

The Neo Ebreeq: Invigorating Tradition
within a Contemporary
Context through Redesign

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Abstract

The ebreeq is a traditional Lebanese water vessel, an iconic cultural artefact which is becoming obsolete as result of modernization. The intent of this research is to use motion design and 3D digital technologies to invigorate the traditional ebreeq and revive its sustainability in today's contemporary society. The objective of redesigning the ebreeq focuses on enhancing its ergonomics and visual characteristics, while retaining its identity; this is in addition to evolving the semiotic meaning of the ebreeq by addressing the static past and present moments of interaction with the vessel.

This thesis examines the major design principles of the ebreeq; hence, other visually similar and re-designed water vessels are studied as well. It also discusses the literature related to motion design and relevant 3D projects and explores the divergent realms of digital technologies and traditional craft. This study indicates how motion design generates new forms through a range of techniques which reveal the invisible – but essential – moments of transformation during one's interaction with the ebreeq while using it. In other words – following Sennett's "domain shift" – the principles of motion design are transferred into product design to amalgamate gestural moments into one form: the neo ebreeq in its final outcome.

My methodology relates various practice-based examinations and explores crafting a clay ebreeq alongside utilizing motion design and digital technologies to understand these varying techniques of making. The core value of the traditional egg-shaped vessel is emphasized in the new design which is developed based on the captured motion of water within the dynamic space of the neo ebreeq. The redesign of the traditional ebreeq enhances its container, base, spout and neck and maintains the use of intelligent material. This study offers the sensibility of seeing through sequences, while related research determines the link between the past, the present and the future. The interconnection between motion design and locomotion, time-based semiotics, Futurism and Post-structuralism establish a conceptual framework as motion design connects these theoretical components within the practical applications of 3D technology, 3D animation, modelling and rendering.

Finally, this project introduces an initiative to invigorate similar culturally significant objects which are becoming endangered artefacts. It bridges tradition with modernity, combines motion design with product design and merges digital and traditional techniques of making. Despite the fact that motion design has not been a common practice in reinvigorating cultural objects, it remains a vital factor resulting in unconventional outcomes in redesigning the ebreeq.

Keywords: *ebreeq, Lebanon, traditional, product design, 3D digital technology, culture, gestures, fluid, motion design, dynamic, time-based semiology, post-structuralism, locomotion, Futurism*

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Chapter 1: Introduction and Motivation for the Research

My father started restoring the house previously owned by my ancestors which dates back to circa 1450¹ (Figure 1). Due to the escalating Lebanese Civil war (1974-1990), he was unable to proceed and stopped the restoration in 1987. After completing my MFA in the United States, I returned to Lebanon in 2003 and set out to complete the restoration myself. Having become the homeowner, the house was important to me because it had a strong and personal connection with me and held traces to my ancestry and a past that dates back almost 500 years (Figure 2).



Figure 1 The family home in north Lebanon in the 1980s



Figure 2 Beginning of the restoration project in 2003

¹ In his book *The Village of Berbara: from Rural Society to Civil Society*, Dr. Jamal Wakim writes that the ancestors of the Khoury family moved to the village of Berbara in Byblos, where archeologists excavated a Phoenician stone coffin; many researchers have also documented to have found a tablet carrying the first Phoenician alphabet, but its current location remains unknown (p. 40). In a personal correspondence, Dr. Wakim confirms that the mentioned family house is the oldest one in Berbara and is estimated to be 500 years old.

Even though my educational and professional background in motion design² seems distant from such a project, the experience of restoring the house had a personal and creative impact on me, and came to initiate my PhD project. During the restoration, I found objects such as rusted old keys, fossils, fractured ceramic remains, weathered tools and remnants of furniture (Figure 3), uncovering the past of my family and that of Lebanon. I gained a new appreciation for the craftsmanship, materials and the construction of previous forms of architecture and object designs that have a great cultural significance.



Figure 3 Objects found during the restoration of the family house: lunchbox, coffee grinder, clay ebreeq (left to right), spoons and keys

Even though my training is related to contemporary technologies, I am passionate about collecting ancient objects as culturally and socially valuable possessions. My house has been an ongoing project, whereby the house itself is a static object within a dynamic environment. In the past few years, I felt a need to heighten this experience as a designer and a scholar. The dynamic effect of daylight and shadows within the new architecture creates a significant effect in the shaping of the old architecture. Time is not akin to pure empiricism where it exists in the chronological order of past, present and future; it rather manifests itself in completely different time periods, or different levels of time (Bergson, 1922/1965).

² Motion design is the practice of applying the principles of graphic design into producing films and videos by means of animation, visual effects and digital technologies.

Time can be seen as the changing nature and position of the light that could create a dynamic effect on pre-existing architecture (Figure 4).



Figure 4 A recent image of the family house, 2019

1.1. Roots – A Background to This Research Project

Intangible cultural heritage [...] concerns “*the practices, representations, expressions, knowledge and skills*” that belong to communities and [...] is not static, but it continually transforms and innovates. (Cominelli and Greffe, 2012, p. 245)

I began exploring how design can be used to reconnect traditional practices and values within modern living, and to adopt a sustainable approach. The objects I collected have a historical significance and cultural value that derive from traditional craftsmanship and practices which have been passed down from one generation to another. I imagined the possibility of reviving them through a unique connection between the “original” and the “redesign” based on the cultural value of these objects. This approach to cultural sustainability has been examined by contemporary design researchers (Walker et al.) in *Design Roots: Culturally Significant Designs, Products and Practices* saying

Individuals who contribute to such a tradition are, then, upholders of values that are seen to be important and worth preserving. These values are manifested through the artifacts of traditional practices – songs, dances, paintings, crafts, rituals – and are taken forward in the knowledge or the hope that those who come after us will share our values. (Walker et al., 2018, p. 45)

Besides my house and the objects I unearthed, my educational background and academic activities have influenced the direction of my PhD research project. My MFA thesis, titled *Sequence* (completed at Boston University in 2001) was related to time, space and technologies; I investigated motion graphics alongside experimental notions of technologies and transport. Motion design uses the principles of graphic design in making videos and films, often integrating visual effects and animation. My thesis project consisted of a series of three short experimental motion graphics which were based on subject matters such as ATMs, trains and telephone/electricity wires. I extracted frames from each film and created static posters with those images; these posters portrayed a sense of motion even though they were static works. I extracted multiple key-frames and manipulated them to become a single entity in a poster. The key-frames here examined how everyday technologies affect society and were visual representations addressing people's loss of cognitive processes in their automatic response to everyday technologies (Appendix 1). This response came, in part, from the need to be constantly in motion. Motion design, key-frames, experimentation and technology were employed in my doctoral research, which set out to examine the traditional ebreeq³ (one of the cultural artefacts I discovered during the house renovation, see Figure 3) and, more importantly, to re-design and re-create it for present day use.

After graduating from Boston University and becoming a faculty member teaching design, I found writing and research to be crucial to the design process and design thinking. In 2009, I co-authored a paper "Writing & Research for Graphic Design within Undergraduate Studies"⁴ which addressed how research and writing should be part of every publication, printed material and online resources related to design; many of today's professional publications on graphic design are image-based with little or no explanation, information or included description. Through the examination of recent design research in publications, the potential expansion of written research in graphic design was explored. Critical writing was examined as a means to influence and inspire design innovation based on research and written

³ The ebreeq is a traditional drinking vessel that dates back thousands of years and is highly valuable as part of the Lebanese heritage. Pottery, especially the production of the ebreeq, was passed down from one generation to another and often was the main source of living for numerous families.

⁴ "Writing & Research for Graphic Design within Undergraduate Studies" was published in the proceedings of the 3rd IASDR World Conference on Design Research by the International Association of Societies of Design Research with D. Durling, T. Poldma & A. Valtonen as editors (pp. 839–846). Seoul: Society of Design Science.

studies which served as the guiding methodology of developing this research in design innovation (Appendix 2.1). Later in 2009, I co-authored another paper “Cultural Identity Crisis within Contemporary Graphic Design, Case Study: Lebanon”⁵ which addressed how visual representations of Lebanese culture are rich and diverse (Appendix 2.2). Traditionally, the Lebanese culture is a unique conglomerate; however, westernization jeopardizes the cultural identity of contemporary Lebanese graphic design. Furthermore, today’s Lebanese design students commonly refer to Western resources for inspiration and view Middle Eastern influences as conventional, whereby they see design from the region as lacking the trendy, innovative, and “cool” qualities that they associate with design predominantly from Europe, the USA and the UK. Student designers are integral to the revival of the Lebanese visual culture. Pedagogical approaches can encourage the incorporation of visual culture into design by embracing change without obliterating the past. This paper probed ideas underlying my doctoral research in relation to the importance of cultural revival, pointing toward projects like the revival of the ebreeq as a culturally significant object as a means to sustain its heritage.

In 2011, I co-authored a paper “Sustainability and Design Education, Case Study: Lebanon”⁶ which examined how after fifteen years of civil war and continued political and economic turmoil, concern for ecological issues was not a priority for most Lebanese (Appendix 2.3). Students in Lebanon enroller in higher education design programs were typically not even familiar with the term “sustainability”. The literature search of this paper found that a handful of NGOs, global corporations, local businesses and the Ministry of Environment were addressing ecological issues in Lebanon, but only on a superficial level. Living within an ecologically diverse yet a politically deteriorating country, a need for action becomes necessary and raises the question: How can design education in Lebanon be modified to encourage sustainability? A qualitative analysis of sustainability progress within design education outside Lebanon was conducted. It has been proposed to modify the Lebanese design education by making course and program revisions in an attempt to make them more environmentally focused, whereby faculty members

⁵ “Cultural Identity Crisis within Contemporary Graphic Design, Case Study: Lebanon” was published in Conference Proceedings of the MX Design Conference: Impacto Social, Mexico City, Mexico. It was also presented at the WCCES 14th World Congress 2010 hosted by the XIV World Congress of Comparative Education Societies and Bogazici University, Istanbul, Turkey.

⁶ “Sustainability and Design Education, Case Study: Lebanon” was published in the proceedings of the Cumulus 2010 Shanghai Conference: Young Creators for Better City & Better Life, Shanghai, China.

are viewed as question-asking facilitators and reference providers, and students as content-creators. The notion of sustaining both culture and the environment is of great importance, and is the focus of this research and its practice-based project which operate together in an interdependent and complementary manner based on the principle of “*practice-based research* [as] an original investigation undertaken in order to gain new knowledge, partly by means of practice and the outcomes of that practice” (Candy and Edmonds, 2018, p. 63). The ebreeq is one of the objects that have experienced continuous marginalization within its environment regardless of being a representative item of the Lebanese heritage and, thus, reinvigorating it becomes a referential in terms of incorporating design education within a culturally and environmentally focused project aimed at the sustainability of the ebreeq.

My interests, research, published writings and my MFA thesis (Appendices 1-2) have cumulated in this PhD study; it has expanded my knowledge and experience as a motion designer, researcher and author, transforming my passion for education and the sustainability of Lebanese cultural objects into a strategy to redesign them for today’s society.

The object I set out to redesign as the subject of this PhD study is the ebreeq. Various sorts of water vessels, including the ebreeq, were once abundantly used in Lebanon; the ebreeq is a clay vessel that has a narrow base but a wide center. It also has a long narrow neck and two openings, one at its top for filling it with water and another – the spout – on its side to drink from it (Abboud, 2014). It is important to mention here that the ebreeq is not only a drinking vessel, but also a culturally significant artefact which is closely associated with the Lebanese history, heritage and ancestry (Figure 5).



Figure 5 On the left, clay ebreeq (1800s – mid-1900s)
On the right, glass ebreeq (1975 –1990)
During the mid-1900s, the clay and the glass ebreeq
were simultaneously manufactured, but the glass
ebreeq became more popular throughout time until
the 1990s when its use started to remarkably decline.

Therefore, I am interested to demonstrate how motion design studies can be used to reveal relations between traditional materials, ergonomics and personal/shared values of this traditional Lebanese drinking vessel — the ebreeq. Unfortunately, it is one of the many culturally significant Lebanese products that has been forgotten or left behind as society modernizes; nonetheless, it can be revived through new technologies.

One of the challenges that manifests itself in regards to the sustained existence of traditional objects is retaining their cultural value in the face of modernisation. It is undeniable that technology can be a catalyst in enabling the invigoration of cultural objects, but it also crucial that

crafts practices [...] are strongly rooted in their territory and associated with the traditional activity of the community and its history. Their specificity is of being both traditional, passed down through generations, innovative, able to adapt to different needs as they arise, and creative, since they foster new uses and practices. (Cominelli and Greffe, 2012, p. 248)

During the research process, I carefully considered technologies that I could build upon and enhance the traditional and cultural qualities of the ebreeq. My research proposes that motion design as a medium and a method has the potential to improve and extend the ebreeq's cultural significance and ergonomic value. Motion design also reveals insights through its fourth dimension – which is time. It can create a narration of multi-moments in time, when the ebreeq is used to drink from, is emptied and filled. In this sense, my research focuses on how motion

design can make the past, the present and the future into one perceptual entity. The study of motion within an object is not a common approach toward product design. Most product designers would not study an object through filming and extracting key frames. Hence, such studies lend themselves to new perspectives in examining, understanding and re-designing the ebreeq (and other culturally significant artefacts alike) through the use of today's technologies and latest methods of making. This is an unconventional approach towards object design and is made to lead to unconventional results.

It is an important part of my research method to capture, through film and analysis in motion design, moments that are not visible to the naked eye such as when water moves into and out of the ebreeq. The flow of water is incredibly beautiful and is the essence of the ebreeq. Water, as a fluid transparent substance, is embedded with visual intricacies that can be captured and examined in both film and 3D generated mesh⁷ forms. This research uses new technologies of filmed imagery and 3D mesh forms as a basis to generate new 3D forms of the ebreeq, which I have chosen to name "neo ebreeq" for its new and revived representation which invigorates new designs based on a traditional archetypal form. With the use of new bio materials and technologies, transitions are created that reference the ebreeq's traditional use and cultural significance. Motion capture is employed to enable the analysis of the ebreeq while in use, and help ground the neo ebreeq without losing its cultural significance.

1.2. Structure of the Thesis

There is a need to reimagine the past for future generations while respecting the very traditional values and heritage that connected in the first place, as without this, there is a disconnect between what people used to value and the contemporary lens through which they view the past. (Walker et al., 2018, p. 355)

The literature review of this thesis places my research in an historical perspective and craft lineage related to my own analysis of existing knowledge. It serves to contextualise my research and structures the various references I gathered. Moreover, the literature review itself is interwoven into several chapters rather than being a single chapter. Through this review I evaluate promising research methods and their usefulness in elucidating my own work. Most importantly, I

⁷ Mesh generation is the creation of vertices, edges and faces that defines the shape of an object in 3D computer graphics and solid modelling. Retrieved from https://en.wikipedia.org/wiki/Polygon_mesh

demonstrate the necessity and cultural relevance of my own research through a description of existing literature, past/present practices, examples of design projects, and theory in the field.

My research project merges diverse yet interrelated information to help shape a new vision of a traditional Lebanese drinking vessel — the ebreeq. This research is composed of multiple critical stages that, when put together, unfold an understanding of the ebreeq, from its origin to the period when it ceased to be used, allowing the identification of a series of key points when the ebreeq is in use that can be morphed into new possibilities.

Sennett coins the term “domain shift” and refers to the way in which a tool originally used for a particular purpose is employed for another practice or the way the guiding principle of a task is transferred to another (2009). Accordingly, as a practitioner, much of my knowledge is in the area of motion design. What I bring to this research is the sensibility of seeing via sequences that reveal interrelationships between the past, the present and a hopeful future. I looked into new perspectives, theories and outcomes of related research to formulate a relationship between the theoretical and the practical components of my subject. Consequently, the literature review examines tradition and theoretical studies in post-structuralism, semiotics, motion design and locomotion to establish an approach to redesign the ebreeq within the framework of the interconnected conceptual aspect of futurism and parametricism. This is applied through the practice of 3D technology, 3D animation, modelling and rendering.

This thesis outlines the evidence I gathered through my readings, research, fieldwork, interviews and practical work. The purpose of this research is to develop a critical discussion and to build on insights based on differing arguments, theories, approaches, analysis and a synthesis of relevant published work linked to my own purpose and rationale.

Having set out the background behind my pursuit of this doctoral research in this chapter, Chapter 2 explains what an ebreeq is and provides the historical context which identifies it as an item closely associated with the Lebanese heritage and culture. It also looks into the key design principles of the ebreeq and the dynamic interrelationship between the ebreeq and the water it contains. Along with the

examination of the relationship between tradition and modernity, this thesis elaborates on vessels that have physical and cultural attributes in common with the ebreeq. After discussing how designers took the initiative to reinvigorate them, Chapter 2 concludes by pointing out that although motion design has not been commonly used in such projects, it is an essential factor in this project which brings unconventional outcomes to redesigning the ebreeq. While Chapter 3 discusses the theoretical framework that has informed my research, Chapter 4 looks into the research in motion design that can best relate to a redesign of the ebreeq and a selection of 3D art/design projects that merge object, function and digital enhancement. Lastly, Chapter 5 presents the final design outcome of the neo ebreeq as a product that bridges tradition and modernity, combines motion design and product design, in addition to merging digital and traditional techniques in the process of invigorating the traditional Lebanese ebreeq.

1.3. Aim and Objectives

The primary aim of this study and practice-based research is to revive the ebreeq through redesign. The process of redesigning this culturally significant object focuses on enhancing its visual characteristics, traditional material, ergonomics and emotional personal/shared values with digital technologies in a contemporary context. The outcome of this project not only creates a harmonious connection between the traditional aspect of the ebreeq and the contemporary environment, it also paves the way to revive other culturally significant items that are on the verge of becoming endangered artefacts.

Aim:

To invigorate the traditional ebreeq and to redesign it for contemporary society through the use of motion design and 3D digital technologies

Objectives:

The objectives of this thesis include understanding the identity, legacy and common relations of spouted water jugs through cultural, historical, typological, anthropological and material qualities. This is in addition to applying theoretical frameworks in relation to the ebreeq or similar examples that formulate relationships between digital and traditional functions.

Besides maintaining the ebreeq's traditional and cultural value through the egg-shape, ergonomics and emotional personal/shared significance in design, this study seeks to apply extracted imagery from motion design and 3D generated meshes to redesign the ebreeq towards the creation of multiple neo ebreeqs with enhanced meaning through the development of a contemporized aesthetic.

Lastly, among the important objectives of this practice-based research is to prototype a neo ebreeq embedded with implied motion based upon a fusion of fluid through the use of: motion studies, digital composites and multiplicities of potential visual outcomes.

