consistently aim to include power calculations and long-term follow-ups. Findings from this study were published in *The British Journal of Health Psychology* (Persson, Benn, *et al.*, 2018). The study makes a valuable

contribution to the existing literature as the last review was carried out in 2012, and appearance-focused interventions to reduce UV exposure have developed since, for instance with the inclusion of facial morphing techniques. The study also included a greater number of studies - both in the review and the meta-analysis - thus providing a stronger evidence base from which to draw conclusions.

As older, non-student populations have been largely under-represented in research into appearance-focused interventions to reduce UV exposure (Dodd & Forshaw, 2010; Persson, Benn, *et al.*, 2018), as well as in previous facial morphing research (Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b), two subsequent qualitative studies examined attitudes to facial morphing among older (35-61 years) women and men respectively. Semi-structured interviews revealed that both men and women appeared to find the intervention persuasive in terms of motivating them to increase sun protection use, but that there may be differences in the reasons behind why the intervention may be effective. The interviews suggested that appearance concerns and the degree to which situations are considered salient for sun protection use may impact on the effectiveness of this type of intervention. Participants also negotiated their UV exposure based on immediate and distal drawbacks and benefits. In line with previous research into older men's engagement with personal health (e.g., Davidson & Meadows, 2010; Thompson & Langendoerfer, 2016), it appeared that masculinity may play a role in both general attitudes to sun protection use, as well as in engagement with the intervention. A distinct advantage of these studies was that participants were also asked about their general attitudes to UV exposure and sun protection; this allowed for qualitative exploration of this topic among an underrepresented group, with findings informing the next stages of the PhD, as well as hopefully being informative to those seeking to design an intervention to reduce

UV exposure (appearance-focused or otherwise). Study Two was published in *Psychology & Health* (Persson, Grogan, *et al.*, 2018).

The final stage of the research programme involved a small-scale experimental study with 53 women and men comparing facial morphing to a health-focused intervention on UV exposure-related behaviour and intentions. The qualitative findings informed the design and implementation of this study, as recommended by Sofaer (1999). Situation salience was accounted for by examining the effect of implementation intentions in conjunction with the interventions; and appearance concerns, consideration of long-term consequences, and masculinity were examined as moderators. To account for recommendations arising from the systematic review and meta-analysis, the study had a rigorous methodology, e.g., including comprehensive statistical reporting, and long-term (six months) follow-ups. A number of analyses revealed that there was no main effect of either condition (type of intervention or implementation intentions) on any of the outcome variables. It appeared that both information relating to facial morphing and personal health improved sun protective intentions immediately and long-term, but this did not translate into actual behaviour change.

Moderator analyses revealed that those considering proximal consequences more important than distal consequences (low in CFC) were more persuaded by facial morphing with implementation intentions than facial morphing only. Although somewhat contradictory to previous research into facial morphing with student populations (Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b) these findings can be understood in the context of previous research into CFC (Murphy & Dockray, 2018), and the importance of temporal perspective in health behaviour choices (Hall & Fong, 2007, 2010). Specifically, these findings suggest that implementation

intentions can be a useful addition to facial morphing, as it may shift temporal perspective from immediate to distal consequences, particularly among those who normally only consider proximal outcomes of a given behaviour (Webb & Sheeran, 2010).

Synthesis of Findings

The systematic review and meta-analysis found small but positive effects associated with appearance-focused interventions to reduce UV exposure; similarly, the qualitative studies suggested an increased motivation to reduce UV exposure following a facial morphing intervention. As outlined above, these effects were not found in the small-scale experimental study implemented as the last stage in this PhD, where only a moderating impact of CFC was found. Several reasons can be proposed to explain these apparent contradictory findings.

First, and as previously noted by Dodd and Forshaw (2010), the current meta-analysis included a majority of studies from the US, making it uncertain to what extent these results can be translated to the UK. It is possible that appearance-focused interventions to reduce UV exposure may work differently in a UK context as compared to a US context, partially because the latter presents more opportunities for sun exposure. Although US climates vary widely in terms of temperature and hours of sunshine (e.g., 88% average annual sunshine in Las Vegas versus 45% average annual sunshine in Pittsburgh [National Oceanic and Atmospheric Administration, 2004]), there are still more opportunities for sun exposure than there are anywhere in the UK. In a facial morphing context specifically, this can be exemplified by comparing baseline levels of UV exposure in the current RCT to that of a recent US study (Blashill *et al.*, 2018a). Using frequency estimates for the past month, Blashill *et al.* (2018a) found mean baseline indoor and outdoor tanning levels

of 1.36 and 7.32 respectively across the sample (calculated as a mean value of the baseline measures across the three conditions); this can be contrasted with the current study's comparative values of 0.11 and 1.96 for the same frequency measures. As tanning behaviours and perceptions of skin tone attractiveness are somewhat culturally dependent (Cox *et al.*, 2009) it seems reasonable that interventions that emphasise the appearance-related consequences of UV exposure may work differently in these contexts. It may therefore be possible that appearance-focused interventions more generally (including facial morphing) may need to be adapted to a non-US context, to account for differing levels of baseline UV exposure as well as cultural perceptions of skin tones.

Second, Chapter Two noted that the majority of studies included in previous reviews, as well as those included for the current PhD's meta-analysis, consist of student samples under the age of 30 years old. Consequently, it is possible that appearance-focused interventions in general may work differently with those who are older, which would also explain why the findings from the experimental study contradicted those of previous studies comparing it to a health-focused intervention (e.g., Blashill *et al.*, 2018a; Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b). As discussed elsewhere in this thesis (e.g., Chapter Two), it appears that priorities concerning health, appearance, and body image shift as people age; this would presumably mean that interventions such as facial morphing which incorporate all of these aspects may work differently with older participants than with those who are younger. Then current research is therefore an important first step in examining how these types of interventions can work with older age groups, and in assessing ways in which they may need to be adapted to maximise effectiveness. As appearance-

focused interventions are still not regularly implemented with those aged 35 years and older, exploratory research of this nature is very much needed.

Finally, the findings from the RCT are somewhat contradictory to the findings from the qualitative studies, where the latter indicated an increased motivation to reduce UV exposure following the facial morphing intervention. However, when noting that the qualitative studies did not compare the appearance-focused intervention to a health-focused intervention, the findings may actually be in line with the results from the within-participants analyses revealing a main effect of any type of intervention, i.e., that both interventions increased sun protection intentions over time. Moreover, noting that the effect of any intervention was on intentions rather than behaviour is also in line with the qualitative findings, where participants were only asked to indicate how they *might* behave in future, and not measuring actual behaviour following the intervention. Aside from these findings aligning with past research noting the intention-behaviour gap (Norman *et al.*, 2018; Sheeran & Webb, 2016), they also highlight two issues. First, and as noted in Chapter Six, this underlines the importance of using an active control condition, as otherwise the effects of an intervention may be overstated and conflated with the effect of time, or simply being part of any intervention (Karlsson & Bergmark, 2015), as would have been the case for the facial- morphing intervention in the current RCT had it not been compared to a health-focused intervention. Second, the findings also highlight the necessity of complementing qualitative research with experimental quantitative research (and vice versa, as qualitative findings can inform the design of quantitative research), as it is otherwise difficult to establish the practical significance of an intervention, or the impact of moderators. This therefore suggests that the findings from the experimental study can inform future, larger-scale

research projects, and that further qualitative research into how facial morphing is perceived by the current participant group is needed to fully understand how it may need to be adapted to maximise its effectiveness.

Strengths

This PhD is the first attempt to examine how facial morphing is perceived by those aged over 35 years, as well as how effective it can be in reducing UV exposure long-term. Aside from the novelty of the research, there are also several strengths associated with this PhD that deserve to be highlighted.

First, this programme of research has employed a comprehensive mixed-methods methodology, where data collection and analyses have been designed and implemented to be complimentary, thus maximising benefits of each approach. This is in line with recommendations regarding methodological rigour, as specified by Malterud (2001), something that has been considered throughout each stage of this research. Where many research projects are either qualitatively or quantitatively focused, this PhD has adhered to recommendations by a number of researchers (e.g., Johnson & Onwuegbuzie, 2004; Polit & Beck, 2010; Sandelowski, 2000) that a mixed-methods approach may be advantageous. This has been evidenced in the rich nature of the findings from the current PhD, which provide an extensive understanding of facial morphing within the current context. Attitudes to UV exposure in general and reactions to the specific intervention have been considered, and results have subsequently been quantified, giving a detailed indication as to how well this type of intervention can work in the long-term, especially when compared to a health-focused intervention.

Relatedly, an important aspect of this PhD has been the process whereby each step of the research informed the next, meaning that considerable formative

work was undertaken prior to the experimental research (Epton *et al.*, 2015). Findings outlined in Chapter Two were used to inform decisions surrounding the design of the experimental study, for instance by including power calculations (although recruitment did not result in full sample as suggested by the power calculation, the calculation enabled the interpretation of the results within context) and a long-term follow-up. They were also used to inform methodological rigour through comprehensive statistical reporting following the analyses. In line with the exploratory nature of qualitative research in a health promotion setting (Dugdale *et al.*, 2017; Sandelowski, 2000) findings from Chapters Four and Five were also used to inform the design of the experimental study, for instance by including implementation intentions as an additional independent variable, and considering a number of moderation analyses. Where the facial morphing intervention was mainly guided by findings from the qualitative studies outlined in Chapters Four and Five, implementation intentions and the moderators were also theory-driven, thus adhering to recommendations that interventions to improve health should be based on formative and theoretical work (Epton *et al.*, 2015; Norman *et al.*, 2018). The resulting outcome was a rigorously designed RCT, examining novel moderators and it is also the first of its kind to combine facial morphing with implementation intentions, all with a methodology designed to avoid oversights by previous studies in this area.

Finally, a key strength of this PhD is the participant group, and the active recruitment strategies that were employed to target them. Although the quantitative research failed to reach the numbers specified by the power analyses, the total sample of this PhD nonetheless included more than 100 people, recruited from an age group particularly difficult to engage due to work and family constraints. These

participants were specifically recruited via a variety of means, for instance through community gatekeepers and one public engagement event. Where previous research into facial morphing to reduce UV exposure has focused exclusively on student populations (e.g., Owen *et al.*, 2016; Williams, Grogan, *et al.*, 2013b), this PhD is the first serious attempt to establish how this intervention can work with different groups, thus significantly expanding the knowledge in this area. As noted by the systematic review in Chapter Two, research into appearance-focused interventions to reduce UV exposure has largely included student populations, and it can therefore be argued that the current PhD makes an important contribution to the existing knowledge in this area more broadly.

In their systematic review on appearance-focused interventions to reduce UV exposure, Dodd and Forshaw (2010) specifically point out that these types of interventions need to be examined in a non-US context (with different climates), and with older, non-student populations that incorporate both men and women. It is therefore argued that the current programme of research has achieved this; by implementing the research in the North of England (a climate with relatively little everyday sun for most of the year), and by including men and women aged between 35 and 61 years recruited through community samples, this PhD has substantially expanded the context in which appearance-focused interventions have been examined, thus allowing for increased generalisation as to how well these types of interventions work in different settings.

Limitations

Although the current programme of research is an advanced attempt to examine facial morphing to reduce UV exposure in a novel setting, the project was

associated with a number of limitations that should be considered when interpreting the overall results.

One factor that may limit the conclusions that can be drawn from the results is that it remains somewhat unclear whether participants perceived the facial morphing intervention as distinctly appearance-related in nature, or whether it was perceived as health-related information. As was evidenced in Chapter Five, some participants regarded the high-UV image as representative of underlying health issues, rather than relaying information about future appearance. It is therefore possible that a perceived similarity (e.g., both relaying information about personal health) between the two intervention conditions was behind the lack of main effect between conditions in the RCT; it is equally possible that the expressed motivation to increase sun protection found in the qualitative studies was motivated by health concerns rather than appearance concerns, or a combination of both. This was evidenced in how both men and women noted that the high-UV photo looked unwell; this could highlight appearance concerns, health concerns, or both. Another potential indication of this is the main effect of both interventions, which was found on sun protection intentions across all time points, where both interventions were equally effective. As the current study did not include manipulation checks, it is not possible to know for certain whether the conditions were perceived as distinctly different. It should however be noted that the facial morphing intervention used for the current research has been successfully implemented with other age groups, suggesting that it is generally perceived as different to a health-focused intervention (e.g., Blashill *et al.*, 2018a; Williams, Grogan, *et al.*, 2013b). Future research into facial morphing would benefit from establishing that the intervention is perceived as being distinctly focused on appearance, for instance by utilising manipulation checks

following the intervention, e.g., “How appearance-focused would you rate the intervention as?”. This could also be achieved through including specific questions on this in qualitative enquiry.

Moreover, the current PhD did not assess whether participants actually followed the implementation intentions instructions (i.e., to write down specific plans for sun protection use), as participants were allowed to do this in privacy. Michie, Dormandy, and Marteau (2004) found that only 63% of participants in their sample accurately followed the implementation intentions instructions, indicating that the degree to which participants actually engage with implementation intentions is an issue in this area of research. It is therefore possible that the lack of main effect of implementation intentions was due to some participants not reading or engaging with these instructions, resulting in a similarity between the two (presence or absence of) implementation intentions conditions. It is also possible that where participants did write down if-then plans, the quality of these was lacking (e.g., low instrumentality of non-specificity), something that has been previously found to impact on goal achievement (Hostler, 2017; van Osch, Lechner, Reubsæet, & Vries, 2010). This is a difficult issue, as one has to balance participant privacy against the need to ensure that instructions have been properly followed. A possible solution to this that future researchers may wish to consider is the inclusion of instructional manipulation checks (IMC), as recommended by Oppenheimer, Meyvis, and Davidenko (2009). IMCs aim to detect whether participants are motivated to follow the instructions of an experiment, without compromising the privacy of their answers.

Although the current PhD has expanded our understanding of how well facial morphing works with different groups, an important limitation is the homogenous

nature of the participant group in terms of socio-economic status (SES). A lower SES may mean that one is financially unable to purchase sunscreen (thus placing members of this group at an immediate disadvantage), and previous research (Gavin *et al.*, 2012; Michie *et al.*, 2009) has found that those with lower SES suffer worse health generally and may have riskier sun exposure to begin with. Although the qualitative studies did not measure SES, the nature of the recruitment pool (university grounds), will inevitably have resulted in participants skewed towards the top two SES groups (ONS, 2010). Based on data from the Office for National Statistics only 23.15% of the UK population would fall within these two groups (Fry, Al-Hamad, & White, 2012), meaning that the sample is not representative of the wider population.

Similarly, although an active attempt was made to recruit for the experimental study through community means, a majority of participants had at least one university degree, something that is not representative of this age group overall, where only 42% have at least one degree (Higher Education Statistics Agency, 2018). It should also be noted that the definition of SES was somewhat limited, as it only examined highest educational qualification. A more sophisticated tool would benefit from also including measurements of occupational social class, standard of living, and family size (Diemer, Mistry, Wadsworth, Lopez, & Reimers, 2013; Skapinakis, Weich, Lewis, Singleton, & Araya, 2006). Combined, the current examination does not necessarily answer questions surrounding how well this intervention can work among those with lower SES, or how to reduce UV exposure more generally among this group. Findings should therefore be generalised with caution to those with limited economical means, and fewer educational qualifications.

Finally, and as more broadly applied to facial morphing in general, is the possibility that this type of intervention may unnecessarily promote appearance-related concerns among its target population, specifically through negative affect following exposure to the high-UV photo. As has long been noted by feminist research into objectification theory (Fredrickson & Roberts, 1997), and research into appearance pressures placed on both men and women more broadly in society (Grogan, 2016), excessive concern about physical appearance may result in a host of negative consequences for the person, including, among others, negative affect (Fredrickson & Roberts, 1997; Maltby & Day, 2001), poor self-esteem (Grogan, 2016; Grossbard, Lee, Neighbors, & Larimer, 2009), and disordered dieting (Putterman & Linden, 2004). As these consequences tie more broadly with health behaviours, particularly in their relationship with restricted eating and exercise, it is important to ensure that this type of intervention does not reduce one unhealthy practice (UV exposure) and replace it with another (e.g., disordered eating). Although this issue has not been examined extensively in the context of facial morphing, recent research by Blashill *et al.* (2018a) did measure appearance concerns and negative affect at baseline and following exposure to the facial morphing software, and found no differences over time on any of these measures. This suggests that although Blashill *et al.* (2018a) found that facial morphing reduced tanning long-term, it did not appear to do so through increasing concern about personal appearance. Unpublished mediation analyses on this data set (Blashill, Rooney, Luberto, Gonzales, and Grogan [2018b]; personal communication, September, 2018; undertaken as part of the author of this thesis's study visit to San Diego State University funded by the British Psychological Society's postgraduate study visit grant) confirmed that neither of these measures

mediated the main effect of the intervention, indicating that they were not part of the mechanisms promoting change among this sample. Although more research is needed to establish that this type of intervention does not promote negative self-evaluation through appearance concern, particularly in a UK context, the current findings do tentatively suggest that this is not the case.