Methods:

As mentioned earlier, this is a practice-based study whereby practice is a key component in the research examining not only the process but also the product – the neo ebreeq – as well. In other words, this is a method “applied to original investigation seeking new knowledge through practice and its outcome” (Skains, 2018, p. 86). The design of the neo ebreeq is supported by an academic investigation of the interconnected context, concept, process and the importance of the achieved design. The creative process does not dismiss readings or theory leading to the design product design; on the contrary, they are “bound inextricably together, informing one another in their communication of knowledge just as the research and creative practice informed one another” (Skains, 2018, p. 86).

A number of methods including archival research and studio-based analysis were employed within the process of redesigning the ebreeq; I conducted a field research at a pottery in MishMish and collected data about distant potteries located in the south of Lebanon. The conceptual and research aspects provided this study with insights related to the ebreeq, upon which the implementation of the creative outcome of redesigning the traditional ebreeq was based within a complementary modern context.

As such, studio and technical methods were designed to investigate the main factors, concepts and variables of traditional water spouted jugs through similar examples and interviews in order to examine their commonalities, their evolution and their contemporary re-design, and to relate these findings to the redesign of the ebreeq. This research is based on relevant literary theories and a form of design investigation interrelated to my project, that when put into practice

construct a conceptual framework towards a practical application. Also, examples in art/design projects were gathered which use interrelationships between computational technologies, 3D imaging, motion design, 3D rendered photography and 3D printing to analyse methods that integrate technologies. The theoretical framework and the application of these technologies were combined to create multiple aspects of the ebreeq through water in motion as an interactive gesture. This project formulates a means to extract a multiplicity of water fluid stimulation 3D forms that append to the core egg-shape of the ebreeq from initiatives in practical research in order to render select examples for prototyping. Lastly, studio and technical methods designed, tested, analyzed and refined 3D printed prototypes of the neo ebreeq focusing on the intrinsic value of water/drinking, the ergonomics and the aesthetics of the neo ebreeq.

Chapter 2: The Traditional Ebreeq

2.1. The Ebreeq and its Background

Before the mid-1950s, providing water was a challenge for villagers who used to transport it from springs and stored it in their households using particular vessels which are either no longer used or are on the path of extinction (Abboud, 2014, para. 1).

Rural women in Lebanese villages went to a water well, rumored to be a “window” onto an underground river. Other women went to water springs (called “eyes” in Arabic) sometimes thousands of meters away, carrying a vessel commonly known as Al Jarra that could hold about 20 litres of water. They used to return home with the jars on their heads and boast that they did not use their hands and were not afraid of dropping the jars (Figure 6). Their heads would be stationary while they walked and this way of carrying water seems to have influenced Eastern forms of dance which depend on the movement of the body while maintaining the stability of the head (El Sharyaa, 2013, para. 2).



Figure 6 Village women with water vessels above their heads walking to the springs to fill them with water

Image retrieved from an article by Khaled El Sharyaa
<https://kwana.net/2013/01/17>

Carrying this vessel above the head required not only skill, but also strength and balance; interestingly, it was carried as such because women had to use their hands to cover their faces with their garments from the village men (Abboud, 2014,

para 7-8). In order for the jar to rest firmly on a woman's head, she would deliberately wrap a cloth in a circle on her head and then, either herself or with the help of others, would place the jar within the cloth frame. The women walked in a procession until each of them reached home.

The second method of securing water was to drill a cistern near their houses to collect rain water in winter; such cisterns date back to ancient times. Man-made water storage, however, often did not provide enough water throughout the year, especially since such facilities were shared by several families and were also used for animals. Hence, the women of the village were still required to journey in search of water from other sources.

The women collected and stored water at home in either a ceramic jar called Al Jarra (Figure 8) or another common ceramic vessel called "Al Khabiya" (the name derives from the Arabic root which means "to store") (Figure 7). It was typically spherical or egg-shaped, with handles or "ears" fixed on both sides.



Figure 7 Al khabiya – a cylindrical water vessel used for storing water
Image retrieved from an article by Khaled El Sharyaa
<https://kwna.net/2013/01/17>

Gradually over time, the "Al Khabiya" was replaced by an oval longitudinal jar which is narrow from the bottom and gradually expands to the top; the neck of the

jar rises about 40 cm and ends with a nozzle (Figure 9). The jar was placed on a three-legged iron stand, with a ring at the top which the jar was placed into; a container was placed as a base to collect dropping water. Some buried the jar in the ground, especially those who spent time outside, to maintain a cooler water temperature.

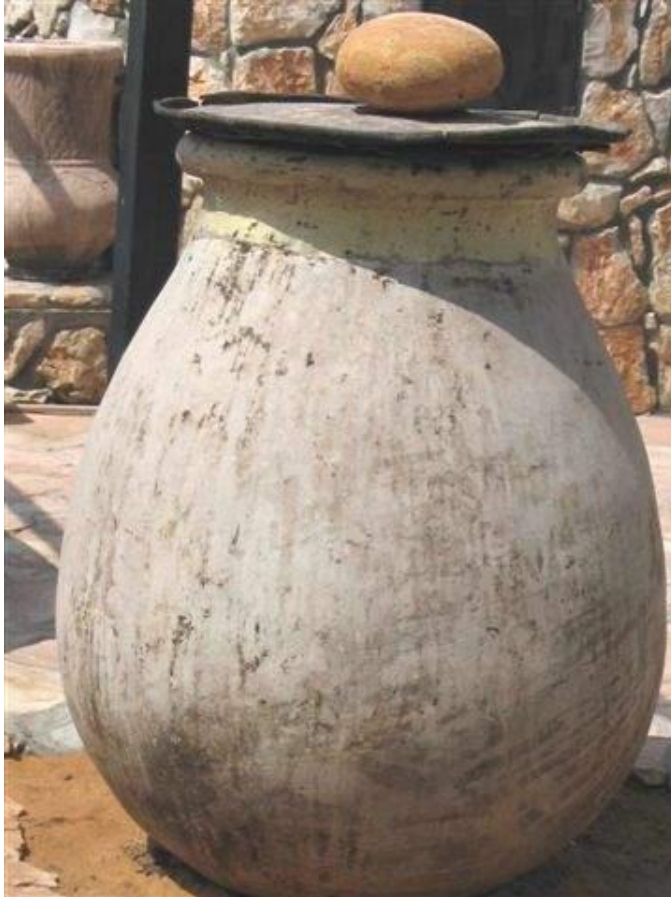


Figure 8 Al Jarra – a ceramic vessel used for storing water
Image retrieved from an article by WAFA
http://info.wafa.ps/ar_page.aspx?id=8978



Figure 9 Ceramic water vessel that gradually replaced the Alkhabiya
Image retrieved from an article by Jamil Abboud
<https://jamilabboud.com>



Figure 10 Pouring water from an ebreeq into a clay cup
Image retrieved from an article by Khaled El Sharyaa
<https://kwna.net/2013/01/17>

The vessels mentioned above were used to transport water from various sources to households. The production of these jars was accompanied by the production of clay ebreeqs which were used to drink water from, either using a cup or directly from the ebreeq itself (Figure 10). One would simply pick the ebreeq up and pour the water directly into the mouth, provided that the mouth did not touch the spout which has an opening of 1.5 cm. The handle is on one side with the spout on the opposite side (Figure 11). The ebreeq can be found in different shapes and colors according to the taste and skill of their makers.



Figure 11 Clay ebreeq
Image retrieved from an article by WAFA
http://info.wafa.ps/ar_page.aspx?id=8978

The word ebreeq relates to the word "ebrieze" which in Persian translates to pouring water ("eb" meaning water); in addition to other variations of the word ebreeq in other languages, one of the most similar is the word "abreac" in modern Persian which is a name given to a water vessel that has an opening and a spout from which water is poured (Mustafa, 2018, p. 52). The vessel was elegant, swollen from the centre like an egg and conical at the base. The diameter of the base was equal to the rotated cylindrical neck opening; it also had a handle from the neck to the shoulder, a spout opposite the handle, and a narrow circular base. It was filled with water and placed at the window sill; the water filtered through the porous pottery and vaporized in the air stream from the window, helping the cooling process (Figure 13).

As mentioned earlier, the drinker would lift the ebreeq and let the water flow into the mouth; this was done by raising it high, tilting back the head, opening the mouth towards the sky, pouring the water quickly so as not to waste a drop of water and drinking without the lips ever touching the spout (Figure 12). This way of drinking is called "zirzak", which refers to the sound made by a person expressing triumph or happiness. Men used to compete by raising the ebreeq as high as possible. When a child failed to imitate the adults and was seen drinking with the lips touching the spout or sucking from it, the adults used to scold the child. Also, if the lips of an adult guest touched the spout while drinking, it was thought to be bad luck and the ebreeq should then be broken.



Figure 12 A villager drinking water from an ebreeq
Image from Lebanon in a Picture
<https://www.lebanoninapicture.com/>

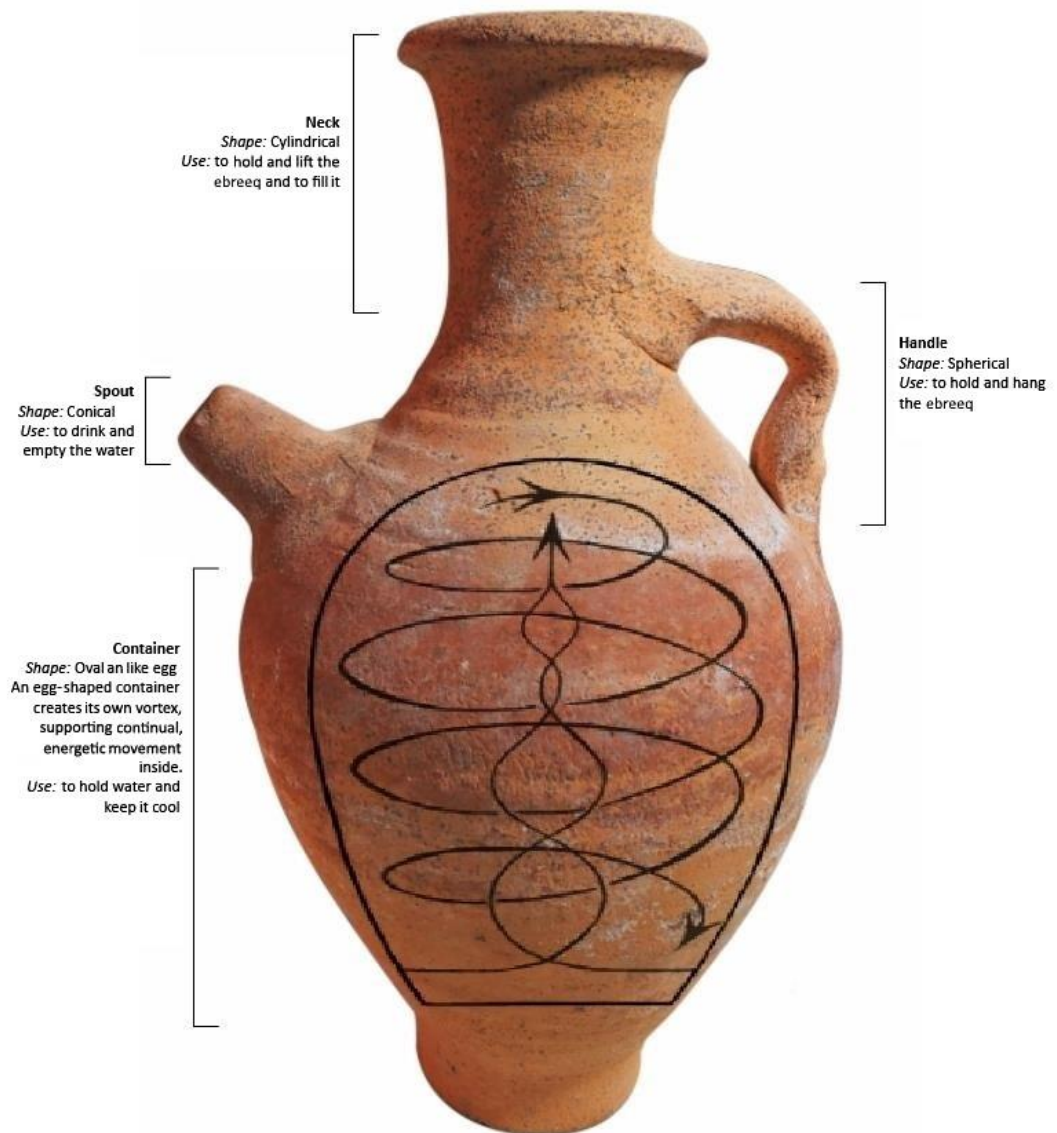


Figure 13 The ebreeq – my grandparents passed down this particular example of a traditional Lebanese clay drinking vessel to me; it is estimated to be from the time of the Ottoman Empire (circa 1516-1918)

2.1.1. Investigation into the History of the Ebreeq

The ebreeq has a lengthy history; it originated during the Phoenician era and one of the few available resources, which is also academically credible, studies an excavated example from the 9th–10th century BCE (Figure 14) found to the south of Beirut (Seeden, 1991).

This research project is complicated by the fact that there are several vessels that are similar to the ebreeq in the Middle East in general and in Lebanon in particular; in various parts of the globe, many similar vessels have been used for storing oil, for burial purposes, or as vases. In order to narrow down my research, I

specifically looked into drinking (wine or water) vessels with a neck, handle and spout from the region. I then constructed a timeline based upon this research in order to chart its evolution and redesign the ebreeq based on the functionality of their common form.

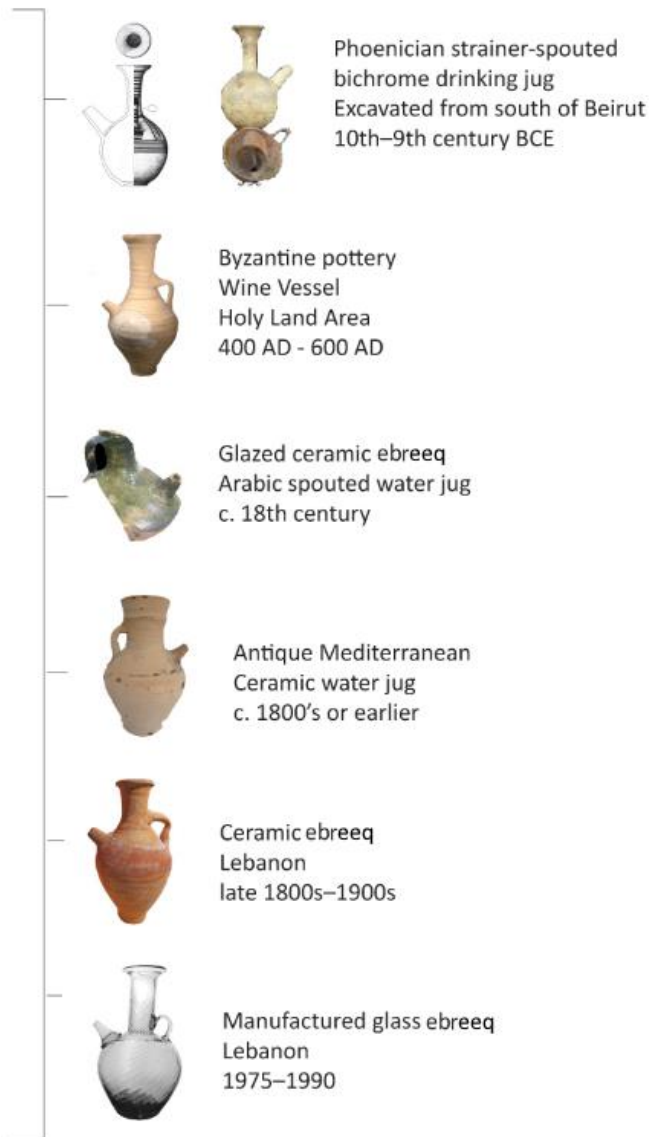


Figure 14 Historical timeline of the ebreeq put together based on the findings of the article “A Tophet in Tyre?” by Helga Seeden, the Mar Musa artifacts and my ebreeqs

Images retrieved from
<http://almashriq.hiof.no/ddc/projects/archaeology/berytus-back/berytus39/seeden- and tophet/http://users.stlcc.edu/mfuller/MarMusaArtifacts.html>

Constructing an outline of the historical evolution of the ebreeq (Figure 14) through the three millennia since it first appeared proved challenging, as no single source outlines this development comprehensively. While there are studies of Lebanese ceramics and pottery in general, specific information on the ebreeq is scattered, as

are representations of known existing ebreeqs. My research relies on the best available relevant sources, including an article by Helga Seeden published by the American University of Beirut (1991), a thesis by Fatima Amin Barkawi (1963) and the information from the archive of the Monastery of Saint Moses the Abyssinian in Syria [Deir Mar Musa Artifacts].

The article "A Tophet in Tyre?" (Seeden, 1991) documents various archaeological items discovered in Tyre, a city in southern Lebanon. From the excavation, several jugs were unearthed and documented. Though most were offering jugs, one was for drinking. This was an interesting example due to its built-in filtering system. In another article, the archive of the Monastery of Saint Moses the Abyssinian in Syria was documented by Dr. Michael Fuller. The archive contains various artefacts with one drinking vessel. This object from the 18th century, referred to as 'briq', is glazed and fragmented [Mar Musa Artifacts, n.d.].

Further information was retrieved from a thesis by Fatima Amin Barkawi, defended at the Beirut College for Women in 1963. In her thesis *A Survey of Contemporary Lebanese Pottery*, she writes that prior to the mid -1900s, the Lebanese made "very massive water jars when the water resource was mainly 'al ein' [Arabic for a water spring]. Now, [after the 1960s] after running water has been supplied, they have stopped producing these big jars, and smaller jars have become more practical. The average potter can produce sixty to eighty jars per day" (Barkawi, 1963, p.18).

Barkawi further explains that, at the time of her thesis research, potters were based in the following areas across Lebanon: Rachaya el Foukhar, Sidon, Beit Chebab, al Jamhur, Khaldeh, Jdeidet al Metn, Bchettfine, Jisr al Kadi, and Derkousheh. The ebreeqs of the mid 1900s were glazed which waterproofed the vessels and slips were also used to decorate the items. She adds that only Rashaya el Foukhar was where slip glazing was applied to ebreeqs and water jars (1963, p. 15). Of the various ceramic pieces, the ebreeq was the most in demand, costing twenty-five Lebanese piasters each (Barkawi, 1963, p. 18). In a recent interview, Nemr Atallah (one of the few ceramists left in the south of Lebanon) confirms that an ebreeq would cost no more than 3,000 Lebanese Liras today (Zeiter, n.d., para. 4) which is equivalent to about 1.5 UK pounds.

Barkawi explains that water vessels are one of the main ceramic objects historically made in Lebanon; such vessels were crude. She adds that the “number of contemporary Lebanese potteries is decreasing each year [since the 1960s]. From the findings, one can see a very slight difference between the ancient ways of production and the contemporary methods” (Barkawi, 1963, p. 45).