Implications for Healthcare Practitioners

Skin cancer is an increasing problem globally (WHO, 2018), and incidence rates in the UK are expected to rise by 7% by 2035 (Cancer Research UK, 2018c). New cases for both men and women are increasing, and older adults are at particular risk for skin cancer, as damage to the cells accumulates over time (Cancer Research UK, 2018c). Although skin cancer has a relatively low mortality rate (90% surviving for 10+ years), increasing NHS waiting times in combination with the mental and physical trauma that can follow skin cancer treatment, prompt action to prevent cases on a population-based level (Cancer Research UK, 2018b; Iacobucci, 2018). Research programmes such as the current PhD therefore have considerable practical implications for clinicians considering using facial morphing in their practice.

As health-focused interventions have had limited effectiveness (see Miles *et al.* [2005] for a review of the UK ‘SunSmart’ campaign), it is evident that new strategies are needed to prevent additional costs to both the person and to public health bodies through skin cancer prevention. As such, clinical practitioners may wish to consider incorporating appearance-focused interventions into skin cancer prevention strategies. Appearance-focused interventions have been a burgeoning new direction since before the 21st century (Mahler, Fitzpatrick, Parker, & Lapin, 1997) but have gained increasing momentum more recently following a number of systematic reviews and meta-analyses examining aggregate effect sizes directly

comparing these types of interventions with those focusing on health (Persson, Benn, *et al.*, 2018; Williams, Grogan, *et al.*, 2013a). Where interventions such as photoageing have been used for quite some time, facial morphing is still relatively novel. The current PhD represents the first attempt to utilise facial morphing to reduce UV exposure among those aged over 35 years, and although the experimental study found no main effect of this type of intervention when compared to a health-focused intervention, the findings do nonetheless indicate that this type of intervention can be a useful strategy for healthcare professionals.

The qualitative studies indicate that older participants are willing to engage with a facial morphing intervention and may perceive it as an informative and at times empowering experience. This provides a strong rationale for the continued examination of this type of intervention among this age group, although practitioners may wish to adapt the intervention when implemented with older age groups. Based on findings from the current research, as well as the large body of studies into ageing and body image (e.g., Baker & Gringart, 2009; Tiggemann & Lynch, 2001), this PhD makes the recommendation of including discussions surrounding underlying health concerns in the facial morphing intervention to maximise effectiveness. This could, for instance, be achieved through an additional screen of information, or by providing participants with a small leaflet; this procedure could be conveniently implemented in a short meeting with a person needing to reduce their UV exposure. By doing this, the intervention could effectively target concerns about different aspects of ageing, e.g., those surrounding appearance as well as health. Based on findings from Chapter Five, it is likely that this would be particularly effective among men, who appear to be persuaded to change their behaviour to the extent that the high-UV image is regarded as representing underlying health issues. This is

highly relevant for practitioners wishing to promote behaviour change among older men, who can be a difficult group to reach as they may be reluctant to engage with traditional means of health information, and may be sceptical of health professionals more generally (Davidson & Meadows, 2010; Wang, Hunt, Nazareth, Freemantle, & Petersen, 2013).

Finally, the combined findings from this PhD suggest that practitioners wishing to utilise facial morphing may want to consider combining it with implementation intentions; these could be conveniently attached to a facial morphing intervention, without being time-consuming or incurring extensive costs. The qualitative research noted that, in line with goal-directed behaviour theory (Carver & Scheier, 1982, 1990), the goal of sun protection is not salient enough in many everyday situations, resulting in participants failing to adopt safer behaviour in the sun. Conversely, in situations where the goal of skin protection is salient (e.g., whilst skiing or being abroad), people appear to more consistently use sun protection. Crucially, the experimental study did consequently find that among those considering proximal consequences more important than distal consequences, facial morphing with implementation intentions was more persuasive in increasing sun protection intentions than facial morphing alone. In line with recommendations by Hall and Fong (2007) and Webb and Sheeran (2010), this suggests that implementation intentions have the capacity to shift temporal perspectives, resulting in an increased prioritisation of distal consequences among groups otherwise considering these less important. Relatedly, it also appears to create a level of automaticity (Gollwitzer & Sheeran, 2006) which reduces expenditure of mental resources; this is particularly relevant for sun protection, which participants in the current studies viewed as effortful, something that is supported by past literature

(Leske *et al.*, 2014; Rodrigues *et al.*, 2017). Likewise, healthcare professionals should also note that this intervention may need to be differentially implemented across participant groups, as was illustrated by the interaction effect between CFC and implementation intentions that was found in the experimental study. Healthcare professionals would therefore benefit from assessing attitudes (e.g., CFC) among the target group, before administering an intervention. This would have the benefit of maximising the effectiveness of an intervention, whilst also reducing unnecessary costs incurred from repeatedly delivering interventions that may never work with a particular group.

Future Areas of Research

Aside from establishing a number of novel findings in the area of facial morphing to reduce UV exposure among older adults, the current programme of research also notes a number of possible avenues for future research in this area.

First, it is recommended that future research consistently examines moderators and mediators of the relationship between interventions and sun protective behaviour. This can be achieved both through qualitative and quantitative enquiry, as it is important to understand the general conditions under which a behaviour change intervention operates. It is likely that there are additional moderating variables that were not discovered through the qualitative enquiry, and therefore not subsequently quantified, and future researchers would benefit from examining this further. As was done with the current PhD, it may be advantageous to implement qualitative inquiry ahead of quantitative inquiry, as this will allow for an exploration of the participant group before examining the effects of the interventions quantitatively. Findings from the qualitative research noted that appearance concerns and masculinity (for men) interacted with participants' general attitudes to UV

exposure to affect how the intervention was perceived, and the experimental study revealed a moderating effect of CFC. The current PhD has therefore signposted a number of moderators that can be investigated alongside intervention effects, particularly in terms of temporal perspective and CFC which has been previously suggested as impacting on most health behaviours (Hall & Fong, 2010; Murphy & Dockray, 2018).

Second, future research should consistently aim to examine how well a facial morphing intervention can work with BME groups, as this group has been insufficiently reached both by health professionals, and by past public health campaigns to reduce UV exposure (Oyebanjo & Bushell, 2014). Relatedly, the qualitative findings suggested that those with darker skin tones may not find the intervention as persuasive as those with a lighter skin tone, which is a cause for concern, as this calls in to question how well this intervention can be implemented across different groups in society, even though the software developers, AprilAge Inc (2017), contends that APRIL® works across skin tones. If an intervention is to be implemented nationally, it needs to be effective across ethnic groups and with a wide array of skin tones. Future research in this area may therefore wish to examine the effectiveness of facial morphing on a participant group with exclusively darker skin tones. This would benefit from being conducted through qualitative inquiry, at least initially, to establish how the intervention is perceived. When this is fully understood, recommendations can be made to either adapt the intervention to be effective across skin tones, or for the software developers to consider whether they may need to improve their product.

Finally, the combined findings from the current programme of research suggest that implementation intentions will continue to be an important area of

research for health promotion generally, and with interventions to reduce UV exposure specifically. It would be of great benefit to investigate how implementation intentions could be adapted to better suit an intervention like facial morphing, particularly if one suspects that the target group may be lower than average in CFC. To maximise the impact of implementation intentions, future research could, rather than generally focus on sun protection use, adapt the instructions to be specific to facial morphing, for instance “When I am in the sun, I will think about the high-UV photo”, to combine the benefits of the two interventions. Lastly, this further supports the previous point about the need for future research into facial morphing to consistently examine moderators, and for researchers to consider adapting these types of interventions to individual participant groups.

Conclusions

The current programme of research is the first systematic attempt to examine how effective a facial morphing intervention can be in reducing UV exposure and improving sunscreen use among people over the age of 35. The PhD has employed a comprehensive mixed-methods methodology, incorporating one systematic review and meta-analysis; two qualitative studies; and one small-scale experimental study, resulting in rich findings based on more than 100 participants. Combined, the findings from the studies suggest that facial morphing has the potential to motivate both women and men aged 35-61 years to adopt safer behaviour in the sun, particularly when combined with implementation intentions. Findings further suggest that moderation variables such as CFC may impact on the effectiveness of this type of intervention, and this is an area of research that should be explored further. This PhD is therefore of practical relevance to health professionals wishing to include facial morphing in their practice, but they should note that it may need to

be adapted to the target group based on age, Skin Type, and previous attitudes to temporal perspective of consequences. Despite limitations associated with some of the stimuli as well as the relative homogeneity of participants in terms of SES, the current PhD nonetheless makes an important contribution to the existing knowledge on skin cancer prevention strategies, and expands the knowledge in this area considerably.

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Appendices

Appendix A: Chapter Two

Table A2.1. *Full PRISMA (2011) Checklist.*

Section	#	Checklist item	Achieved
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	✓
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	✓
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	✓
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	✓
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	✓
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	✓
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	✓
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	✓
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	✓
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	✓

Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	✓
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	✓
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	✓
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I ²) for each meta-analysis.	✓
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	✓
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	✓
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	✓
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	✓
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	✓
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	✓
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	✓
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	✓
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	✓
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	✓
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	✓
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	✓
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	N/A

Appendix B: Chapter Two

Table A2.2. *Theoretical Basis and Critical Points for Each Study.*

Reference	Theoretical basis	Critical points
Bae <i>et al.</i> (2017)	No theoretical basis	<ul style="list-style-type: none"> → No comparison group, so it is not possible to determine whether any type of intervention would have had similar effects → Utilised a non-student sample with a mean age of 48.6 years for women and 47.2 years for men
Chait <i>et al.</i> (2015)	Dissonance theory (Festinger, 1957); when faced with ideas that challenge tanning, people will change behaviour to create mental harmony; participants wrote down and role-played statements that challenged the tanned ideal.	<ul style="list-style-type: none"> → Only included female risk group (tanners) making it unclear whether intervention can be generalizable to other groups → No comparison between psychoeducation (health) condition and dissonance condition – would have been useful as a clearer health/appearance comparison → Majority of participants were Caucasian but no full ethnicity data reported
Christensen <i>et al.</i> (2014)	DV (Stages of Change) originated from transtheoretical model (Prochaska & DiClemente, 1983), but authors also utilise theory of planned behavior (Ajzen & Madden, 1986), and Health Belief Model (Rosenstock, 1975), to inform intervention and outcome measures.	<ul style="list-style-type: none"> → Conditions were dissimilar which could have impacted the results; UV photo or emotional video about skin cancer, where the latter could have been more effective as it elicited strong emotions.
Cooper <i>et al.</i> (2014)	Terror-management health model (Greenberg <i>et al.</i> , 1986); framing sun protection behaviours as effective, whilst priming thoughts of death will motivate behaviour change. Participants were primed with a fear-appeal on negative appearance consequences of tanning.	<ul style="list-style-type: none"> → Authors conducted a pilot study to test efficacy of intervention → Majority of participants Caucasian, unclear if results can be generalized.
Cornelis <i>et al.</i> (2014)	Elaboration-likelihood model (Petty & Cacioppo, 1984); when faced with two-sided messages, people are more likely to process an appearance-message elaborately and thus reduce intentions to suntan.	<ul style="list-style-type: none"> → A pilot study was conducted to test the quality of the materials → The authors do not specify participant ethnicity → No long-term follow-up so unclear whether the effects of the intervention persisted.
Dwyer (2014)	Prototype-willingness model (Gibbons <i>et al.</i> , 1998); appearance-interventions can alter the prototype men have about men who use sun	<ul style="list-style-type: none"> → Not enough power to detect a medium effect size, however this was controlled for in analyses.

	protection, and thus alter levels of willingness to engage in the behaviour	<ul style="list-style-type: none"> → Targeted white men only, so it is unclear whether results can be generalized to other populations → Conducted pilot study to assess quality of information manipulations
Gibbons <i>et al.</i> (2005a)	Prototype-willingness model (Gibbons <i>et al.</i> , 1998); people's mental representations of people who tan will influence their willingness to engage in this behaviour. Participants completed questionnaire on attitudes and cognitions relating to measure constructs of the model.	<ul style="list-style-type: none"> → Authors do not report participant ethnicity → Study conducted on undergraduate Psychology students, which may have resulted in demand characteristics
Gibbons <i>et al.</i> (2005b)	Same as above.	<ul style="list-style-type: none"> → Authors do not report participant ethnicity → Minimized differences between UV photo condition and control condition by giving all participants natural photo and information on photoaging
Heckman <i>et al.</i> (2012)	Motivational interviewing	<ul style="list-style-type: none"> → Targeted participants who had behavioural risk factors, such as skin cancer history or previous sunbathing history → Three follow-up points, including after 12-months, which gives a good estimation of long-term intervention efficacy → Assessed the impact of factors such as therapeutic alliance on intervention efficacy
Hekcman <i>et al.</i> (2017)	Intervention informed by integrative model for behavioural prediction (IM) (Fishbein <i>et al.</i> , 2003)	<ul style="list-style-type: none"> → 35.2% of participant had family history of skin cancer → Included various measures of SES → Active and passive control condition
Hevey <i>et al.</i> (2010)	Prospect theory (Kahneman & Tversky, 1979); people will respond differently to health messages depending on whether losses or gains are highlighted. Authors manipulated this by delivering either loss or gain-framed messages about tanning. Outcome measures were informed by theory of planned behavior (Ajzen, 1991).	<ul style="list-style-type: none"> → Levels of body consciousness moderated the intervention effects → Appears authors did not obtain baseline comparisons between conditions – it is therefore not possible to determine if both or neither conditions progressed on outcome measure.
Hillhouse <i>et al.</i> (2008)	A decision theoretical framework; the Jaccard model/behavioral alternate model (Jaccard, 1980); health behaviours will be influenced by attitudes to this behaviour, perception of social norms relating to this behaviour and alternative behaviours that are available. The model focused on	<ul style="list-style-type: none"> → Sample was female indoor tanners, so it is unclear whether the findings can be generalizable to other populations. → Utilised behavioural measure in combination with bi-weekly diaries to get an accurate representation of participants indoor tanning

	challenging attitudes and perceived social norms of IT and providing behavioural alternative to it.	→ Control was waitlist only which may have skewed results.
Hillhouse <i>et al.</i> (2017)	A pilot-tested theoretical model including psychosocial mediators such as attitudes, normative beliefs and positive and negative expectancies. Has been informed by behavioural alternative model (Jaccard, 1981) and behavioural willingness (Gibbons & Gerrard, 1995)	→ Control condition was not focused on UV exposure, so it is not possible to isolate effect of appearance-framing → Intervention had been pilot tested before study → Significant financial incentive for taking part (up to 120 dollars)
Jackson & Aiken (2006)	Psychosocial model of sun protection and health Belief model (Jackson & Aiken, 2000, Rosenstock, 1974); based on their previous research on factors influencing tanning behaviours, intervention aimed to alter social norms about attractiveness of tanning and beliefs about tanning and sun protection, and assess mediational constructs to behaviour change.	→ Control group received similar intervention on different topic (stress management) to ensure relative similarity of conditions → Highest attrition rate: (34.1%) which may have skewed results.
Mahler <i>et al.</i> , (2010a)	No theory mentioned.	→ Only female under 30's included in study, so unclear if findings can be generalized. → No baseline measure of tanning attitudes, so unclear if groups were homogenous. → Lack of control condition without a model, meaning it is difficult to know what impact the presence of a model has on attitudes
Mahler <i>et al.</i> , (2010b)	No theory mentioned.	→ Only female under 30's included in study, so unclear if findings can be generalized. → No baseline measure of tanning attitudes so unclear if groups were homogenous.
Mahler <i>et al.</i> (2008)	Theory of planned behaviour mentioned in regards to injunctive descriptive norms (Cialdini <i>et al.</i> , 1991); participants were administered an appearance intervention and received information about injunctive or descriptive norms (or both) about sun protection.	→ Participants were not aware of follow-up. → Experimenter who conducted phone follow-up was blind to condition
Mahler <i>et al.</i> (2006)	Considered constructs relating to theoretical models such as the health belief model (Rosenstock, 1975), protection motivation theory (Maddux & Rogers, 1983) and theory of planned behaviour (Ajzen & Madden, 1986) as mediators to intervention effects.	→ Participants were aware there might be end of summer follow-up, which could have had an effect on results. → Included a slightly older sample (35.76) that did not consist of university students, making it a relatively unique participant group → About 1/3 of approached beach patrons refused to participate; there may have