Thuraya Hasan Zeiter’s article elaborates and confirms Barkari’s observation; she writes about the status of pottery workshops in Lebanon today which have been continuously reduced in number due to the fact that pottery and clay vessels are no longer in demand. She interviews Nemr Attallah, who inherited this craft from his father and has resisted closing his workshop despite the odds. He adds that the region of Sidon originally had 12 potteries and 17 additional ones between Beirut and Khalde (a town in southern Lebanon); however, only a handful of pottery workshops remain in Rashaya el Fikhar, Mount Lebanon, and in the northern and the southern regions (Zeiter, n.d., para. 4).

He paints a more concrete image of the status of the pottery and clay products as he reveals that his workshop contains more than 4000 pieces of various pottery forms which, unfortunately, did not respond to customers’ interests or needs. The latter is a clear indication that these merchandise and products no longer belong to the golden age as they once did; they have drastically transformed from being an essential household item for daily use to mere decoration or pieces of accessories in extravagant houses.

The article points out that various cultural industries have developed and managed to keep up with progress; however, the process of producing pottery has preserved its conventional style, taking into consideration that this craft is heavily dependent upon human labor as opposed to machinery and equipment. On the other hand, the only element that has changed in pottery making is the technique of preparing the clay, where machines have replaced manual labor.

The article also points out that since the 1980s when industrially produced ceramics and plastics have become widely accessible, customers’ purchasing tendencies have shifted away from pottery, rendering the process of marketing and retailing pottery rather difficult.

Today there are only a handful of potters specifically making the ebreeq. In contemporary Lebanon, the most common handcrafted ceramic objects are hummus and ice cream bowls sold in wholesale or to restaurants. Most Lebanese ceramic making has evolved toward manufacture and mass production. Finally, the ebreeq today is sometimes made of ceramic, but is more typically manufactured in glass; this will be further elaborated in Chapter 3 through personal correspondence and interviews with ceramists in the Lebanese town of MishMish (Appendix 3).

It is difficult to find more in-depth documentation specifically about the ebreeq. One reason for this lack of information, and for similar heritage objects in Lebanon may, in part, be due to the fact that legislative authorities in modern Lebanon have ignored many heritage concerns since the country gained its independence in 1945. The last laws that dealt with heritage were issued during the French Mandate (1923–1945). One law (number 166/L.R., issued on November 7, 1933) deals with archaeological ruins. The second is the Environment and Natural Scenery Protection Law (issued on July 8, 1936). With the exception of these two texts, Lebanese legislature remains silent regarding the Lebanese heritage (Thabet, 1998, para. 5).

There are a few instances where excavated ebreeqs are on display in museums as is the case with ebreeqs at the Nabu museum in Chikka, a town in the northern part of Lebanon.

The first three items displayed at the top of the above image (Figure 15) are clay handmade vessels, described as Islamic ebreeqs. The ones on the left and the right date back to the 14th century AD; the ebreeq in the center is estimated to date back to a time between the 12th and the 13th century. Although slightly different in their shape and details, the three vessels are similar to one another and have the general shape of the ebreeq including its egg-shaped center, the long neck, the spout and the handle on the side. They are also strikingly similar to the pottery in the lower part of the image, which are Algerian water vessels (collected in 1900) with the same properties of the ebreeq, having an egg-shape, a spout and a handle (Figure 15).



Figure 15 Islamic ebreeqs at the Nabu Museum in Lebanon (top) and similar Algerian water vessels with handle and spout displayed at Pitt Rivers Museum (bottom)
 Images retrieved from Pitt Rivers Museum
<http://objects.prm.ox.ac.uk/pages/PRMUID34922.html>
<http://objects.prm.ox.ac.uk/pages/PRMUID34919.html>

2.2. Research Rationale

“Humans, the world over, share a deep history in the development of artefacts which have today become an inseparable component of everyday life, a totem of cultural identity and an important source of reference for modern society” (Adelabu and Yamanaka, 2014, pp.1155-1156). The ebreeq and similar drinking vessels such as the *botijo*, *bummulo malandrino* and the *kendi* stand as hallmarks of civilization, cultural mediums for aesthetic expression and socio-cultural interaction within a local context. As human history has unfolded in layers of development and technological advancement, the making and use of water spouted jugs has been shaped by evolving lifestyles.

Evidence from various countries in Europe and Southeast Asia, like Spain, Italy and Indonesia, shows a great variety in the usefulness of traditional knowledge for improving traditions. The following text from an article titled “Transforming Tradition for Sustainability through ‘TCUSM’ Tool” addresses the importance of traditional knowledge and its role today:

There are some factors why tradition receives many great concerns. [One] factor is based on concern of the [loss] of valuable knowledge. Most of the traditional knowledge and practices that people carry is silent, known as tacit knowledge. [If] the practitioners fail to pass on their knowledge, there is a risk of losing it. [...] In addition, the [greatest] reason why transforming tradition is worth doing is that it supports things [becoming] sustainable. (Nugraha, 2010, p. 22)

In many areas, traditional and indigenous knowledge is far more relevant and functional than suggested by the misrepresentative label of “primitive” or “inferior” (Nugraha, 2010, p. 22). This labelling comes across in the context of comparing cultural objects – that have been prominently used by older generations and even ancestors – with their counter items used nowadays that are perceived as developed and modernized. As indicated in Adhi Nugraha’s article, cultural items – like the ebreeq – have a similar status and are sometimes met with the effort to revive them (2010). There are some factors as to why indigenous technical knowledge of the ebreeq is highly pertinent. The ebreeq is an object based on design knowledge passed from one generation to the other, with excellent qualities in practical use and design. In traditional and indigenous knowledge and practice, there is often undoubtedly a harmonious balance between aesthetics and function, physical and ideological purpose, and economic and ecological decision making. Such qualities result from the accumulation of practical experience and collective wisdom over thousands of years.

In the book chapter “Forging New Futures: Cultural Significance, Revitalization and Authenticity” Amy Twigger Holroyd explores how culturally significant designs, products and practices are important to particular communities because of their social, historical, and/or aesthetic values. Revitalization initiatives bring new life to these cultural forms while aiming to retain, or even enhance, the values associated with them. Designers often play a key role in such initiatives and thus their work can have far reaching implications in terms of cultural significance. Although “authentic” traditions are often thought to be static, culturally significant designs, products, and practices must change if they are to remain relevant (Walker et al., 2018, p. 10).

The idea behind reviving the ebreeq is to address a small part of a much bigger phenomenon. This research is a reaction to the ongoing loss of Lebanese cultural memory and the disappearance of traditional objects. The invigoration of tradition

is presently pursued by concerned citizens⁸ and designers, and is a trend that is not solely Lebanese. In local societies across the globe there is a need to declare one's identity (Alver, 1992). Lebanon has reached its present formation after a lengthy history with a succession of ruling powers and cultural influences. This has given Lebanon a rich and diverse traditional heritage, and simultaneously confused pluralistic forms of identity (Kaufman, 2004). Traditional architecture, crafts and design aesthetics in numerous instances were replaced in favour of new materials, and imported cultural aesthetics. Physical communities have also been dispersed; hence, the use of shared social objects such as the ebreeq has also diminished.

Based upon my field research and interviews with craftspeople (Personal correspondance, 2014-2015) in Mishmish (Appendix 3), it can be seen that new ideologies have overtaken various facets of design and culture in Lebanon throughout the past five decades. The ebreeq is one of numerous traditional Lebanese crafted artefacts that have been largely replaced in favour of imported objects that utilize new materials and aesthetics. I have also found that even though skilled craftsmen, artists and designers have redesigned the ebreeq, the object itself is no longer commonly used in Lebanon for its original purpose. It rather typically serves as a decoration, artefact or displayed object; people rarely drink from it anymore. Three thousand years of tradition are being forgotten; nonetheless, can these millennia be bridged by rethinking the ebreeq for today and for the future?

I believe that the use of new materials and technological innovation, especially motion design and 3D printing can serve as a means towards reinvigorating the value of the ebreeq as a traditional and culturally significant object. The vessels that are considered in the sections below demonstrate how frameworks for redesigning traditional objects are being redefined to readdress functionality, ergonomics, and aesthetics. Through advancements in technologies, traditional objects obtain new values in addition to their form and function. It should be noted that one of the principles of practice-based research revolves around the practice involved in the research as well as the research questions that come forth from the

⁸ In a social, environmental and cultural initiative, "Volunteer for Lebanon" and "National Youth Service Week" in collaboration with "Recycle for Lebanon" join forces to launch the campaign "Bringing Back the Briq". Using social media as its main platform and inviting people to share videos/pictures of people drinking from the ebreeq, the campaign mainly aims to restore this Lebanese tradition, spread awareness about the ebreeq and promote the habit of drinking from it. Retrieved from <http://www.volunteerforlebanon.org/?q=BBB>

process of practice; this provides an opportunity of exploration and new knowledge within an existing practice in a particular context which also extends beyond the given case (Candy and Edmonds, 2018). As such, the questions arise: How could advanced technologies in general, and motion design in particular, be applied to redesigning the ebreeq? How might the ebreeq be redefined in order to enhance modern life while preserving its traditional value and meaning?

2.2.1. Design Principles: The Ingenuity of the Egg-Shaped Container

A significant element to consider is the form of the ebreeq itself. According to *Living Energies: An Exposition of Concepts Related to the Theories of Viktor Schauberg*, the majority of today's commonly used liquid storage containers are either rectangular or cylindrical in one form or another. Although these shapes are efficiently and economically mass manufactured today and are commonly used for water storage, they not only inhibit natural water circulation but also stimulate water suffocation (Coats, 2002, p. 200).

As such, the angular shape of these containers creates an environment of stagnant zones which are optimal for pathogenic bacterial growth. This is equivalent to a plastic bottle and the same principle applies to all water-resistant materials, when "the contained water is unable to breathe and suffocates as a result. In this debilitated state or as a water-cadaver, it quickly becomes diseased and requires further disinfection" (Coats, 2002, p. 200).

Coats elaborates referring to the ancient Egyptians and Greeks as an example, who were evidently aware of the benefit of using egg-shaped containers because their grains and liquids (oil, wine and water) were stored in terracotta amphorae and closed with beeswax. It should be pointed that although egg-shaped containers were inefficient in regards to space and ease of handling, it is clear

that the selection of this form over any other was intentional and the result of certain knowledge of the long-term storage properties of such shapes. In many amphorae that have surfaced in archaeological excavations over the last 100 years or so, grains of wheat have been found that were still viable and even after storage over 2,000 years, grew when planted. (Coats, 2002, p. 201)

As part of my research on the history of drinking vessels, I came across research regarding the use of ostrich eggs in the making of drinking vessels. This led to my

understanding that the primary design principle of the ebreeq is its egg-shape. This shape derives from the use and the form of the ostrich egg as a drinking vessel in ancient times. The ostrich egg is found surprisingly often by archaeologists working all around the Mediterranean area and North Africa. Indeed, ostrich eggs historically functioned as drinking cups and containers for water or other liquids (Figure 16). Ancient people punctured a small hole in the top of the egg, emptied the contents and filled it with an average of one litre of water (Conwell, 1987, caption 7).



Figure 16 Ostrich eggs with silver support and neck (left) and a hole on the side (right) both collected from South Africa and used as a water container Images retrieved from Pitt Rivers Museum <http://objects.prm.ox.ac.uk/pages/PRMUID44623.html> <http://objects.prm.ox.ac.uk/pages/PRMUID197151.html>

The egg-shape maximizes water's receptive potential (Figure 17). In addition to the shape, the ebreeq's traditional material (porous clay) is also highly beneficial for storing water, which reaches its most refined energetic state in perfect balance and equilibrium within clay. *Dancing with Water: The New Science of Water* explains that this is because permeable clay allows water to "breathe" by surface evaporation, which keeps the water in the vessel cool. As such cool, dense water at the outer edges of an egg-shaped clay container sinks to the bottom, forcing warmer water to rise up to the centre. The process ensures constant cooling and enhances the continual circulation of energy (Pangman, 2011, pp. 131-151).

Thus the insights of my investigation of other forms of water jugs brought me to realize the importance of this traditional material (clay) and form (egg-shape). As elaborated in Chapter 3, my investigations were additionally reinforced by

interviews with a local ceramist and ebreeq maker who confirmed my findings (Arcangel Moussaand, personal correspondence, 2014-2015). These factors are important because they relate to how water interacts with the object. With this in mind, I looked into similar water jugs from other countries using egg-shaped containers.

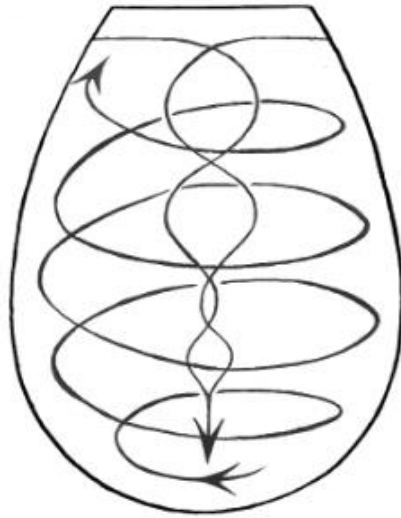


Figure 17 Natural cooling and ventilating system of water with the egg-shape
Image retrieved from *Dancing with Water: The New Science of Water* by MJ Pangman (p. 131)

I also looked into what other traits they have in common with the ebreeq to understand the value, evolution and use of these objects in comparison to the former. I limited my research criteria to researching drinking vessels that have an ancient past, were created in clay, have a spout and neck and were used for drinking water. In the course of my investigation, I found that each ancient example I identified has been redesigned in a contemporary version. The selection of the redesigned objects did not follow a particular criterion, but my focus was driven towards researching examples in which attempts were made to modernize these traditional drinking vessels in some way.

2.3. Investigation into the Ebreeq and its Redesigns

Even though the ebreeq can be found in the region today, only a few Lebanese designers have attempted to redesign the vessel. In what follows, I review the following different approaches. The most commonplace form of redesign is the addition of decorative embellishments or accessories (Figure 18). In such instances the ebreeq is made from glass rather than clay. The basic shape is the

same; however, the glass versions have a more rounded body and the flow of water between the neck and the body is not as fluid in some instances as in the more traditional form, which is more of a vertical egg-shaped body. Besides the form of the ebreeq, additional changes to the more touristic product are merely made through decorative surface-painted patterns and the addition of embroidered caps to prevent dust from entering the upper opening.



Figure 18 Ebreeq making is a craft in Lebanon and hand painted/decorated ebreeqs are common today at touristic sites and gift shops
Image retrieved from
<https://i.pinimg.com/originals/44/fb/83/44fb835951b259b3f6460bc7bf8e623f.jpg>

A second example of a redesigned ebreeq is by David Raffoul and Nicolas Moussallem (Figure 19). The design elongates the ebreeq into an extended glass form with a pointed shiny brass decorative element fixed to the inside bottom (Stoughton, 2015). Their design is less egg-like than the traditional ebreeq and no longer uses the traditional material of clay. This object serves more as a decanter rather than performing the traditional drinking function of the ebreeq.

A third example of a recent redesigned ebreeq is by Vrouyr Joubanian (Figure 20). In this instance the ebreeq is rendered in horizontal or vertical axes that are made visible through the repetition of ring-like layers. This design maintains the overall form of the ebreeq with the addition of a textured surface. The designer proposed to make it from Corian rather than the traditional clay. It was not produced in large quantities.



Figure 19 Redesigned ebreeq in glass with brass by David Raffoul and Nicolas Moussallem
 Image retrieved from Dailystar
<http://www.dailystar.com.lb/Arts-and-Ent/Culture/2015/Jan-08/283313-updating-tradition-in-glass-and-brass.as>



Figure 20 Breeq – 3D rendered prototype of a redesigned ebreeq by Vrouyr Joubanian
 Image retrieved from Yanko Design
<http://www.yankodesign.com/2011/04/05/a-take-on-the-caraf/>

A fourth example is the Breek by Albi Creation, whose functional design aims to combine the past and future by means of craftsmanship and technology. The Breek⁹ is a carefully hand blown glass piece. It holds more than 1 litre of liquid. It sits on a carved marble or terrazzo base which holds ice, keeping it cool while collecting dripping water (Figure 21). The carafe is connected to its cooler via a

⁹ Another spelling for the word ebreeq

laser cut, hand polished stainless steel ring, which insures that no leaks occur. The combination of the materials used was described as frail, firm and strong, which makes a tribute to Lebanese history.



Figure 21 Breek – a redesigned ebreeq, hand blown borosilicate glass by Albi Creation
Image retrieved from Decoventure
<https://www.decoventure.com/lebanese-designers-bdf/>

2.3.1. Findings from the Ebreeq Redesigns Research

Lebanon is a small country with an estimated population of four million Lebanese nationals and a small community of designers. In comparison, the population in the UK has an estimate of 67 million people and, based on the UK Design Council, has a design industry of 232,000 designers which is 29% larger today than it was in 2005¹⁰. Being part of that community of Lebanese designers, I have the opportunity to familiarize myself with the various proposed product designs. Furthermore, touristic locations are typically similar throughout the various parts of the country, making it easy to access, view and see examples of the ebreeq. In my investigation within the design community, it appears that there are few contemporized versions of the ebreeq. Of these, the last three examples discussed above stand out in terms of their design significance.

Indeed, these three examples of redesigned ebreeqs provide a glimpse into initiatives by designers to address the ebreeq today. Joubanian's Breeq is

¹⁰ Data retrieved from Design Council
designcouncil.org.uk/sites/default/files/asset/document/DesignIndustryResearch2010_FactSheets_Design_Council.pdf

interesting in that it explores the notion of multiplicity and layers both vertically and horizontally. The notion of multiplicity does relate to my research; yet, the use of layers appears here for rather aesthetic purposes. Raffoul and Moussallem's design is also of relevance to my research, as they use the term "retro-futuristic" because of the way they draw inspiration from multiple time periods" (Stoughton, 2015, para. 2). Albi Creation's ebreeq is interesting as well in the way they pay tribute to Lebanon's history through their Breek. The less relevant aspect of their Breek for my research is that it is designed to hold Arak (anise flavored liquor served with ice) rather than water. These three designs do share, however, the intention to potentially contemporize the ebreeq's aesthetic for current tastes.

The use of materials and technological innovation serves as a means towards reinvigorating the value and quality experience of the ebreeq as a traditional object. As the above examples demonstrate, frameworks for redesigning traditional objects are being redefined to readdress functionality, ergonomics, and aesthetics. Through advancements in the technologies being used, traditional objects are redesigned and gain additional value besides their form and function. The questions arise: How could advanced technologies be applied to redesigning the ebreeq? How will the ebreeq be redefined in order to enhance contemporary society while preserving its traditional value and meaning?