		been a common factor among those who agreed that elicited the behaviour change
Mahler <i>et al.</i> (2007)	Mention of health belief model (Rosenstock, 1975), Protection motivation theory (Rogers, 1983) and theory of planned behaviour (Ajzen & Madden, 1986).	<ul style="list-style-type: none"> → One of the largest percentages of Asian participants (34.3%), resulting in findings that could potentially be generalized to different cultures → Participants were aware there might be a post-summer follow-up, but did not know about the 12-months follow-up
Mahler <i>et al.</i> (2010c)	Social comparison model (Feistinger, 1954); intervention combined photoaging information with upward (less skin damage) or downward (more skin damage) comparison with a peer.	<ul style="list-style-type: none"> → Participants were probed for suspicion about the study - none was detected → Unclear whether or not participants were aware of 5-week follow-up
Mahler <i>et al.</i> (2013)	Health belief model (Rosenstock, 1975) is mentioned as interpretative factor in discussion, but intervention is not based on it.	<ul style="list-style-type: none"> → Over half of the sample (50.8) had personal or family history of skin cancer, which may have influenced the results in that an awareness of the risks of skin cancer may increase intervention impact. → All participants were given brochure about risks of sun exposure – this may have made the conditions too similar and thus been one of the reasons for the modest results
Mahler <i>et al.</i> (2005)	Theory of alternative behaviours (Jaccard, 1980); intervention aims reduce UV exposure by alter perceptions of UV exposure (e.g., risk factors) and provide alternatives to tanning (sunless tanning lotion samples).	<ul style="list-style-type: none"> → Over half of the sample (53.2) had personal or family history of skin cancer, which may have influenced the results in that an awareness of the risks of skin cancer may increase intervention impact → Group had very low sunbathing levels to begin with which may have impacted results
Morris <i>et al.</i> (2014a)	Terror management health model (Greenberg <i>et al.</i> , 1986); participants primed with mortality before given UV-photo of their face.	<ul style="list-style-type: none"> → Excluded Black participants on the basis of the UV photo technique not being able to show skin damage on dark skin – this might lead to limited generalizability for this study → Offered participants free sunblock as a behavioural measure of intervention efficacy. However as 41% of participant did not take any sunblock results are not robust.
Morris <i>et al.</i> (2014b)	Same as above.	→ Excluded Black participants on the basis of the UV photo

		<p>technique not being able to show skin damage on dark skin – this might lead to limited generalizability for this study.</p> <p>→ Passive control where participants did not get a natural photo; this might have increased difference between conditions.</p>
Owen <i>et al.</i> (2016)	No theory mentioned	<p>→ Active control condition</p> <p>→ Long term-follow up (6 months), however this resulted in significant attrition</p> <ul style="list-style-type: none"> ○ Exclusively male sample
Pagoto <i>et al.</i> (2010)	No theory mentioned.	<p>→ Follow-up period of 12 months to assess long-term effects of intervention</p> <p>→ 46% refusal rate which may have resulted in selection bias</p>
Sontag & Noar (2017)	Social cognitive theory (Bandura, 2001) mentioned in introduction, but intervention not generally based on theory.	<p>→ Analysed results from IT women and non-IT women separately</p> <p>→ Overwhelmingly Caucasian sample</p> <p>→ All participants were members of sororities, making it a highly specific sample difficult to generalise from.</p>
Stapleton <i>et al.</i> (2010)	No theory mentioned, however the authors' latent profile analysis of tanner-subgroups could create foundation for future theory on UV-exposure.	<p>→ Intervention booklet adopted from Hillhouse <i>et al.</i> (2008)</p> <p>→ Appears to have been a waitlist control which could have skewed results in favour of intervention condition</p> <p>→ Sub-group 1 and 2 distinctly bigger than the other groups, making it problematic to make group comparisons.</p>
Stapleton <i>et al.</i> (2015)	Cognitive behavioural approach (Beck, 1967); online intervention focused on restructuring beliefs and perceived social values of tanning.	<p>→ Few participants reported any IT sessions, thus additional analyses were conducted that demonstrated intervention participants were more likely than controls to be in the tanning sub-group</p> <p>→ Appears to have been a waitlist control which could have skewed results in favor of intervention condition</p>
Stock <i>et al.</i> (2010)	Intervention based on health belief model (Rosenstock, 1975); perceived susceptibility to sun-damage and barriers to sun protection will influence UV exposure. Also drew on prototype-willingness model (Gibbons <i>et al.</i> , 1998); perceptions of masculinity and sun protection will influence the	<p>→ A very high-risk participant group; 81% reported never or rare use of sun protection. Might be difficult to generalize findings to less risky groups</p> <p>→ All participants received natural photo to ensure similarity between conditions.</p>

	men's willingness change their UV exposure.	
Tuong & Armstrong (2014)	Video intervention based on health belief model (Rosenstock, 1975) and specifically targeted negative outcomes of sun exposure and benefits and barriers to using sun protection.	<ul style="list-style-type: none"> → Intervention videos available to view online → The largest non-white sample with 92% of participants indicating their ethnicity as non-white; this may expand generalizability of the findings to non-white populations
Walsh & Stock (2012)	Intervention informed by prototype-willingness model (Gibbons et al., 1998); authors included masculinity as a construct to assess mediators to intervention efficacy.	<ul style="list-style-type: none"> → Compared masculine and non-masculine men in analysis, but unclear what qualifies as more or less masculine. → Immediate follow-up which so unclear if intervention effects persisted.
Williams <i>et al.</i> (2013)	No theory mentioned.	<ul style="list-style-type: none"> → Did not randomize participants to conditions due to nature of facial morphing technique → Baseline difference in sun protection intentions between conditions – this was controlled for in analysis → Control condition was 8-page leaflet on health effects of UV exposure – this gives a useful comparison between health and appearance-based interventions.

Appendix C: Chapter Two

Table A2.3. Summary of Main Findings from Each Study.

Study	Sample	Intervention*	RCT	Cond**	Outcomes measured***	Follow-up	Findings	
Bae <i>et al.</i> (2017)	88 women and 13 men	UV photo (VISIA Facial skin quality analysis)	N	1.	UV photo (VISIA facial skin quality analysis)	1 Sun protection intentions	Immediate	Significant increase in intention to use sunscreen following the intervention
Chait <i>et al.</i> (2015)	225 female students	Group interventions discussing and challenging the tanned ideal and perceptions about tanning	Y	1. 2. 3.	Dissonance condition (tanning) Psychoeducation condition (on tanning) Dissonance condition (healthy lifestyle)	3 Tanning behaviour and sunscreen use	1-month post-intervention	Dissonance condition led to fewer hours spent sunbathing No effect on sunscreen use
Christensen <i>et al.</i> (2014)	55 women and 39 men	UV photography	Y	1. 2. 3.	UV photo Emotional health video Control	1 Stages of change; sun protection	Immediate and one week	No effect of UV photo on stages of change
Cooper <i>et al.</i> (2014)	95 female and 52 male beach patrons	Participants viewed woman judging the negative effect of UV exposure on her appearance	Y	1. 2. 3.	Fear appeal: appearance Fear appeal: health Control	1 Intentions to use sun protection	Immediate	The appearance appeal marginally increased intentions to use sun protection as compared to the other conditions
Cornelius <i>et al.</i> (2014)	93 women and 304 men (convenience sample)	An advertisement with a one or two-sided message relating to costs and benefits of tanning	Y	1. 2.	Appearance related costs and/or benefits of tanning Health related costs and/or benefits of tanning	2 Intentions to suntan	Immediate	In the two-sided message condition, appearance frame was more effective in reducing intentions to suntan. No difference in one-sided message condition.
Dwyer (2014)	122 male students	UV photography	Y	1. 2.	UV photo + normal photo Control (neutral photo)	1. Intentions/willingness to use sun protection	Immediate	Men in UV condition reported lower risk willingness and intention and a more favourable prototype of men who sun protect
Gibbons <i>et al.</i> (2005a)	31 female and 27 male students	UV photograph + 2 min presentation photo	Y	1. 2.	Intervention Control (waitlist)	2 Tanning behaviours	4 weeks	Main effect of UV intervention on tanning booth use at follow-up
Gibbons <i>et al.</i> (2005b)	55 female and 54 male students	UV photograph + presentation	Y	1. 2.	Intervention Control (neutral photo)	2 Tanning behaviours	4 weeks	Main effect of UV intervention on tanning booth use at follow-up
Heckman <i>et al.</i> (2013)	162 female and 35 male students	UV photo + motivational interviewing	Y	1. 2. 3. 4.	UV photo UV photo + motivational interviewing Motivational interviewing Educational control	1 Stages of change: skin protection	Immediately, 3 months, 6 months, 12 months	UV photo condition had significantly more improvement in SOC than educational control

Heckman <i>et al.</i> (2017)	637 females and 328 males	UV4.me website	Y	1. UV4.me website 2. Skin cancer website (active) 3. Assessment only	3 UV exposure and skin protection behaviours	3 weeks, 12 weeks	Intervention reduced UV exposure and increased sun protection at both follow-up points
Hevey <i>et al.</i> (2010)	228 women and 162 men (general public)	Vignette about skin cancer focusing on either appearance or health effects	Y	1. Appearance focus 2. Health focus	3 Intentions to use sunscreen and sunbeds	Immediate	No difference between health or appearance condition on intentions to use sunscreen or sunbeds
Hillhouse <i>et al.</i> (2008)	430 female indoor tanners	24-page booklet containing information about negative effects of IT and providing behavioural alternatives	Y	1. Intervention 2. Control (waitlist)	2 Indoor tanning behaviour	1 month and 6 months	All participants increased IT use due to season, however intervention participant increases were significantly lower (35%) at 6 months
Hillhouse <i>et al.</i> (2017)	443 female pre-teens	Online indoor tanning prevention intervention (website)	Y	1. Intervention 2. Control (alcohol prevention website)	2 Indoor tanning willingness & intentions. Sunless tanning willingness	6 months	Intervention decreased willingness and intentions to indoor tan. Increased sunless tanning willingness
Jackson & Aiken (2006)	211 female students	Multicomponent group intervention including discussions and videotapes of unattractiveness of skin cancer, sun protection and image norms.	Y	1. Intervention 2. Control (stress management)	1 Sun protective knowledge, intentions and behaviour	Immediate and 6 weeks	Intervention group had intentions to sunbathe at both follow-ups. At 6 weeks, sun bathing increased for control but decreased for intervention. Intervention also had stronger intentions to sun protect.
Mahler <i>et al.</i> (2010a)	128 female students	Binder with 18 stock photos of models with or without a tan	Y	1. Model without tan 2. Model with tan	2 Attitudes towards tanning	Immediately	Participants who viewed pale models had fewer positive attitudes towards tanning
Mahler <i>et al.</i> (2010b)	169 female students	Binder with 18 photos of models with or without a tan	Y	1. Model without tan 2. Model with tan 3. Control (no model)	2 Attitudes towards tanning	Immediately	Participants who viewed pale model expressed least favourable attitudes
Mahler <i>et al.</i> (2008)	104 female and 21 male students	UV photo + photoaging info (injunctive and/or descriptive norms)	Y	1. UV photo 2. Photoaging information 3. Both 4. Neither	3 Sun protection intentions and behaviour, sun exposure	Immediate and one month	UV photo group had stronger intentions to use sunscreen and used more sun protection strategies at one month. This was enhanced by photoaging information.
Mahler <i>et al.</i> (2006)	145 female and 99 male beach patrons	UV photo + photoaging information	Y	1. UV photo 2. Photoaging info 3. Both 4. Control (neither)	3 Sun protection intentions and behaviours + skin colour change (indicating sun exposure)	Immediate and two months	UV photo led to stronger protection intentions immediately, photoaging info had stronger protection

								intentions at follow-up
Mahler <i>et al.</i> (2007)	107 female and 26 male students	UV photo + photoaging information slideshow	Y	1. UV photo 2. Photoaging info 3. Both 4. Control (neither)	3 Skin colour, sun exposure and protection behaviours	Immediate and after 4, 5 and 12 months	UV photo group and photoaging group both had short-term lighter skin-color, this effect persisted at 12 months only for photoaging group. Photoaging group had long-term lower sun exposure.	
Mahler <i>et al.</i> (2010c)	97 female and 29 male students	UV photo and photoaging info (slideshow with information and photos)	Y	1. Intervention 2. Control	3 Behavioural intentions, sun protection intentions and behaviour, exposure	Immediately and five weeks	Greater sun protection behaviour and intentions for intervention immediately and at follow-up.	
Mahler <i>et al.</i> (2013)	277 female and 165 male students	UV photo and photoaging info (including graphic photos)	Y	1. UV photo 2. Photoaging info 3. Both 4. Control (neither)	3 Cognitions, sun exposure and protection behaviours	Immediately, 22 weeks, 1 year	Modest findings. Each intervention was successful in changing cognitions short-term. Long-term lighter skin colour for both interventions. No effect on sun protection behaviour.	
Mahler <i>et al.</i> (2005)	114 female 32 male students	UV photo + photoaging info (with or without sunless tanner)	Y	1. Intervention 2. Intervention + sunless tanner 3. Control	3 Intentions to use sunscreen, sun bathing + protective behaviours	Immediately, one month	Both intervention groups expressed significantly stronger intentions to use sunscreen and actual sun protection use. No effect on sunbathing levels.	
Morris <i>et al.</i> (2014a)	59 female students	UV photo	Y	1. UV photo 2. Control (regular photo)	1 Sun protection intentions	Immediately	Higher sun protection intentions for UV photo group	
Morris <i>et al.</i> (2014b)	84 female students	UV photo with or without health or appearance message	Y	1. UV photo 2. UV photo with appearance message 3. UV photo with health message 4. Control	1 Sun protection intentions	Immediately	No main effects of UV photo.	
Owen <i>et al.</i> (2016)	75 male students	APRIL facial morphing software	N	1. Facial morphing 2. Health literature	1 Sun protection intention, sun protective behaviour	Immediately, 6 months	No differences between the conditions immediately, long-term effects for the facial morphing intervention on sun protective behaviours	
Pagoto <i>et al.</i> (2010)	191 female beach goers	20 min intervention containing UV photo and discussing benefits of	Y	1. Intervention 2. Control	3 Sunbathing, sunscreen use, use of tanning lotion	2 months, 1 year	Intervention had long-term effects on lower sun bathing, no difference in use of sun protection	

								sun protection and tanning lotion, challenging tanned ideal and image norms
Sontag & Noar (2017)	568 female students	Photos of UV damage with text description	Y	1. 2. 3. 4.	Intervention Health effects Immediate effects Text only	2 Indoor tanning intentions	Immediate	No difference between intervention and health condition.
Stapleton <i>et al.</i> (2010)	362 female students	24-page booklet adapted from Hillhouse <i>et al.</i> (2008)	Y	1. 2.	Intervention Control (waitlist)	2 Indoor tanning frequency	6 months	Among subgroup of low-knowledgeable tanners, intervention significantly reduced IT. No effects in other groups.
Stapleton <i>et al.</i> (2015)	187 female indoor tanners	Online psychoeducation program discussing and challenging IT and appearance norms	Y	1. 2.	Intervention Control (waitlist)	2 Indoor tanning frequency	6 weeks	Intervention participants more than twice as likely to be in subgroup that had not engaged in IT
Stock <i>et al.</i> (2009)	148 highway workers	UV photo + photoaging information	Y	1. 2. 3. 4. 5.	UV photo + skin cancer info UV photo + photoaging info Skin cancer info Photoaging info Control	3 Sun protection intentions, skin colour	Immediate, 2 months, 1 year	UV photo + cancer info had more favourable sun protection cognitions After a year, only UV photo group had increased sun protection.
Tuong & Armstrong (2014)	40 female and 10 male 11 th grade students	5-minute videos discussing appearance (or health) effects of tanning	Y	1. 2.	Appearance video Health video	1 Sunscreen application behaviour	6 weeks	Appearance group reported significantly higher sun screen application
Walsh & Stock (2012)	152 male students	UV photo	Y	1. 2.	UV photo Control (normal photo)	1 Sun protection willingness	Immediately	Viewing UV photo was associated with stronger sun protection willingness for more masculine men
Williams <i>et al.</i> (2013)	70 women	APRIL facial morphing software	N	1. 2.	Facial morphing Health literature on negative effects of UV exposure	1 Sun protection intentions	Immediately	Stronger sun protection intentions for facial morphing group