From this, the following question came forth: Are there ways that an ebreeq redesign could further contribute to a contemporary and changing society? One way that I approach my redesigned ebreeq is through motion graphics, a pathway unexplored in the examples I found. Through my investigation of similar water jugs, I also examined whether or not they have an egg shape; yet, this was not one of the other designers' selection criteria. Spouted, clay water jugs with a neck have a lengthy history of production in various contexts and geographical locations. Further questions also arose: Are there similar water jugs to the ebreeq outside Lebanon that have been redesigned? Has motion design served as a medium for such redesigning? I later found specific examples from Spain, Italy and Southeast Asia.

2.4. Investigation of Similar Traditional Water Jugs

The Botijo

The *botijo* (*búcaro* in Spanish) is a traditional Spanish clay egg-shaped drinking vessel designed to contain water (Figure 22). However, unlike the ebreeq, its handle is on top and the opening to fill the *botijo* is opposite the spout for drinking. Drinking from the *botijo* is similar to drinking from the ebreeq.



Figure 22 The *Botijo* – a traditional Spanish drinking vessel made with porous clay
Image retrieved from Botijopedia
<http://www.botijopedia.com/en/>

One recent approach to the *botijo* design is the *Neo-rebotijo* by Martin Azua (Figure 23). This design is somewhere between a bottle and a Tetra Brik (a contemporary liquid carton packaging). Like the traditional *botijo*, it has two openings on opposite sides and is made from porous clay. However, it no longer maintains the egg-shape. In this example, the redesigned *botijo* brings back a pleasant and organic way to drink fresh water. Like the ebreeq, the water in the *botijo* stays cool even under the sun due to absorbency of the clay and has a 1.5 litre capacity.

Another recent approach toward a redesigned *botijo* is *La Siesta* (Figure 24). It is a white earthenware bottle that combines the look of a 1.2 litre water bottle with the

handle and openings of the traditional *botijo* (Phaidon Press, p. 328). In order to drink from it, one has to use the spout, the outlet with the smallest hole, raising the jug and tilting it towards the head and catching the stream of water in the air, as is the case with the *ebreeq*. *La Siesta* is not made from porous clay like a traditional drinking jug, so it does not cool the water.



Figure 23 *Neo-rebotijo* – a redesigned version of the *botijo* handmade in red clay by Martin Azua of Numbered Studio
Image retrieved from Martinazua
<http://www.martinazua.com/product/neo-rebotijo/>



Figure 24 *La Siesta* – a redesigned version of the *botijo* by Raky Martínez, Alberto Martínez and Héctor Serrano
Image retrieved from Gandiabrasco
<http://www.gandiabrasco.com/us/product/botijo-la-siesta/>

The Bummulo Malandrino

The *Bummulo Malandrino* was created as a container to preserve liquids such as oil or water. It arrived in Sicily during the Moorish domination (872–1091 AD) (Figure 25). Like the ebreeq, it is egg-shaped and made from clay. However, it is used for water or oil. It has only one upper opening which is the spout. It is filled from the bottom. It sits upon a pedestal. The reason for filling the vessel from the bottom was to prevent foreign debris from entering it.

“Today the container is made in the district of Caltagirone [Italy] where now it is bought exclusively as a travel souvenir” (“Pètra: Make that studio & Imprintabarre”, 2015, para. 2). A recent version of the *Bummulo Malandrino* is a design by Viktor Schauburger (Figure 26). The fundamental aesthetics and function are similar to the traditional *Bummulo Malandrino*. It is very curvilinear in form and is grounded in Schauburger’s vortex water implosion research. Specifically, Schauburger’s work points to the importance of storing liquids in opaque egg-shaped containers. Because there are no corners or crevices, there is no stagnation and disease-causing bacteria are much less likely to breed. According to Schauburger, spiralling motion (or vortex) energizes the water and gives it “livingness” properties (Coats, 2002). This is an aspect that closely relates to my research, especially in terms of the importance of the egg-shaped form of the neo ebreeq, and will be further discussed later in the research.

A second recent approach to the *Bummulo Malandrino* redesign is Petra designed by Make that Studio and Imprintabarre (Figure 27). The intention of this redesign was to give a new life to the aesthetics of the *Bummulo Malandrino*. The Petra is overall very different from the traditional *Bummulo Malandrino*, being a smooth river pebble-inspired object held from its base rather than by a handle. A hole replaces the spout. However, like the *Bummulo Malandrino*, the Petra is filled from the bottom and is made of clay.



Figure 25 The *Bummulo Malandrino* – a traditional Sicilian drinking vessel of Moorish descent made from porous clay
Image retrieved from Formagramma
<https://www.formagramma.com/design/22430/petra-make-that-studio-improntabarre/>



Figure 26 Water Egg Jug – an opaque egg-shaped container – a redesigned version of the *Bummulo Malandrino* by Victor Schaubeger
Image from Vortex Water Enhancement
<http://www.vortexwater.co.nz/Vortex-Water-Energiser/>

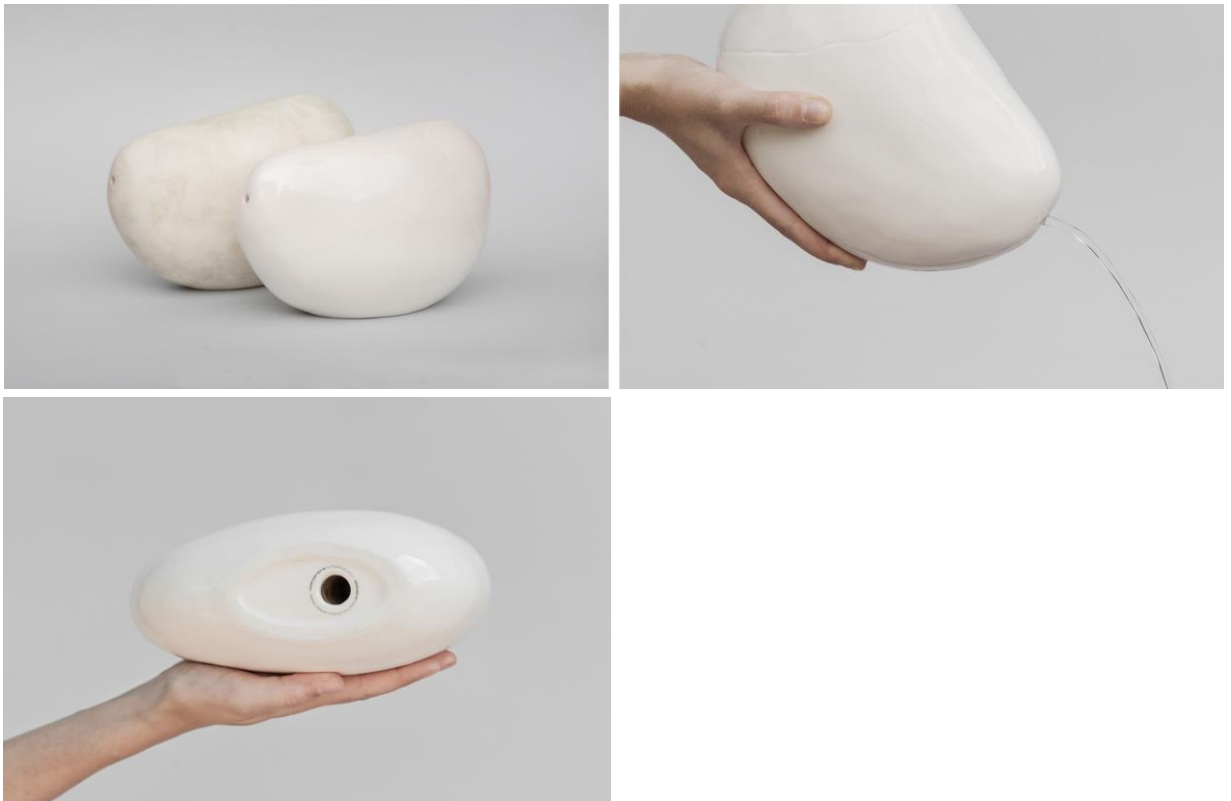


Figure 27 Pètra – a redesigned version of the *Bummulo Malandrino* by Make that Studio and Improntabarre
Image retrieved from Formagramma
<http://www.formagramma.com/design/22430/petra-make-that-studio-improntabarre/>

The Kendi

The *kendi* is a well-known basic form common to many traditional Southeast Asian vessels (Figure 28). Since ancient times, it has served as an important part in the daily life and rituals of the region. Traditionally, it is made of terracotta. Various versions of the *kendi* all appear as a pouring vessel with a spout. Its basic form is similar to the *ebreeq*, but it is without a handle. The *kendi* varies from a taller elongated form to a stouter oval form. The upper opening and upper lip formations also vary. Nevertheless, its primary use appears to have been for drinking water (Honda & Shimazu, 1999).

One recent approach towards a redesign of the *kendi* is by Jenggala¹¹ (Figure 29). The fundamental form is similar to the traditional *kendi*, with an upper opening and a spout. However, the design has added inverted curves to the body and upper neck of the opening. Rather than terracotta, Jenggala's design is made in ceramics and wood. The wooden neck is detachable in order to wash the ceramic

¹¹ Jenggala is a producer in Indonesia which makes handcrafted tableware and household ceramics.

part easily and to fill it with either water or tea in a way that adapts to today's lifestyle. The idea of the detachable neck is similar to the traditional ebreeq in the sense that the neck, the spout and the handle are attached at a later stage in the process of making the traditional ebreeq; therefore, these elements are in a way detachable and, hence, modified in the neo ebreeq.



Figure 28 The *Kendi* – a traditional Southeast Asian vessel in various forms
Image retrieved from Dawn F. Rooney Cultural Archive
http://rooneyarchive.net/articles/kendi/kendi_album/kendi.htm



Figure 29 *Kendi* – a redesigned version of the *kendi* in ceramic and wood with a detachable neck by Jenggala
Image retrieved from Jenggala
https://www.jenggala.com/xcms_entry.php?xcmsentryid=21

2.4.1. Findings from Research into Similar Traditional Water Jugs

From my investigations into ebreeq-like traditional vessels and their recent redesigns, I concluded that a core commonality and shared value between the traditional vessels is their egg-shape. I see this as the essence and intelligent quality of such vessels. Thus, I believe that this factor is a fundamental design principle that needs to be retained. The following diagram outlines, in particular, the common egg-shape for all these ancient forms (Figure 30). The spout, neck and handle are ergonomically relevant parts that improve and extend the main egg-shaped jug.

Also, the various redesigns of the *botijo*, *bummulo malandrino* and *kendi* are each attempts to contemporize a traditional drinking vessel. Each attempt is unique in its approach and aesthetic. Elements that I extracted as relevant to my research relate to the egg-shape, porous clay, notions of multiplicity and the neck/spout/handle as appendages (Figure 31). I was inspired in part by the fact that Victor Schauberg's design specifically focused on the value of the egg-shape; furthermore, the *kendi*'s detachable neck is particularly relevant in terms of examining the appendages of the ebreeq. Both *kendi* and *La Siesta* come in multiple colour options, relating to notions of multiplicity which are elaborated upon through my approach to the ebreeq's redesign. In terms of color options of the neo ebreeq, this project is fundamentally focused on its redesign and the use of 3D printing to reinvigorate the ebreeq as an item of Lebanese heritage as a stepping stone. Although I experimented with color while 3D printing prototypes (using PETG filament HD glass to print prototypes in silver, gold, blue, red and white), the incorporation of color remains a potential aspect which would be more closely considered in the future versions of the neo ebreeq.

EGG AS A COMMON SHAPE

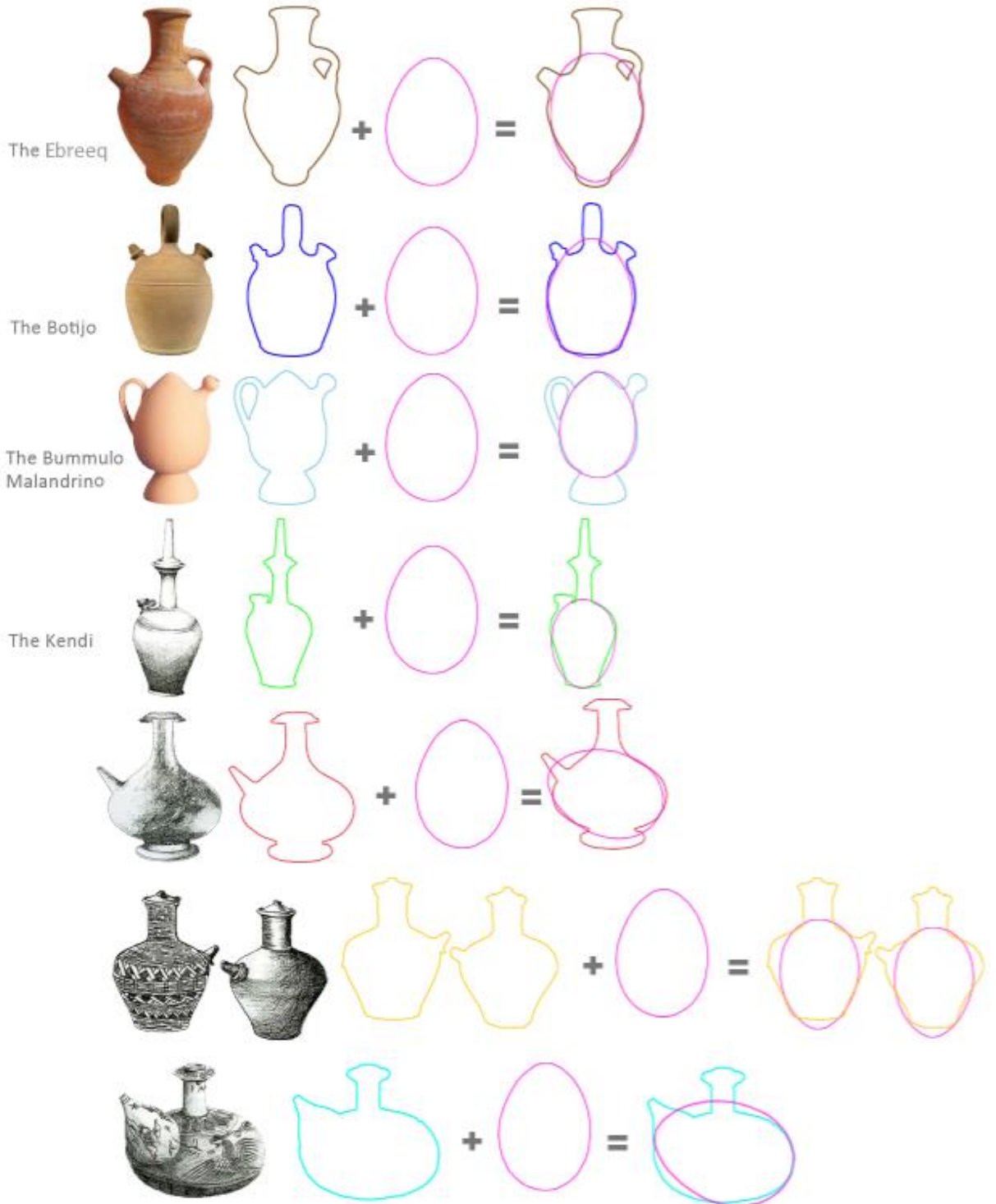


Figure 30 A diagram to display the common egg-shape in the: ebreeq, *Botjo*, *Bummulo Malandrino*, and various versions of the *Kendi*

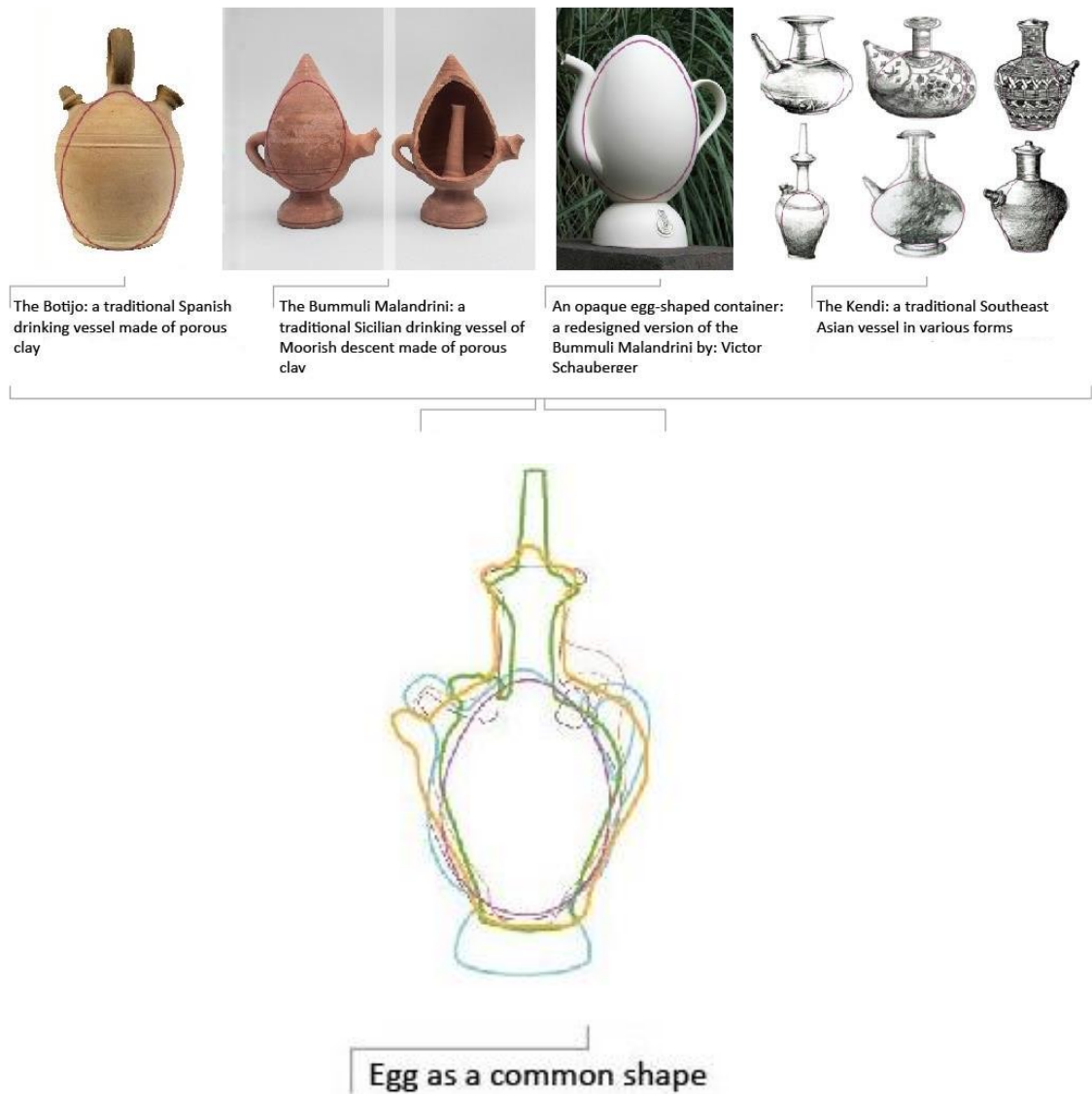


Figure 31 A diagram contouring the drinking vessels and merging the body with the same egg-shape

Furthermore, none of the redesigns seemed to consider the role of motion design studies as a method towards their design. I was positive that my knowledge and experience as a motion designer could contribute a unique approach to the redesign of the ebreeq. As mentioned in my research findings, the ebreeq is not commonly used at the moment; so as a motion designer, I viewed the traditional ebreeq as a static condition. This approach implicated a new definition of motion design, based on the experience of interacting with the traditional ebreeq that involves movement, motion and dynamism that create gesture.

Also, my research proposed a designed solution that addresses the use of motion design as an alternative approach to making, which is not addressed in the redesigned samples above. I saw this as a research opportunity for the development of a conceptual framework that would lead to a contemporary design approach by the application of related practices and theories supporting my research: motusthetics, futurism, semiotics and parametric design.

Chapter 3: Conceptual Framework

“In every drop of water dwells [...] the Soul of the ‘first’ substance – Water – whose boundaries and banks are the capillaries that guide it and in which it circulates – Viktor Schaubergger” (Coats, 2002, p.107).

I started framing the concept for this research based on the interactivity of water inside the ebreeq. The ‘boundaries and banks’ of the ebreeq without the circulation of water would be of no use. Therefore, my conceptual framework needed to encompass the subtle energies inside the ebreeq while in use. Exploration of this dynamism, captured through the use of motion graphics entailed an understanding of theories and strategies adopted from locomotion, Futurism, post-structuralism, time-based semiotics and parametricism.

Adrian Bejan and John Peder Zane advise the designer that “To know why things look the way they do, first recognize *what* flows through them and then think of what shape and structure should emerge to facilitate that flow” (2012, p.9). I took this as my starting point for my investigation. I studied the water inside the ebreeq, following the principles of motion capture in an attempt to analyze the relation between the ebreeq and the water, which was central to its dynamism. The use of motion capture techniques for studying the motion of water in the ebreeq has also been applied by scientist Étienne-Jules Marey, photographer Eadweard James Muybridge and artist Giacomo Balla in order to track, deconstruct and analyze movement, revealing frame-by-frame moments that are invisible to the naked eye.

Similar to my own creative process, those made me deconstruct the movement of water inside the traditional ebreeq as signifying moments while in use. I did not view these moments of water inside the traditional ebreeq as a source of comfortably fluid forms, rather as a sensible gestural system drawn from the three dimensional significant moments while using the traditional ebreeq. This gestural interaction of the ebreeq, which will be discussed in Chapter 4, is divided into Drinking, Emptying and Filling conditions (D.E.F.):

- Drinking, capturing the first drip of water out of the spout
- Emptying, capturing the first moment of pouring water from the neck
- Filling, capturing the first moment of water touching the bottom of the ebreeq

I approached these gestural moments as a creative force to explore new design. I saw a fine line marking the surface of water while extracting the frame-by-frame film; I also noted the variations in its contour extracted from the inner surface of the ebreeq that changes its fluid organic form, creating an inner rhythm of the rise and fall of water in a curvilinear manner. As a motion designer, I recognized these creative forces that could be connected with motion design to produce a new design form. Once these signifying moments were discovered, I looked into introducing them as an embodiment between the traditional ebreeq (signifying the past) and the water inside (signifying the present), which were reimagined and instilled to produce a new design using 3D technology.

The method of contemporizing the design of the ebreeq may be seen “as irreducibly plural, an endless play of signifiers, which can never be finally nailed down to a single center, or meaning, a fixed system of relations” (Emiroğlu, 2014, para. 7). Such plurality can be represented by paths in time and space. Hence motion design studies, as part of my methodological approach, closely relates to post-structuralism¹² as well as time-based semiotics¹³. I researched the interrelationships between post-structuralism and the study of the past and semiotics, the signifying moments while using the traditional ebreeq, to better understand the intrinsically semiotic nature of the ebreeq. In other words, the ebreeq is a symbolic cultural item, binding the nominally opposing forces of pouring/drinking water and filling/emptying water from it. This connection offers the possibility of generating a new form of the ebreeq by means of time-based semiotics as an expression of bridging today’s norm with the traditional past. My research found that “almost any kind of the product of design becomes as reality through which the addressee and designer communicate” (Emiroğlu, 2014, para.1). In addition, “Design benefits from every kind of representation, which are evidently semiotic by nature, in a manner of a system, which is multi-layered ...” (Emiroğlu, 2014, para.10). It is this multi-layered quality, in part, that is closely related to post-structuralism.

¹² Post-structuralism – an approach that believes that understating an object involves not only the necessary study of that object, but also the system of knowledge that produced it

¹³ Semiotics – the study of signs/ symbols and their significance in how meaning is created and communicated

When mentioning time-based semiotics in respect to each moment, it was important for me to understand the writings of Charles Sanders Peirce, regarding projects related to image and time-based signs. From the perspective of semiotics, it can be proposed that the ebreeq, as a symbol, was examined through time-based semiotic studies within a post-structural framework. I researched Parametricism to support my methodological approach of interrelating these time-based semiotic moments to one form.

Parametricism provided me with a particularly dynamic approach towards design. It aligns with post-structuralism in notions of complexity, plurality and layers and is in line with my research on time-based semiotics, where it addresses concepts related to continuum. All natural procedures somehow create patterns.

Parametricism can be described as nature's patterns placed in order. It is a style that uses new tools and semiologies and can be viewed in diverse ways:

“Systematic, adaptive variation, continuous differentiation (rather than mere variety), and dynamic, parametric figuration concerns all design tasks from urbanism to [...] the world of products” (Schumacher, 2008, para. 1).

Parametricism facilitates the creation of “complex, polycentric [...] fields which are densely layered and continuously differentiated” (Schumacher, 2008, para. 2).

Hence, Parametricism lends itself to 3D printing through its often organic and undulating complex forms. 3D printing is a technology that I adopted in order to prototype a redesigned ebreeq. I also looked into examples of parametric design in order to understand how designers apply this theory and found that there are important interconnections between post-structuralism, time-based semiotics and Parametricism (Figure 32), all of which are further elaborated in the following chapters.

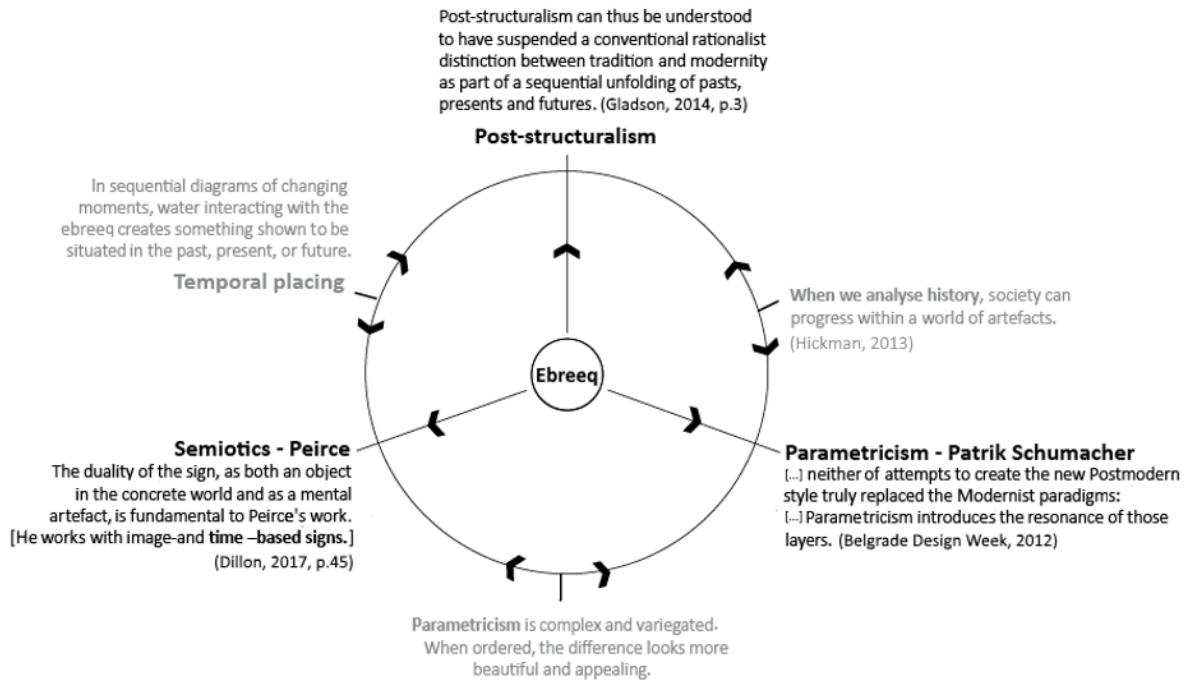


Figure 32 A diagram establishing the connection between post-structuralism, Parametricism and semiotics with the ebreeq

The conceptual framework for my research project was developed as a means to extend and connect my background in motion design with my personal passion for traditional Lebanese objects through an understanding of their redesign for today's society. I am interested in how motion design studies can reveal the relationship between traditional material, ergonomics and the personal/shared values of the traditional Lebanese drinking vessel — the ebreeq. This is one of the many traditional Lebanese objects that have been forgotten or left behind.

In this sense, my conceptual framework proposes that motion design can make the past, present and the future into a single entity. The study of motion within an object is an uncommon approach when it comes to designing a product. Most product designers would not rely on observing an object through filming, extracting key frames and 3D technology. Thus, such studies explore new perspectives in investigating, understanding and re-designing the ebreeq. This is an unconventional approach towards object design that leads to unconventional results.

3.1. Innovation within Motion Capture: The Use of Motion Design as an Alternative Approach to Making

It has been remarkable to see mechanical inventions (like Étienne-Jules Marey's photographic gun) capturing objects in motion, arrested in mid-flight. It is miraculous to slow down living motion and capture it in multiple moments in time revealing the unseen, which shows the innovative nature of motion captures.

Within my research, I have studied the principles of motion capture in an attempt to analyze the relationship between the ebreeq and the water, which is central to the theory of Dynamism. Scientist Étienne-Jules Marey, photographer Eadweard James Muybridge and artist Giacomo Balla tried to record and track movement in order to better deconstruct, dissect and analyze its functionality in medicine, science and art. Revealing frame-by-frame moments that are invisible to the naked eye by using or devising a mechanical invention that could freeze time in motion is known as locomotion (Braun, 1994, p. 42). In a diary entry on the 12th of October 1907, Umberto Boccioni writes:

I saw a photograph that competed with whatever other painting. Mechanics have made such advances in the reproduction of nature that to man there remains only the *spirit*. Everything moves toward the *spirit*. (Poggi, 2009, p. 109)

3.1.1. The Study of Aesthetics in Motion (Motusthetics)

Step one [of seeing constructally] starts with Leonardo da Vinci's insight that 'motion is the cause of every life.'" (Bejan and Zane, 2012, p. 7)

Close to five hundred years ago, Leonardo da Vinci pioneered the study of flow visualization (Figure 33). The free water jet issuing from a square hole into a pool represents perhaps the first use of visualization as a scientific tool to study a turbulent flow. Da Vinci is quoted in *Flow control: Passive, active, and reactive flow management*:

Observe the motion of the surface of the water, which resembles that of hair, which has two motions, of which one is caused by the weight of the hair, the other by the direction of the curls; thus the water has eddying motions, one part of which is due to the principal current, the other to the random and reverse motion. (Gad-el-Hak, 2007, p. 37)



Figure 33 Leonardo da Vinci's Sketch of water exiting from a square hole into a pool, ca 1500
Image retrieved from *Flow Control: Passive, Active, and Reactive Flow Management*, by Mohamed Gad-el-Hak, p. 37

Da Vinci's observation and drawing may seem commonplace today; yet, it is important to understand the innovation it represented centuries ago. Gad-el-Hak further describes that, at the time, drawings conventionally served to capture something that appeared static to the eye. Da Vinci, in contrast, created a single drawing that captured a multiplicity of moments in time. His studies were scientific, in that he observed at first hand the turbulent flows of water (2007, p. 37).

Similarly, my studies benefit from an examination of such flows as water enters, swirls and exits the ebreeq; the circular movement of pottery while throwing on the potter's wheel also creates a flow. The study of such flows and their visualization generate new potentials in the redesign of the ebreeq.

However, before investigating the water inside the ebreeq, I prioritized understanding and analyzing the process of shaping clay into the traditional ebreeq. This led me to several visits to a small local ceramics studio at the Kfarsamaa Monastery, located in a rural area in the village of Mishmish, Mount Lebanon Governorate. It is one of the few remaining conventional ceramic studios that continue to produce the traditional ebreeq (Figure 34) and the proceeds made from the sale of their ceramics go to help Christian refugees. The primary objects they make include the ebreeq, jars, pans, oil lamps, decanters, cups and bowls.

During my visits to the studio, I had several discussions with Arcangel Moussaand, the owner and primary ceramist at the studio (Appendix 3).



Figure 34 Kfarsamaa Monastery in the village of Mishmish (in Mount Lebanon) and visits to its pottery workshop between 2014 and 2015

Through interviews and documentation with photography and filming (Figure 36), the essence and the ‘intelligent’ part of the ebreeq — its non-glazed clay egg-shaped form — have been revealed. The study has also identified the spout, neck and the handle as ergonomic parts that improve and extend the main egg-shaped form. In addition, I observed, filmed and photographed one of the studio potters making an ebreeq on several occasions.

Important insights that came out of these visits are:

- Unglazed ceramic absorbs excess calcium from the water, which is why white streaks appear on the outer surface of older used ebreeqs (Figure 35).
- Even when the ebreeq is not being used, its egg-shape creates a cycle in the water it contains, which prevents the formation of green algae.
- A cyclical motion occurs not only in the movement of the water inside the ebreeq, but it is also part of the process of wheel-throwing the body of the clay ebreeq.



Figure 35 Clay ebreeq absorbs calcium



Figure 36 Filming the wheel-turning and the making of the clay ebreeq in Kfarsamaa Monastery in the village of Mishmish (in Mount Lebanon) in 2016

- The shaping of formless clay to create the ebreeq through the potters' wheel is very similar to 3D printing: both techniques are characterized by a process of rotation to make an ebreeq.
- The spout and the handle are attached after the main body of the ebreeq is formed and are added at a later stage for practical handling.
- The fact that the neck can be customized (shortened or elongated) is another proof that the neck, handle and the spout are added for ergonomic purposes.

I had the opportunity to create a short film documenting the traditional process of making the ebreeq¹⁴. A Sony RX 10 with 100 frames per second was used to film. I found that film, sound and editing gave me further insight into an incredibly beautiful process in the making of the traditional ebreeq. Understanding the conventional wheel-throwing process of making the ebreeq is invaluable; this experience gave me an opportunity to closely observe how clay was wedged, thrown and shaped by hand to create the ebreeq in a continuous symmetrical movement. I believe that documenting such an experience provides an important record of this traditional process as part of the Lebanese heritage.

The following are additional important insights that were revealed from this observation and filming:

¹⁴ To view the above film visit: <https://vimeo.com/189290235>

- Rotation is essential to create the egg-shaped form of the ebreeq.
- Craftsmen limit their practice to making the commonly known form of the ebreeq and shy away from the potential of experimentation.
- Clay is an incredibly malleable material, which grants the maker of the ebreeq the flexibility to mold it into its fundamental egg-shape.
- Clay transforms from a static piece of earth into a moving volume infused with intent and meaning as the ebreeq is created.

Another realization that I had as I observed the wheel-throwing and contemplated the 3D fabrication process is the common cyclical movement in the creation of the body of the ebreeq in both forms of making. In other words, wheel-throwing and 3D printing create the body of the ebreeq from its base upward through a circular motion (Figure 37).



Figure 37 Photographs of the making of the body of the ebreeq (core egg-shaped container) in Kfarsamaa Monastery in Mishmish

Based on the above observations, I excluded the handle, the spout and the neck when I worked on the ebreeq. This helped me analyze the ebreeq without these elements and focus only on its egg-shape, where one of my main discoveries lies. This egg-shape is used for testing its form and ergonomics.

After the analysis and investigation of the making of the traditional ceramic ebreeq, I also made it a point to understand and analyze how water flows within this form. Taking frame-by-frame photos of a glass ebreeq in action using the theory of Locomotion is similar to Étienne-Jules Marey's chronography.

3.1.2. Futurism, the Theory of Dynamism and Movement

The power of the graphic method lay in its flexibility: no matter how varied the movement to be traced, the inscriptors were constructed according to a unifying principle [...]. (Braun, 1994, p. 31)

Étienne-Jules Marey (1830-1904) was a French polymath and prolific scientist who extensively wrote on the circulation of blood, cholera, terrestrial and aerial locomotion, experimental physiology and graphic methods in physiology. He also contributed to the development of the motion picture in studying the flight of birds. In 1882, Marey found a means to render visible the ephemeral stages of an object's path through space by inventing a photographic gun capable of taking as many as twelve shots per second on a single rotating plate (Figure 38).



Figure 38 Étienne-Jules Marey's photographic gun
 Image retrieved from PetaPixel
<https://petapixel.com/2013/04/27/did-you-know-the-worlds-first-portable-motion-picture-camera-was-a-12fps-rifle/>



Figure 39 Étienne-Jules Marey, 'Flight of gull'
 Image retrieved from Hargrave
<http://www.ctie.monash.edu.au/hargrave/marey.html>

However, he was unsatisfied with the clarity of these initial images; in 1882, he invented the first chronophotographic camera with a fixed horizontal plate and rotating shutter disk capable of recording ten shots per second. The resulting images that showed successive phases of an object or body in motion were remarkable at that time for their accuracy and beauty. By capturing and making available to man's vision what the unaided eye could not register, Marey's (Figure

39) photographs promised to reveal the truth about movement. This is very similar to my investigation in showing the reality of the movement of water inside the traditional ebreeq when in use, as a means to render visible the ephemeral stages that are created within a flow of interaction as demonstrated in my second film.

The constructal law dictates that flow systems should evolve over time, acquiring better and better configurations to provide more access for the currents that flow through them. (Bejan and Zane, 2012, p. 5)

To show the water inside the traditional ebreeq, I used these two films as a means to observe how water interacts with it as water is poured into and out of the shape of the ebreeq. I photographed and filmed a transparent glass ebreeq to be able to see the water inside it¹⁵ (Figure 40).