*Unless specified, intervention described is the one focusing on appearance

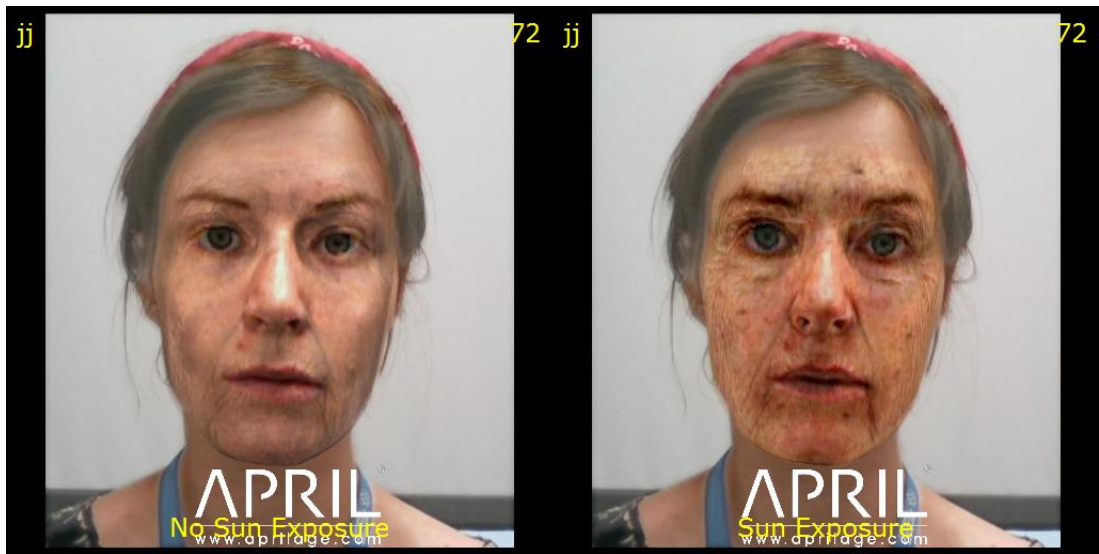
** Study may have contained additional conditions measuring variables not relating to UV exposure

*** 1, Intervention assessed behaviours and/or intentions relating to sun protection; 2, intervention assessed behaviours and/or intentions relating to UV exposure; 3, intervention assessed behaviours and intentions relating to both

RCT = Randomized controlled trial

Appendix D: Chapters Four, Five, and Six

Example Facial Morphing Image.



Appendix E: Chapters Four and Five

Full Interview Protocol.

It is anticipated that the following questions/topics will be discussed during the interviews for Study 2 and 3, however due to the semi-structured nature of the study this will allow for a certain level of flexibility. The main interview will follow after introductory conversation intended to create a level of familiarity between the facilitator and the interviewee.

- Attitudes to tanning and sun protection: “Do you tan?”; “Why?”/” why not”; “How do you feel about indoor tanning”, “Do you use sun protection?”
- Reactions to the facial morphing: “How do you feel when you look at the photo to the right (high-UV photo)”, “Are there any particular details you notice about the photo?”
- A comparison between the non-UV and UV photo: “Do you notice any differences between the two photos?” and if so, “What are the differences between the photos and how does that make you feel?”
- Age relevance, i.e., “Is there any particular age point where you feel the photo changes?”, “Was there a particular age when your tanning and sun protective behaviour became relevant for you?”
- Behaviour change, e.g., “Does this photo make you motivated to change your behaviour at all?” and if so, “How does it make you want to change your behaviour”
- End. “Is there anything you would like to add?”

This will be followed by a debrief, a possibility for the participant to ask questions, and thanking them for partaking in the study.

Appendix F: Chapters Four and Five

Ethical Approval for Study Two and Three.

MEMORANDUM

Manchester Metropolitan University
FACULTY OF HEALTH, PSYCHOLOGY AND SOCIAL CARE
FACULTY RESEARCH DEGREES GROUP

TO: Sofia Persson
CC: Prof Sarah Grogan
FROM: Prof Hugh McLaughlin
DATE: 21/04/2016

RESEARCH DEGREE REGISTRATION: Sofia Persson ID: 14051170

I am pleased to inform you that you have been registered by the Faculty's Research Degrees Group as a Full-Time candidate for the degree of PhD. Set out below are details of the approved registration and information concerning the proposal of the examiners.

REGISTRATION DETAILS

Title of Programme of Research: An investigation of effectiveness of facial morphing in promoting use of sun protection in men and women aged 35+

Supervisors: Prof Sarah Grogan (Director of Studies) and Dr Katie Dhingra (Advisor)

Date of Registration and Duration

The period of registration will be at least 36 months from your registration date 05 January 2016 subject to the conditions specified in University Regulation 27.6. It is anticipated that the award will be conferred within 12 months from the date of submission.

PROPOSAL OF EXAMINERS

Your Director of Studies will need to propose the examiners to the Faculty Research Degrees Committee for approval at least three months before the expected date of the examination – please see University Regulation 37. Forms can be downloaded from the University's Graduate School web pages or they are available from the Faculty Research Degrees Administrator.

I enclose a list of key dates for your reference. Your Director of Studies has been copied in to this correspondence.

Yours sincerely,



Cate Lawton
Research Degrees Administrator



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Appendix G: Chapter Six

Health-Focused Intervention.

Skin Cancer Information

(Cancer Research UK, 2017; NHS, 2017)

Skin cancer is in most cases caused by indoor tanning or outdoor sunbathing. Outdoor sunbathing can be intentional, such as spending time on the beach, or unintentional such as running, or gardening outside. Sun burns increase your risk of skin cancer, and there is no safe way of getting a tan.



Around 100 000 people in the UK are diagnosed with skin cancer each year, and this number continues to increase. It is by far the most common type of cancer in this country. Skin cancer can grow slowly, and it can take many years for it to be noticed. It is recommended that you check your skin regularly for signs of skin cancer, and consult your GP if you notice anything unusual.



Skin cancer requires medical treatment, which can include surgery.



Graph showing increase in skin cancer rates 1993-2014




Most cases of skin cancer can be prevented. You can prevent the disease by avoiding indoor tanning machines, and by using sun protection strategies such as wearing sunscreen, or wearing a hat or long-sleeved clothing. You should also aim to seek out the shade when the sun is strong, usually during the middle of the day.

Prevention


86%

Preventable cases of melanoma skin cancer, UK




You can burn on holiday, but also in the UK, even when it's cloudy. Wear at least SPF 15 on exposed areas of your body; apply it before going out, and reapply throughout the day. Take particular care when you are near water, as it reflects UV rays and increases exposure.

Graph showing average number of new cases per year, in relation to age



Skin cancer incidence is related to age. Like most cancers, incidences are higher in older groups, which is largely because DNA damage accumulates over time. Skin cancer survival is also slightly lower among older age groups. You can be at increased risk of getting skin cancer again if you've already had it once. Early detection increases survival.



Both men and women are at risk of skin cancer.

Skin cancer occurs in several areas of the body; in men the most common area is the trunk, and for women it is the legs.




Image demonstrating body areas affected by skin cancer for both genders


NHS

In the past 10 years, skin cancer rates in the UK have increased by 59% in men and 36% in women*

#CoverUpMate

*Cancer Research Institute

Skin Cancer is increasing more among men than among women. A possible reason for this is that men tend to have more sun risky behaviour than women, such as wearing less sunscreen and staying exposed to the sun for longer. Men are also less aware of skin cancer warning signs.



Skin cancer warning signs include lumps or discoloured patches on the skin. It most often develops on areas that have been exposed to the sun, such as the face, ears, hands, shoulders, upper chest and back.

If any of these signs persist for 4 weeks, you should seek medical advice.

Appendix H: Chapter Six

We would like you to formulate a plan to reduce your sun exposure and increase your sun protection for the coming six months. You are free to choose *how* you will do this, but we would like you to formulate your plans in as much detail as possible. Please pay particular attention to situations in which you will implement these plans.

Figure A6.1. Implementation Intentions Condition.

Appendix I: Chapter Six

What is your gender?

- Female
- Male
- Non-binary
- Third gender
- Prefer to self-describe _____

What is your age? (years)

How would you describe your ethnicity?

- White
- Mixed
- Asian/Asian British
- Black/Black British
- Other; please specify _____

Figure A6.2. Demographic Questions.

Appendix J: Chapter Six

What is your highest level of education?

- No formal education
- Primary school
- GCSEs (up to 16)
- A-levels (up to 18)
- Undergraduate degree
- Postgraduate degree
- Other; please specify _____

Figure A6.3. Highest Educational Qualification (ONS, 2006).