Figure 40 Home studio photography and filming setup

To photograph and film the glass ebreeq, I used:

Gopro

Regular Video and slow motion: 1080p at 200 fps. HD video

Led Light

LED lights were continuously at all times for clarity of vision

Nikon Digital SLR Camera D800/D800E, Single-lens reflex digital camera

¹⁵ To view the above film visit: <http://vimeo.com/189295115>

Format (RAW): 14 bit, uncompressed

- Depth. 3.2 in.
- Sensor Resolution. 36.3 Megapixel
- Fast and slow shutter speed
- Total Pixels. 36800000 pixels
- Effective Sensor Resolution. 36300000 pixels
- Optical Sensor Size. Full Frame (24 x 35.9 mm)
- Sensor Dust Reduction

Other accessories: tripods, reflectors and diffusers

Then I imported the file to the motion graphics software Adobe After Effects and used a warping plugin to create slow warping of the water. This enabled me to see the details of how water reacted with the ebreeq form through extracting frames to show successive phases of water while filling the ebreeq and while one drinks from it (Figures. 41-42).



Figure 41 Extracted frames showing the successive phases of water filling the ebreeq¹⁶



Figure 42 Extracted frames showing the successive phases of water when someone drinks from it¹⁷

Stop motion animators create a moving performance between frames without ever being seen themselves, creating the illusion of independent continuous movement. In the past this illusion has been attributed to a theory called 'persistence of vision'. (Purves, 2010, p.18)

As a result, the following important insights came forth from this observation and filming:

¹⁶ To view the above film visit: <https://vimeo.com/189295115>

¹⁷ To view the above film visit: <https://vimeo.com/189294188>

- When the ebreec is being filled, the spout and the neck do not leak any water; the water remains within the egg-shape, which I believe demonstrates the importance of this shape.
- The movement of the water was incredibly dynamic, creating organic forms that are always changing.
- The water that created intricate and varied forms and movements can be a base for 3D sectioning and typology (very similar to Marey's) with the use of new technology and a means to visibly render the ephemeral stages of the water path through space within the ebreec.

Marey's images also show, for example, the exact position of the bird's wings as it soars or descends (Figure 43), the positions assumed by the limbs of a running horse, or of a walking or jumping man. Eventually, Marey went further to discover the means of photographing even difficult subjects such as currents of wind or the lapping of waves on the beach¹⁸, which are under the principles of locomotion as well. Visibility of the unseen ensured the possibility of precise measurements that are essential to a scientific understanding of cause and effect; these measurements in turn could be graphed or even rendered mathematically. For Marey, chronophotgraphy was a form of graphic method achieved by optical means.

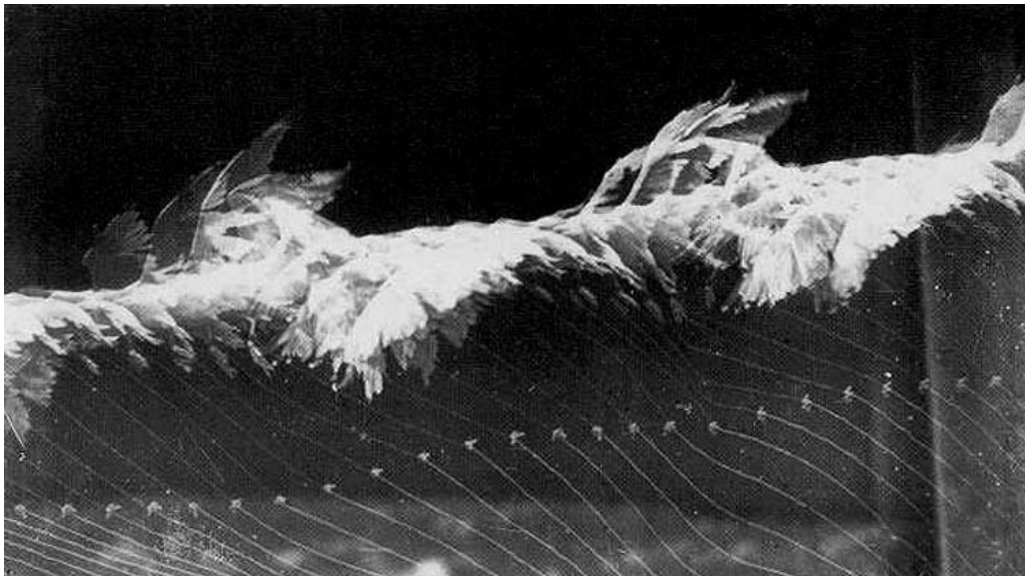


Figure 43 Étienne-Jules Marey, image of motion study of a flying bird
Image retrieved from Graphicine
<http://www.graphicine.com/bodies-against-time-etienne-jules-marey/>

¹⁸ Étienne-Jules Marey, images of motion study <http://www.graphicine.com/bodies-against-time-etienne-jules-marey/>

In *Inventing Futurism*, it is mentioned that “One of the paradoxes of Marey’s method is that in the process of making a sequence of movements visible, the corporeality of the moving body or form was often lost” (2009, p. 115). In late 1882, Marey eliminated at times superfluous detail by dressing his subject in black, with strips of metal, shiny buttons, or various geometric shapes cut out of white paper and attached them to specific body parts (limbs, joints or the head). Upon selecting the parts photographed against a black background, only the reflective elements and other white marks were registered, creating a dematerialized graph of lines and dots (Figure 44).

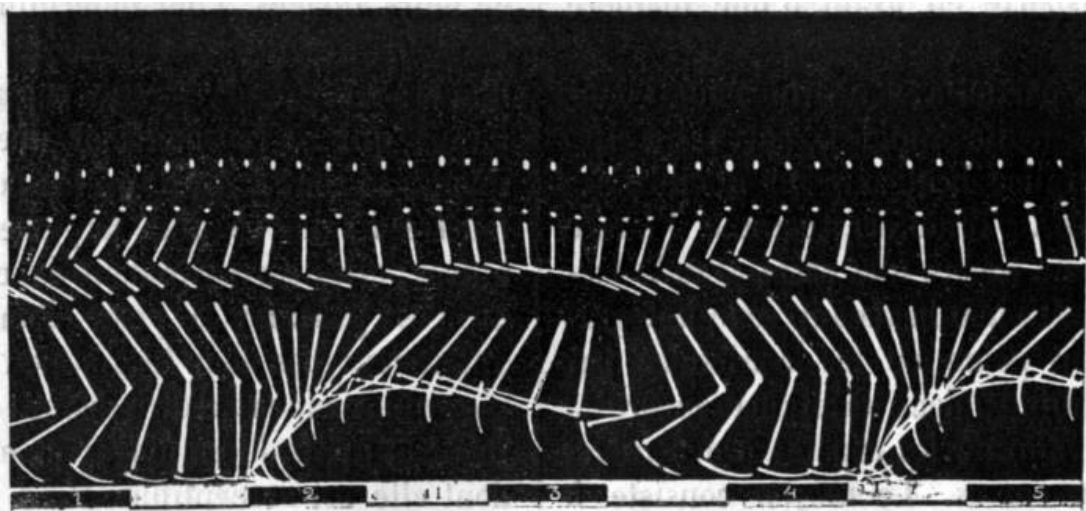


Figure 44 Étienne-Jules Marey image of motion study of a walking man
Image retrieved from ResearchGate
<https://www.researchgate.net/publication/244440576>

For Marey the result was a new visual language that comprised overlapping, angular, two-dimensional elements and measurable signs of motion detached from the body or the object that produced them. This is similar to Eadweard James Muybridge’s work, in the sense that in 1872 he tried to analyze a horse’s movement by using a row of cameras equipped with trip wires to create a series of 12 shots in less than half a second (Figure 45).

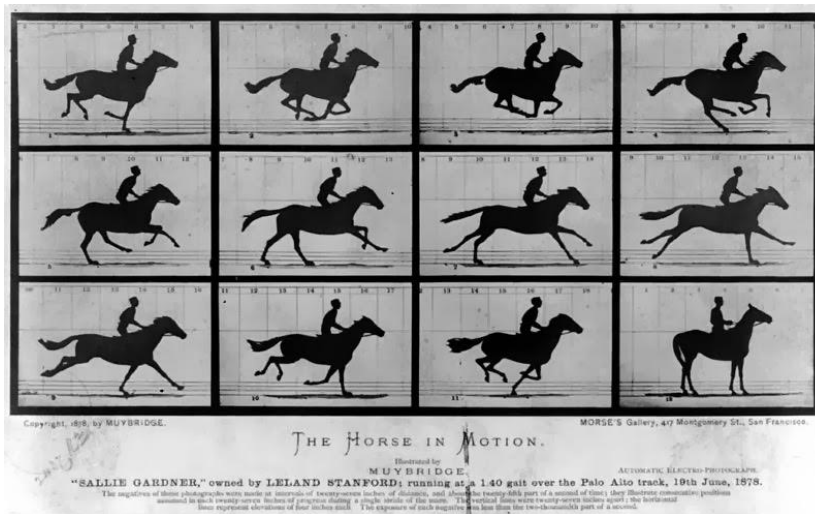
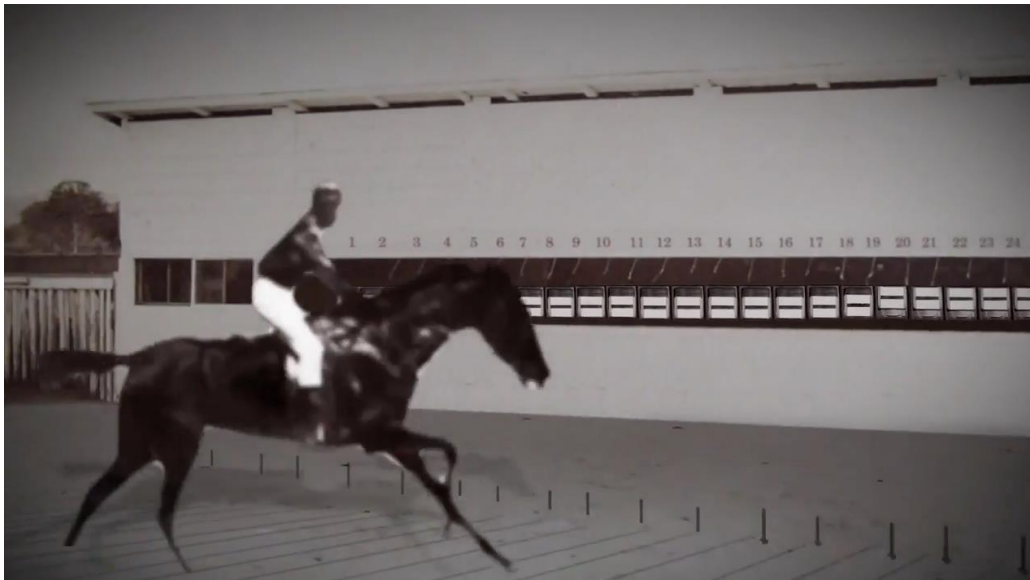


Figure 45 *Animal Locomotion* (Plate 626), a sequence shows a jockey on horseback by Eadweard Muybridge
Image retrieved from Wikipedia
https://en.wikipedia.org/wiki/The_Horse_in_Motion

Eadweard James Muybridge (1830-1904) was an English photographer known for his pioneering work in photographic studies of motion and in motion-picture projection. Marey was inspired by Muybridge's sequential photos of the horse because they were much clearer than his; he could see more details and realistic images and this is where he invented a camera looking like the Gatling gun, which is a drum exposed to 48 plates in 72 seconds (Meggs, 1998).

In 1872 Eadweard Muybridge was commissioned to resolve a bet based on whether or not a horse lifts all four legs off the ground at once when running. Muybridge used photography to capture several instances of the horse through a series of cameras and trip cables. The cables released camera shutters as the

horse ran. The end result indicated that the horse did lift all four legs off the ground at once. Furthermore, the outcome was a precursor to motion pictures and films (Meggs, 1998, p.144). In 1893, Marey adopted the same arrangement to further clarify the mechanism of locomotion, by taking the images with a double-use camera on a glass plate to trace the movement of water. Through this method, Marey could see the fine line of the water surface creating variations in its line contour and revealing the inner rhythm of the rise and fall of water (Figure 46).

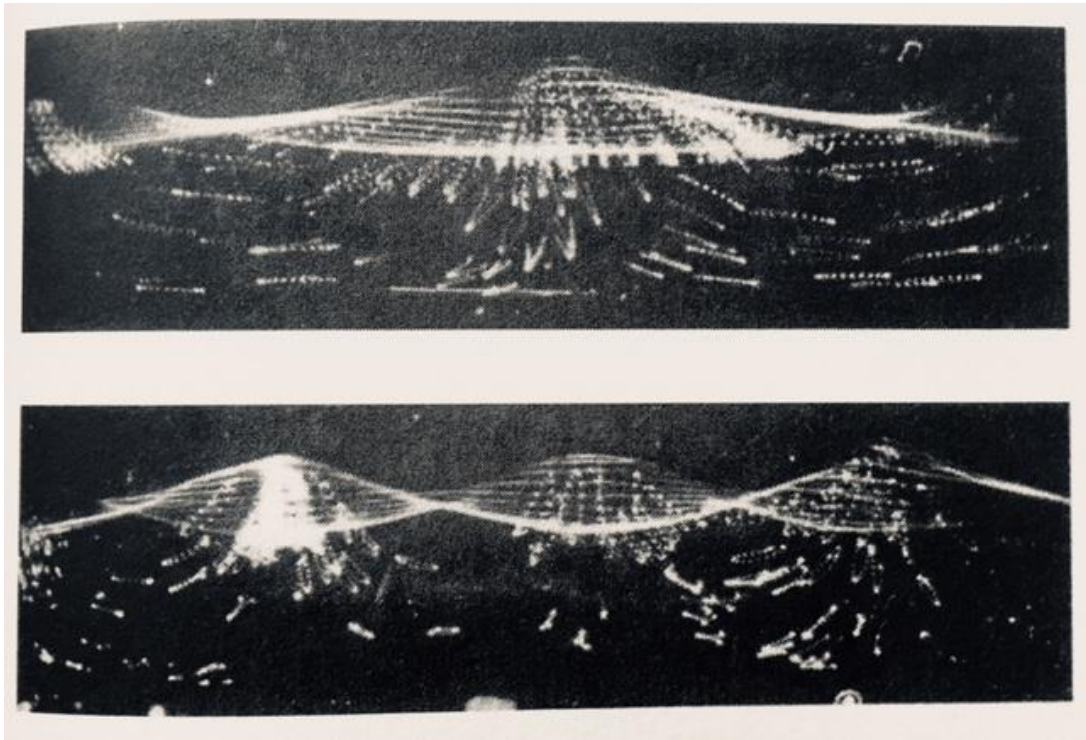


Figure 46 Studying the movement of the surface of water creating a rhythm of rise and fall (top) and the velocity of currents (bottom)
Image retrieved from *Picturing Time: The Work of Étienne-Jules Marey (1830-1904)* by Marta Braun, p. 217

I have applied the theory of dynamism through locomotion and chronophotography to the first stage of my method of production in terms of revealing the unseen, and in capturing the movement of the water through design and scientific understanding which were graphed and rendered.

Muybridge and Marey were contemporaries exhilarated by the possibilities of studying motion through photography with very distinct approaches, which was a great influence to my method of investigation while using new technology. However, it led me to question how photography and 3D rendering could capture the eccentricities of the stages of water inside the ebreeq, depicted as capable of being morphed to create a new form.

Marey's photography had been widely disseminated in Italy. It made an impact on Futurism which depicted the overlapped typology stages of an object as demonstrated, for example, in futurist painters like Giacomo Balla's *A Girl Running on the Balcony* and *Dynamism of a Dog on a Leash*. The frenetic action was embodied in Futurism.

In 1912 motion photography served as a model for the realization of Balla's futurist ideas. It was for him an experimental but concrete language with which he could reconstruct pure sensation in objective terms. Balla [...] continued the direction of his earlier analytic work while elaborating the futurist concern with visualizing motion. (Braun, 1994, p.303)

In the early 1900s, the Futurists proposed an art that celebrated the modern world of industry and technology. They stated, "We declare [...] a new beauty; the beauty of speed" (F.T. Marinetti, 1909). As alternative viewpoint to Futurists rejecting the past, *Design Roots: Culturally Significant Designs, Products and Practices* describes Marinetti's influential *Futurist Manifesto*¹⁹ as "an outspoken condemnation of the accumulated knowledge, learning and wisdom that had been handed down from past generations" (2018, p.42).

The Futurists created a new style that expressed the idea of the dynamism, energy and the movement of modern life, which was the mood of that time. In-depth knowledge, stories, values and traditions were irrelevant to them. The conceptual reference point of my project that allows me to bring together elements of the past and the future is in contrast with Futurism; from a practical method of production, however, Futurism is relevant in terms of showing progress of forms as a sequential moment in time, taking into consideration the in-depth knowledge, interaction and the value of the ebreeq. The use of motion design, revealing sequential layers which could be separated as a multi-moment to create the future in one unit, adopts the methodology of Futurism.

Giacomo Balla emerged as one of the chief representatives of artists from this movement. In his work *Dynamism of a Dog on a Leash* (Figure 47), he shows an almost frame-by-frame view of a woman walking a dog on a boulevard.

¹⁹ *Futurist Manifesto* appeared in Le Figaro on the 20th February, 1909.

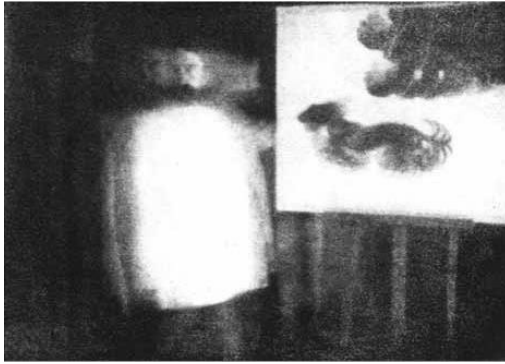


Figure 47 Bragaglia's photograph of Balla standing in front of *Dog of Dog on a Leash*, 1912
Image retrieved from ResearchGate
<https://www.researchgate.net/publication/244440576>



Figure 48 *Dynamism of a Dog on a Leash*, by Giacomo Balla
Image retrieved from ResearchGate
<https://www.researchgate.net/publication/244440576>

Marey's and Muybridge's motion photography served as a model for the realization of Balla's Futurist ideas. For Balla it was a concrete way to recreate pure feeling. The painting *Dynamism of a Dog on a Leash* represents the structure of the stages of a dog trotting alongside a pair of feet. The position of the dog's paws and its owner's feet were broken into overlapping sections, which were moulded by a brushstroke with a blur in between sections to create a sense of motion; meanwhile, the four positions of the leash are joined by continuous dotted lines interrelated in one canvas (Figure 48). In addition, "Representing Motion in a Static Image: Constraints and Parallels in art" considers that the "impact of Marey on Balla is unmistakable in a detail of his *A Girl Running on the Balcony*" (Cutting, 2002, p.1177) when put into comparison with Marey's image of motion study of a walking man. Balla's image was created resembling one that a stationary camera would generate, capturing coherent images of distinct moments of time when the girl moves in the indicated space (Figure 49).