Appendix K: Chapter Six

Have you OR someone close to you personally experienced a diagnosis of skin cancer?

- Yes, myself
- Yes, someone close to me
- Yes, both myself AND someone close to me
- No, not to my knowledge

Figure A6.4. Previous Experience of Skin Cancer.

Appendix L: Chapter Six

THE MBSRQ-AS INSTRUCTIONS--PLEASE READ CAREFULLY

The following pages contain a series of statements about how people might think, feel, or behave. You are asked to indicate the extent to which each statement pertains to you personally. Your answers to the items in the questionnaire are anonymous, so please do not write your name on any of the materials. In order to complete the questionnaire, read each statement carefully and decide how much it pertains to you personally. Using a scale like the one below, indicate your answer by entering it to the left of the number of the statement. There are no right or wrong answers. Just give the answer that is most accurate for you. Remember, your responses are confidential, so please be completely honest and answer all items.

EXAMPLE: _____ I am usually in a good mood.

In the blank space,
enter a 1 if you **definitely disagree** with the statement;
enter a 2 if you **mostly disagree**;
enter a 3 if you **neither agree nor disagree**;
enter a 4 if you **mostly agree**;
or enter a 5 if you **definitely agree** with the statement.

- _____ 1. Before going out in public, I always notice how I look.
- _____ 2. I am careful to buy clothes that will make me look my best.
- _____ 3. My body is sexually appealing.
- _____ 4. I constantly worry about being or becoming fat.
- _____ 5. I like my looks just the way they are.
- _____ 6. I check my appearance in a mirror whenever I can.
- _____ 7. Before going out, I usually spend a lot of time getting ready.
- _____ 8. I am very conscious of even small changes in my weight.
- _____ 9. Most people would consider me good-looking.
- _____ 10. It is important that I always look good.
- _____ 11. I use very few grooming products.
- _____ 12. I like the way I look without my clothes on.
- _____ 13. I am self-conscious if my grooming isn't right.
- _____ 14. I usually wear whatever is handy without caring how it looks.
- _____ 15. I like the way my clothes fit me.
- _____ 16. I don't care what people think about my appearance.
- _____ 17. I take special care with my hair grooming.
- _____ 18. I dislike my physique.
- _____ 19. I am physically unattractive.
- _____ 20. I never think about my appearance.
- _____ 21. I am always trying to improve my physical appearance.

Figure A6.5. The Multidimensional Body-Self Relations Questionnaire (Cash, 2000).

Appendix M: Chapter Six

Considerations of Future Consequences Scale instructions

For each of the statements below, please indicate whether or not the statement is characteristic of you.

In the blank space,
enter a 1 if it is **extremely uncharacteristic** of you;
enter a 2 if it is **somewhat uncharacteristic**;
enter a 3 if you are **uncertain**;
enter a 4 if it is **somewhat characteristic**;
or enter a 5 if it is **extremely characteristic**

- ___ 1. I consider how things might be in the future, and try to influence those things with my day to day behaviour.
- ___ 2. I often engage in a particular behaviour in order to achieve outcomes that may not result for many years.
- ___ 3. I only act to satisfy immediate concerns, figuring the future will take care of itself.
- ___ 4. My behaviour is only influenced by the immediate (i.e. a matter of days or weeks) outcomes of my actions.
- ___ 5. My convenience is a big factor in the decisions I make or the actions I take.
- ___ 6. I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes.
- ___ 7. I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years.
- ___ 8. I think it is more important to perform a behaviour with important distant consequences than a behaviour with less-important immediate consequences.
- ___ 9. I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level.
- ___ 10. I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time.
- ___ 11. I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date.
- ___ 12. Since my day to day work has specific outcomes, it is more important to me than behaviour that has distant outcomes.

Figure A6.6. Consideration of Future Consequences Scale (Strathman *et al.*, 1994).

Appendix N: Chapter Six

CMI – 46 instructions

enter a 1 if you **strongly disagree**

enter a 2 if you **disagree**

enter a 3 if you **agree**

enter a 4 if you **strongly agree**

You should give the responses that most accurately describe your personal actions, feelings and beliefs. It is best if you respond with your first impression when answering.

1. In general, I will do anything to win
2. If I could, I would frequently change sexual partners
3. I hate asking for help
4. I believe that violence is never justified
5. Being thought of as gay is not a bad thing
6. In general, I do not like risky situations
7. Winning is not my first priority
8. I enjoy taking risks
9. I am disgusted by any kind of violence
10. I ask for help when I need it
11. My work is the most important part of my life
12. I would only have sex if I was in a committed relationship
13. I bring up my feelings when talking to others
14. I would be furious if someone thought I was gay
15. I don't mind losing
16. I take risks
17. It would not bother me at all if someone thought I was gay
18. I never share my feelings
19. Sometimes violent action is necessary
20. In general, I control the women in my life
21. I would feel good if I had many sexual partners
22. It is important for me to win
23. I don't like giving all my attention to work
24. It would be awful if people thought I was gay
25. I like to talk about my feelings
26. I never ask for help
27. More often than not, losing does not bother me
28. I frequently put myself in risky situations
29. Women should be subservient to men
30. I am willing to get into a physical fight if necessary
31. I feel good when work is my first priority
32. I tend to keep my feelings to myself
33. Winning is not important to me
34. Violence is almost never justified
35. I am happiest when I'm risking danger
36. It would be enjoyable to date more than one person at a time
37. I would feel uncomfortable if someone thought I was gay
38. I am not ashamed to ask for help
39. Work comes first
40. I tend to share my feelings
41. No matter what the situation I would never act violently
42. Things tend to be better when men are in charge
43. It bothers me when I have to ask for help
44. I love it when men are in charge of women
45. I hate it when people ask me to talk about my feelings
46. I try to avoid being perceived as gay

Figure A6.7. Conformity to Masculine Norms Inventory (Parent & Moradi, 2009).

Appendix O: Chapter Six

Outcome measures

All items will be answered on a 7-point Likert-type scale (strongly disagree – strongly agree OR never – very often)

Sun protection intentions (Dwyer, 2014; Williams *et al.*, 2013)

1. I plan to use sun screen with at least SPF 15 whenever I am in the sun
2. I plan to wear sun protective clothing (e.g. wide-rimmed hat, long-sleeves and/or long trousers) whenever I am in the sun.
3. I plan to get a tan from the sun or tanning booths
4. I plan to limit my UV exposure wherever possible (e.g. by staying inside or seeking the shade) when I am in the sun.
5. I plan to go outside on sunny days without protecting my skin
6. I intend to get a tan from UV rays (e.g. by sunbathing outside or using a tanning bed) in the coming 12 months

Sun protection behaviour (Dwyer, 2014; Williams *et al.*, 2013)

1. I use sun screen with at least SPF 15 when I am out in the sun for more than 15 minutes
2. I have been using sun screen with at least SPF 15 for the last 12 months.
3. When spending time in the sun during the past 12 months, how often have you tried to seek the shade?
4. When spending time in the sun during the past 12 months, how often have you worn sun protective clothing (e.g. a wide-rimmed hat, a long-sleeved shirt, and/or long pants?)

UV exposure (Dwyer, 2014; Stapleton *et al.*, 2010)

1. How often have often have you spent time trying to achieve a tan from UV rays (e.g. sunbathing outside or using a tanning bed) in the past month?
2. How often have you been outside on sunny days without protecting your skin in the past month?
3. Approximately how many hours a week do you spend in the sun during the spring and summer doing any kind of outdoor activity?
4. How many times in the past month have you used a sunbed?

Figure A6.8. Dependent Variables: Sun protective Intentions; Sun Protective Behaviours; UV Exposure.

Appendix P: Chapter Six

Ethical Approval for Study Four.

**Manchester Metropolitan
University**

M E M O R A N D U M

FACULTY ACADEMIC ETHICS COMMITTEE

To: Sofia Persson

From: Prof Carol Haigh

Date: 29.05.2018

Subject: Ethics Application 1482

Title: The effectiveness of a health-focused intervention versus and appearance-focused intervention on people over 35 years' UV exposure

Thank you for your application for ethical approval.

The Faculty Academic Ethics Committee review process has recommended approval of your ethics application. This approval is granted for 42 months for full-time students or staff and 60 months for part-time students. Extensions to the approval period can be requested.

If your research changes you might need to seek ethical approval for the amendments. Please request an amendment form.

We wish you every success with your project.



Prof Carol Haigh
Chair
Faculty Academic Ethics Committee



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