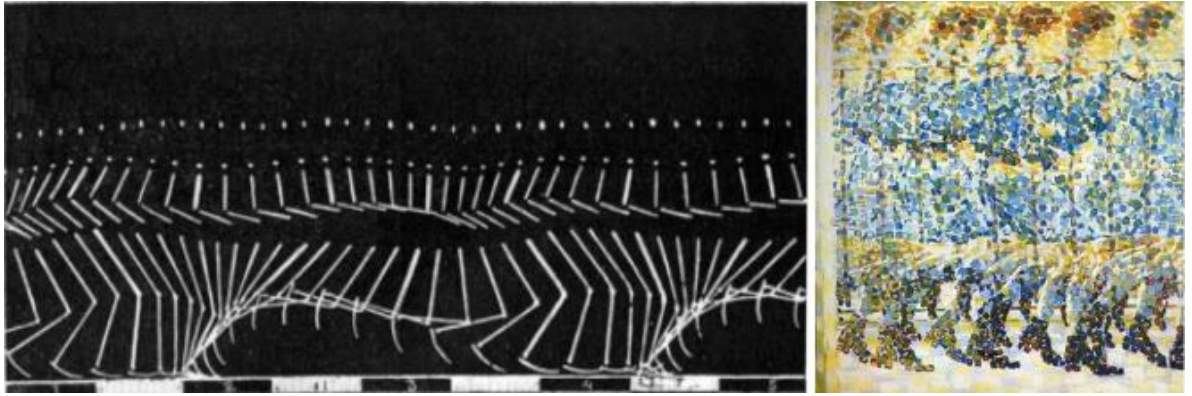


Figure 49 Marey's motion study of a waking man (left) and Balla's *A Girl Running on a Balcony* (right)
 Image retrieved from ResearchGate
<https://www.researchgate.net/publication/244440576>

These examples demonstrate notions related to simultaneity:

Marey sculpted [...] a stroboscopic representation of a gull in flight. It has 34 wings, 17 concatenated bodies, and one head. [Artists like] Kupka, Duchamp, and Russolo only dabbled with this technique [...], however, the Futurist painter Giacomo Balla was much more consistently interested in stroboscopic-like effects. (Cutting, 2002, p.1177)

Balla's visual investigation is related to Da Vinci's work in that it is hand rendered within the composition of a painting or drawing; however, it does not have a precise analytical knowledge of the essential typology of the fluid form that is almost invisible to the human eye. Balla's project is also related to Muybridge and Marey as their work is inspired by technology and photography; nevertheless, this is in contrast with the fact that they use frame-by-frame photography to produce film strips, while I use motion design to extract frames from the film strip. Umberto Boccioni is similar to Balla in examining three-dimensional objects. Boccioni's bronze sculpture *Unique Forms of Continuity in Space* (Figure 50) is a manifestation of movement, speed and forceful dynamism. He aimed to create "artificial continuity" of motion instead of a "logical discontinuity" as seen in classical art. The work depicts a superhuman figure in motion creating a fluid and smooth organic form. Boccioni manages to create the impression of movement from a still object.



Figure 50 Umberto Boccioni's bronze sculpture
Unique Forms of Continuity in Space
Image retrieved from Met Museum
<https://www.metmuseum.org/art/collection/search/485540>

Understanding the personal experience of interacting with the traditional ebreeq and the quality of movement and behavior of water inside it is unique and brings together the past and the present to introduce a new design of the ebreeq. The use of existing 2D and 3D methods through motion design in product design is a relatively new approach. Could this approach of investigating a person's interaction with the traditional ebreeq in use create the neo ebreeq and, at the same time, retain a connection to its traditional form?

Looking at sequential frames from a wider timeline, what comes across is a sequential unfolding of the past, present and the future which becomes a core element in revealing the ebreeq from its historical period until the present time. This is achieved by the use of motion design to capture the element of water within moments in time to produce the neo ebreeq. This method is perceived not as a single moment, but as the sequential unfolding of the past and the present which incorporates the critical theories of locomotion, Futurism and post-structuralism.

The 'now' [...] is problematic as soon as we begin to unpick its contextual particularities. As readers we assume that the 'now' referred to only connects with the 'now' usually connected with the present at the instant of its creation; every moment after that is separated from the manifesto's 'now' by a temporal and contextual gap. (Palmer, 2014, p.77)

3.2. Establishing a Post-Structural Theoretical Framework

Post-structuralism surfaced in France in the 1960s. Etymologically, the concept of post-structuralism consists of the 'post' (new) as of later or after that something in time. Structure suggests the way in which parts of something are interrelated to

one another, with the organization and arrangement of several parts of an entity (Sayin and Ates, 2012, pp.13-14). The theoretical apparatus was linked to Derrida's Deconstructuralism and Foucault's theory of power and discourse. Post-structuralism became a common theoretical approach in philosophy and literary criticism, and by the late 1980s it also extended to sociology (Wexler, 1991, p. 41).

The following is a description of post-structuralism that I find particularly relevant to my research:

[It] can thus be understood to have suspended a conventional rationalist distinction between tradition and modernity as part of a sequential unfolding of pasts, presents and futures, asserting instead shifting networks or constellations of discursive signification wherein neither tradition nor modernity, by dint of their deconstructive differing-deferring (*difference*) from and to one another, are ever made wholly present. (Gladston, 2014, p.3)

Post-structuralism, in tracing elements of the past and reworking them through a present sense of today, has become the conceptual foundation of my project. I used this theoretical framework less as a form of philosophical debate and more as a conceptual reference point that allows me to bring together elements of the past and the future, which stands in contrast with Futurism. It is also a theory that opposes binary opposites and rather looks at notions of plurality. In adopting this framework, the ebreeq is studied as a culturally significant artefact having a great potential in the Lebanese society, and it is also examined through perspectives of multiplicity and various interrelationships.

Post-structuralists argue that to understand an object it is necessary to study both the object itself and the systems of knowledge that produce the object (Emiroğlu, 2012, para. 1). "There is no fixed and unambiguous organization [...], but only a multiplicity of activities, processes, relations, connections, and changes" that are referred to as organization (Styhre, 2001, para. 12). Through a post-structural framework, re-inventions of the ebreeq use traces of the past to establish connections among forces which have been historically set against one another. The ebreeq as a traditional object is often viewed as being old or stasic and is associated with the past, the pre-industrial, the indigenous or aborigine and the primitive; this is habitually contrasted with the present day which is regarded as something that expresses dynamism, hi-tech, industrial, newness and progressiveness. However, a connection of these nominally opposing forces may

produce new forms of the ebreeq, exploring the possibilities of harmoniously bridging present norms and past traditions through a “sequential unfolding” (Gladston, 2014, p.3). If we consider post-structuralism as the sequential unfolding of the layers of the past, the present and the future in relation to the ebreeq while in use, then each of these layers become a symbol of each moment in the past and the present to bring into the future experience.

In other words, from a conceptual point of view and in terms of understanding the traditional ebreeq, post-structuralism looks into the past through the ebreeq itself, and the present sense of Futurism comes through the water within the ebreeq.

3.2.1. The Role of Semiotics in Post-structuralism

Post-structuralism, in tracing elements of the past and reworking them through a present sense of modernity, provided a valuable perspective for my research. Through post-structuralist perspectives, traces of these moments of past and present inform redesigns of the ebreeq. I creatively established connections of past and present to produce new forms of the ebreeq.

In *Design: History, Theory and Practice of Product Design*, Csikszentmihalyi and Rochberg-Halton are quoted:

The development of symbols – signs whose relation to an object is based on a convention rather than on qualitative or physical similarities – in the context of a cultural tradition enables people to compare their modes of behaviour with those of their ancestors in order to predict new experiences. [...] Furthermore, by pointing out that the symbolic dimensions of objects have been researched by ethnologists, Csikszentmihalyi and Rochberg-Halton are able to relate their findings back to the anthropological and semiotic approaches of French Structuralism. (Bürdek, 2005, p. 326)

They also emphasize that ethnologists have gathered a large number of highly detailed and thorough descriptions of the symbolic uses of items from a variety of cultures.

Similarly, Emiroğlu explains how in post-structuralism there is a continuous redesign of traditional objects in newer ways. Objects and physical environments are constantly incorporated and interpreted meaningfully in everyday life. This opens the possibility to look at tradition in a more elaborate manner and to apply a more dynamic theoretical position to them. Various socio-traditional contexts may

be viewed as paths in time and space. Hence, he adds, it is a matter of

not seeing the design as a closed entity, equipped with definite meanings, rather seeing design as irreducibly plural, an endless play of signifiers, which can never be finally nailed down to a single centre, or meaning, a fixed system of relations. Therefore, meaning is de-territorialized and re-territorialized over time, thus liberated by articulations and “re-articulated synchronically.” (2014, para. 7).

In *Design: History, Theory and Practice of Product Design*, Csikszentmihalyi and Rochberg-Halton consider post-structuralism and semiotics are interrelated (Bürdek, 2005, p. 326). My research benefits from looking into such interrelationships to better understand the ebreeq as intrinsically semiotic in nature, especially that design is a form of communication with design elements that channel signifiers (Emiroğlu, 2014, para. 1).

In *Design in Nature*, Adrian Bejan and J. Peder Zane point out that “design in nature [is] a scientific discipline, centered on a physics law of design and evolution: the constructal law” (2012, p.1). They elaborate saying that seeing constructally

[...] turns our drawing into a movie because designs evolve. Flow systems configure and reconfigure themselves over time. This evolution occurs in one direction: Flow designs get measurably better, moving more easily and farther if possible [and] tomorrow’s system should flow better than today’s. (2012, p.9)

The American philosopher Charles Sanders Peirce also addressed the notion of time in relation to semiotics. He “was interested in the fundamental nature of signs and how they function in a concrete world. [...] The duality of the sign, as both an object in the concrete world and as a mental artefact, is fundamental to Peirce’s work.” (Dillon, 2017, p.45)

In *This Means This, This Means That: A User’s Guide to Semiotics*, Sean Hall elaborates on time and semiotics. He writes,

If we view time as composed of linear and discrete elements of past, present, and future, then it would seem to follow that we can think of things as being ahead of the times or behind the times. And this is where our thinking about objects, images, and texts start to become structured and composed by time. (Hall, 2007, p. 94)

From the perspective of semiotics, it can be concluded that the ebreeq – as a symbol – may be examined through time-based semiotic studies within a post-

structural framework. This conclusion also raises the questions: How is the ebreeq assigned new meanings through design evolution? How is the ebreeq de-territorialized and re-territorialized over time? How do the layers of meanings embedded in the ebreeq relate to how I envision a future version of this vessel as a designed object? These interrelated aspects of the ebreeq are worthy of examination.

3.2.2. Motion Capture as a Practical Method of Semiotics in Post-structuralism

Looking into such interrelationships facilitated the perception of the ebreeq as intrinsically semiotic in nature, I worked on connecting the following nominally opposing forces: pouring water/drinking, and filling water/emptying it from the ebreeq. This has produced new forms of the ebreeq through the multi-layered semiotic quality that is related to post-structuralism, exploring the harmonious bridging of present norms and past traditions through a “sequential unfolding” (Gladston, 2014, p.3). Through the use of motion design, the sequences of each of these conditions were separated by 3D sectioning and typology, creating design elements that channel the signifier. This is achieved by tracing each channel of signifier for the three conditions of the past (the first moment of each condition, i.e. Drinking, Emptying, Filling) and reworking them through a present (linking each moment) to create a new design.

The domains of patterns of fluid interaction within the traditional ebreeq here are defined within the domain of the sequential unfolding as layers in time – in the past, the present and the future – to create a new signification within each condition while the ebreeq is in use (Figures 51-53).

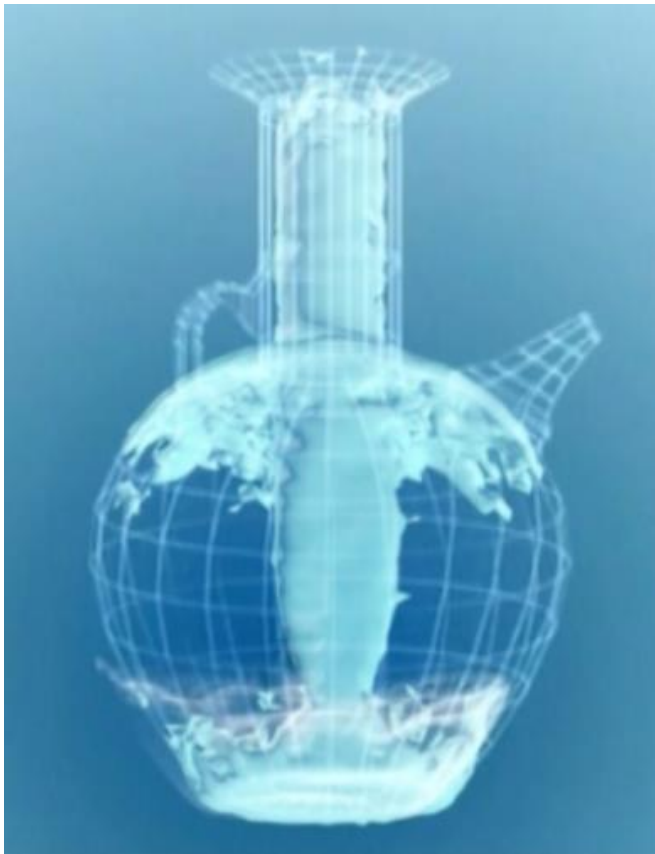


Figure 51 Wire frame ebreeq with water interaction
3D simulation render

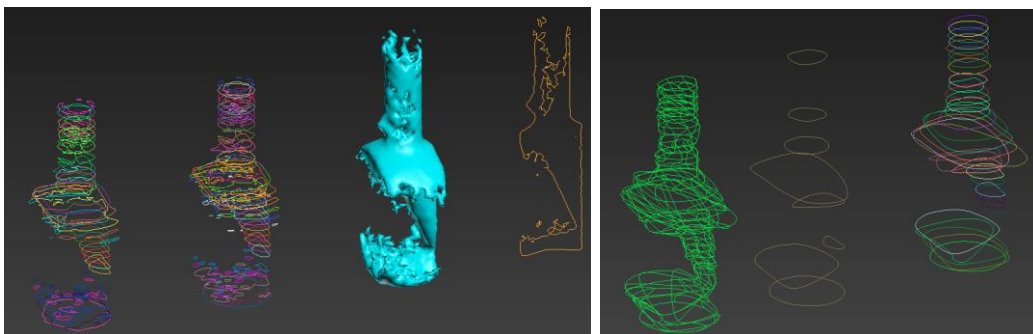


Figure 52 Water simulation mesh sectioning (3D
MAX) – x-axis of emptying water, filling water, and
pouring

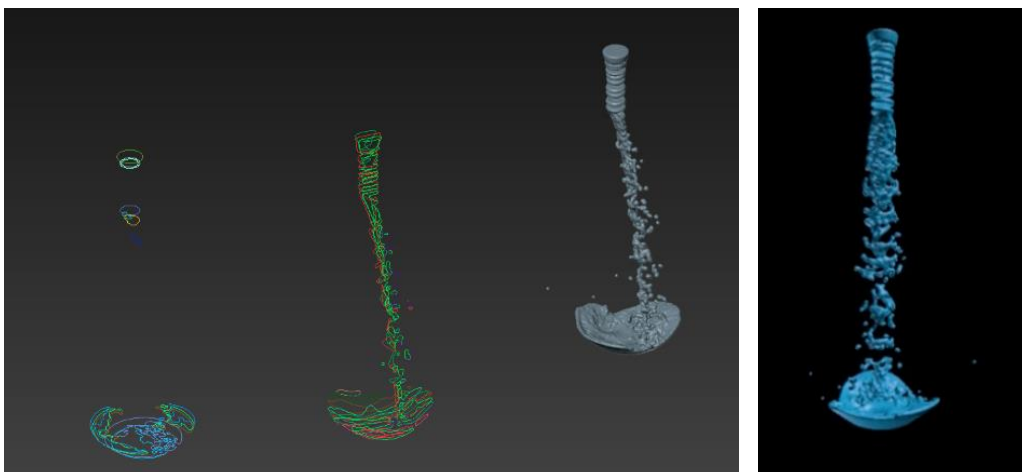


Figure 53 Filling water

“[A] falling drop of liquid, for example, will become a splat (round disk) or a splash (crown shape). Smaller and slower droplets come to rest as splats. Larger and faster droplets come to rest as splashes.” (Bejan and Zane, 2012, p. 11)

The above images are based on a method I used which is a simulation mesh sectioning (3D MAX) of: drinking/pouring, emptying water and filling water (D.E.F). Then through an animation program, I created three-dimensional snapshots of the particular movements, essentially forming their territorial traces of each condition, by selecting the first moment of the each of the (D.E.F.) conditions interacting with the ebreeq. First, I created a 3D model water simulation using real-flow software. Next, I used 3D Max software to extract the main key wire frame (z-axis) where each of these wire frames created multiple sectioning to the above condition, in other words, a sequential layer in a moment of time while in use. I adapted this method through motion design in relation to time-based semiotics.

3.3. Establishing Parametric Design Theoretical Framework

Parametricism and parametric design seem similar, in that

Parametric design is not unfamiliar territory for architects. From ancient pyramids to contemporary institutions, buildings have been designed and constructed in relationship to a variety of changing forces, including climate, technology, use, character, setting, culture, and mood.²⁰ (Phillips, 2010, para. 2)

However, there is a distinction between the two. Parametricism signifies a design principle that is developed through a perception based on an observation which creates parameters that signify an ideology. In contrast to Parametricism as a design principle, parametric design is a design process based on vertexes that produce algorithms by mostly utilizing parametric software. My research adapts a similar approach to motion design, one that focuses on shifting the ebreeq from its current perceived status as a relatively static cultural form towards becoming a dynamic object.

Parametricism provides an interesting approach towards design, with a focus on a design that is dynamic. It also aligns with post-structuralism in notions of

²⁰ Parametric Design: a Brief History. Retrieved from <http://www.aiacc.org/2012/06/25/parametric-design-a-brief-history/>

complexity, plurality and layering. Furthermore, it is in line with my study in terms of time-based semiotics, in that Parametricism addresses concepts related to continuum. As described by Patrik Schumacher in *Parametricism as Style: Parametricist Manifesto*, all natural procedures somehow create patterns. When these patterns are ordered, he refers to it as Parametricism, describing it as a style that uses new tools and semiologies. He pursues this design paradigm in diverse ways: “Systematic, adaptive variation, continuous differentiation (rather than mere variety), and dynamic, parametric figuration concerns *all* design tasks from urbanism to [...] the world of products” (2008, para. 1). Schumacher further explains that Parametricism facilitates the creation of “complex, polycentric [...] fields which are densely layered and continuously differentiated” (2008, para. 2). Parametricism lends itself to 3D printing through its often organic and undulating complex forms. I employed the technology of 3D printing in order to prototype a redesigned ebreeq, as further elaborated in Chapter 4.

If the neo ebreeq’s form is perceived to be an interrelation of its multi-layered sectioning, then the form of the neo ebreeq cannot be understood as an end in itself; as shown in the image below, it is rather a means to articulate the significant sections of the 3D simulation of the fluid “water” that visualizes the function of the space within the ebreeq. Through the use of motion design and 3D techniques, the ebreeq’s different sections and typology within the form creates one coherent spatial connection (Figures 54-55).



Figure 54 3D software Rhino articulates the significant sections from different viewpoints.

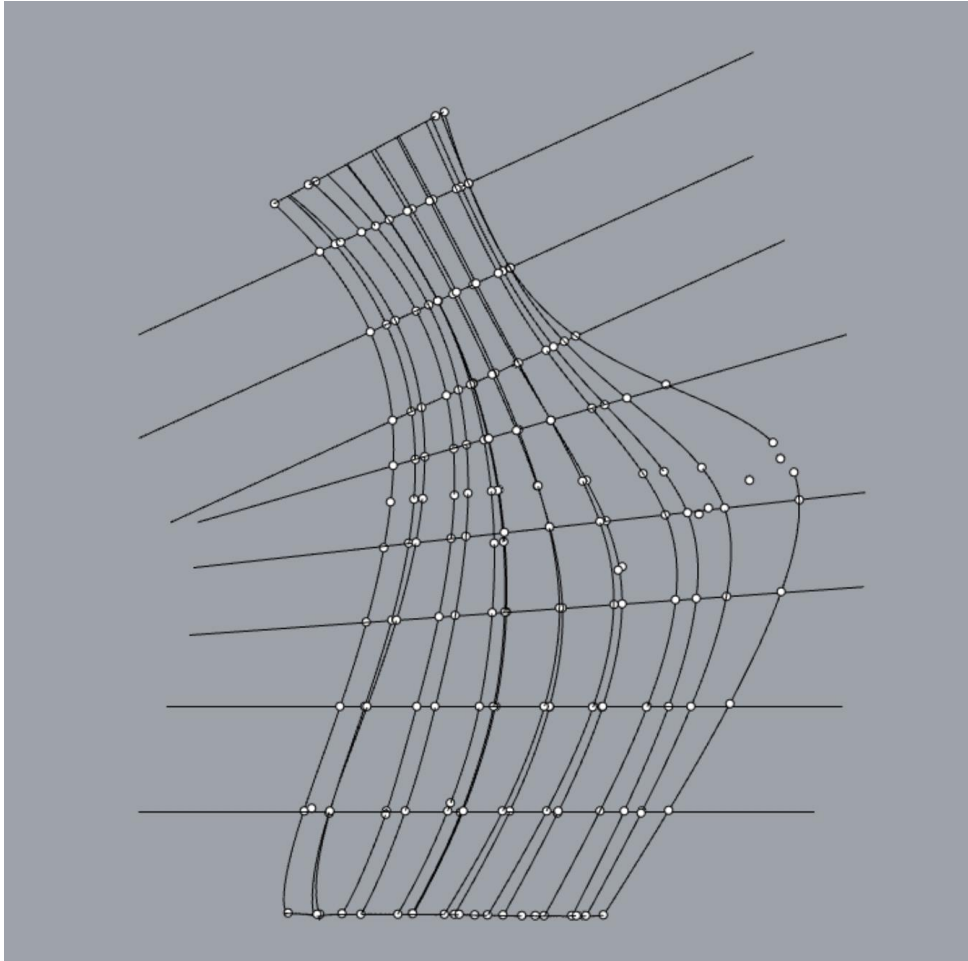


Figure 55 3D Fusion articulates the significant sections

One example of Parametricism put into practice is Dubai's Signature Towers project by Zaha Hadid (Figure 56); the project is inspired by Malevich's work of Cubo-Futurism, which I also address in my research in terms of its inspiration from Futurism.

The sequence of views, in black and white, from different locations of the observer expects the observer to perceive these three intertwined objects. [...] Choreographed movement combines the three towers in one overall gesture and weaves with a series of public spaces through the podium, bridges and landscape beyond, represented by rotating wireframe perspectives. (Lee, 2015, p. 407)

In other words, the observed variation in perspective and angles of the same object creates a combination of movement recorded on a wire frame; this relates to the process of recording the frames of the ebreeq observed from various angles upon its interaction with water which constitutes a main element in the redesign of the neo ebreeq.

"[...] recognize that all flow systems have the tendency to endow themselves with a characteristic that was not recognized until the constructal law-design.

This property includes the flow system's configuration (the architecture, geometry, shape, and structure) and its rhythm (the predictable rate at which it pulses and moves)." (Bejan and Zane, 2012, p. 9)

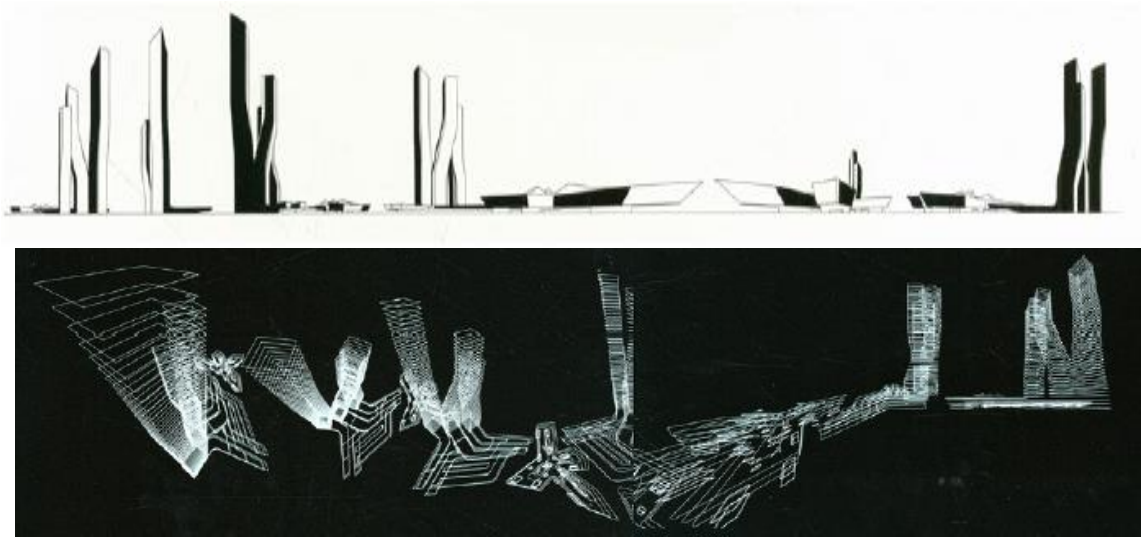


Figure 56 The rotating perspectives (top) and the rotating wireframe perspectives (bottom) of the Signature Towers

Image retrieved from "The Parametric Design Genealogy of Zaha Hadid" by Youngjin Lee
https://www.researchgate.net/publication/277899530_The_Parametric_Design_Genealogy_of_Zaha_Hadid

The following example is the architecture of a body in motion by Samer Sayary. After a thorough study of birds' mechanism of flying and rising to the sky, a reverse engineering of birds kinematics was conducted to regenerate a new form, which establishes a direct relationship to Marey's traditional techniques (Figure 57). Similarly, the dynamism and the movement of water within the ebreeq is observed and recorded similar to Marey's method using frame-by-frame captured moments which when put together generated the redesign of the neo ebreeq.

The three characteristics that define parametric design thinking include thinking with abstraction, thinking mathematically and thinking algorithmically (Woodbury, 2010). Thinking with abstraction is a basis that supports parametric design as a generative method for producing similar alternatives of the neo ebreeq and it also enables parts of the traditional ebreeq to be reused. Thinking mathematically refers to the sectioning and the typology based on the 3D simulation of water used for defining the neo ebreeq's structure. Thinking algorithmically means that the scripting language/plugin provides functions that can add, repeat, modify or remove parts in the neo ebreeq design outcome. Thus, parametric theory proves to be applicable to my methods of product design.

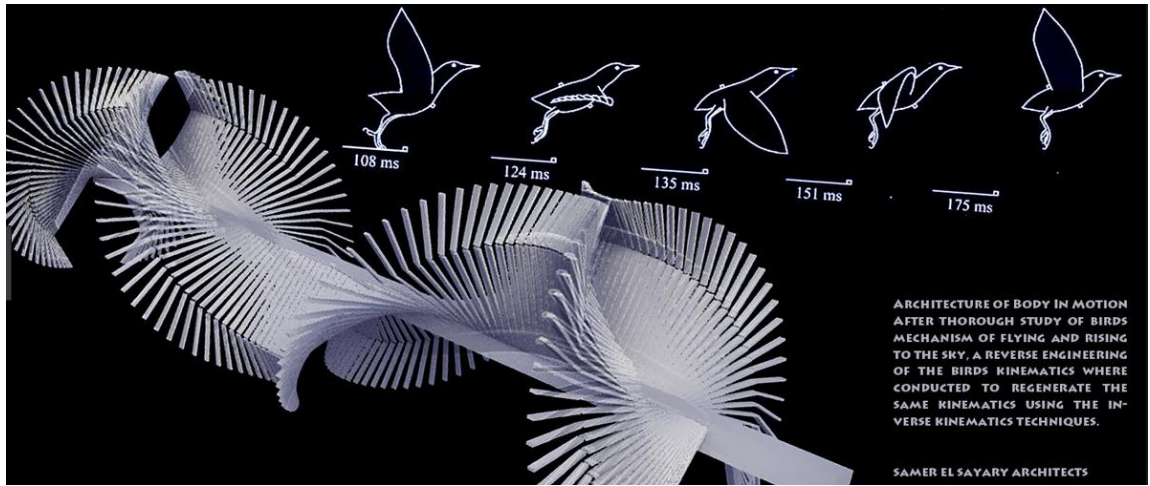


Figure 57 Mimicking birds in motion by Samer Sayary
 Image retrieved from BLOGS@VT
<https://blogs.lt.vt.edu/id2laujw/2015/10/07/when-mathematics-enters-design-we-have/>

3.3.1. Parametricism in Design through Semiotics

Although Parametricism is widely applied in architecture, its application remains restricted when it comes to directions in product design.

At the heart of this Burgess Shale moment in the discovery of new codes of creation at the genesis level are advanced schools of architecture – and not, unfortunately, schools of product design. (Schumacher, 2016, p. 102)

Zaha Hadid's "semiological project"²¹ implies that the design project arranges all form-function relationships into an intelligible system of signification and mapping relationships of the domain of patterns of social interaction (Figures 58-59). This is done within the domain of the signifier of spatial positions and morphological features defining and characterizing a given territory. The overall system should be able to create a clear reading of the space according to its functionality and hierarchy. This is very similar to the design of the neo ebreeq which makes each section of the D.E.F. conditions an intelligible system of signification that could create a pattern of water inside the ebreeq while in use to become an organized form. This approach towards designing the neo ebreeq through motion employs thinking according to parametric concepts; it reveals the embedded shared interaction of the water while using the traditional ebreeqs' form, function and usability – which becomes a coherent system of signification. The traditional ebreeq is used as the original source.

²¹ *Architecture for the 21st Century: postmodernism and beyond*, posted on June 28, 2013

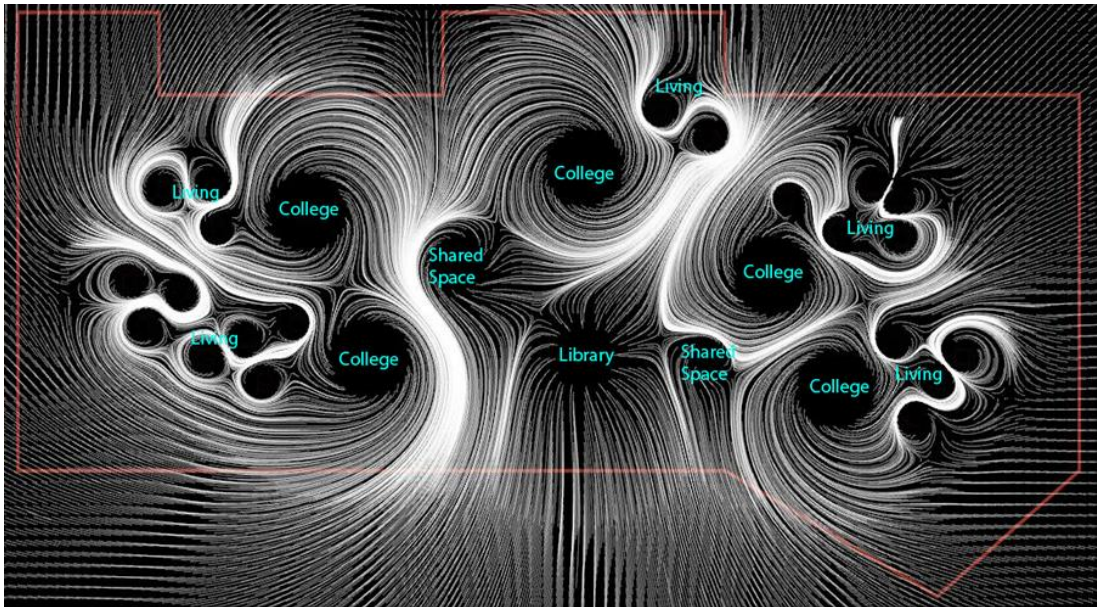


Figure 58 Parametric Semiology: Semio-field, master-plan with program distribution
 Image retrieved from Patrik Schumacher
<https://www.patrikschumacher.com/Texts/Design%20of%20Information%20Rich%20Environments.html>



Figure 59 Beijing Chaoyangmen Galaxy Shopping Center renderings
 Image retrieved from Patrik Schumacher
<http://www.patrikschumacher.com/Texts/The%20Rise%20of%20Parametricism.html>

This application of parametricism to design is employed in a thesis project by Martin Kleindienst in which his research focuses on simulating different sets of data input and exploring how self-coherence and organization is formed through its various qualities of continuous borderless interrelation. The project was applied in Munich to the Olympic village for the Winter Olympics in 2018. The figure below

shows the mapping of these semiological patterns based on social interaction within this space, which formed an architectural form with continued borderless design (Figure 60). Zaha Hadid's use of parametricism is also applied in this project and is similar in terms of its application to the neo ebreeq whereby the recording of the semiological layers of the interaction of water within the space of the ebreeq forms its design.

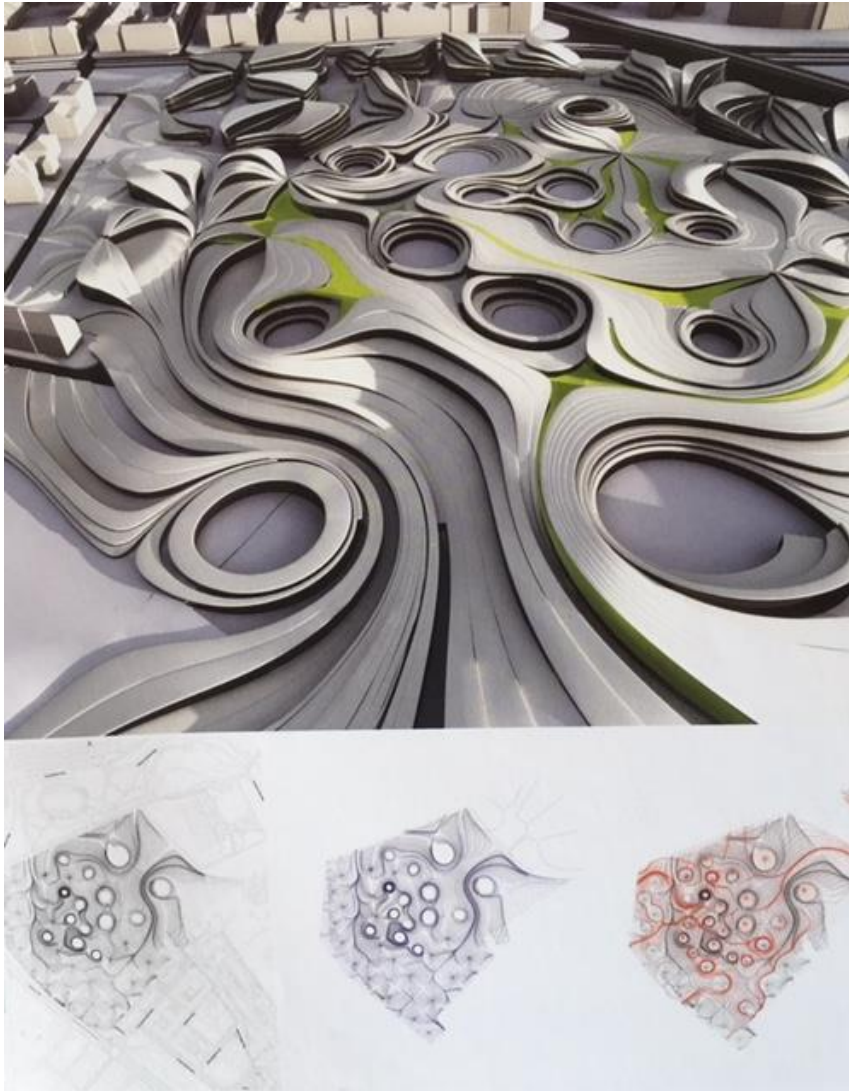


Figure 60 The Olympic Village project by Martin Kleindienst
Image retrieved from *Fluid Totality: Studio Zaha Hadid 2000-2015*, University of Applied Arts Vienna

3.3.2. Motion Capture as a Practical Method of Semiology in Parametricism for Product Design

These examples are related more to architecture and parametric design; I found that very few product designers or industrial designers use parametric theory in relation to motion and fluids. However, in the book chapter *Super Natural*, Ross Lovegrove *Parametricism in Product Design in Parametricism 2.0: Rethinking*

Architecture's Agenda for the 21st Century, which is also related to the stylistic movement of Parametricism and has the scope to move beyond the limits of architecture and into other disciplines. The work of industrial designer Ross Lovegrove is nature-inspired, acknowledges the potential of new codes of creation being incubated in architecture schools for product design, accelerating innovation across materials structures and manufacturing technologies (2016, p. 100).

I translated this knowledge and research into the interactive relationship between humanity, nature and technology into the re-designing the ebreeq. I am not only interested in the beautiful curves and lines that Lovegrove creates in his work, but also in the emotional aspects of his product: form and shape are not intended as an end in themselves, but the focus lies in his appreciation of things existing in nature.

One of his products that connects Parametric theory and fluid motion is the Ripple bottle. Lovegrove was commissioned by Tÿ Nant to create a new Ripple (PET) bottle²² achieving a form which was difficult to produce at the time in 2001. It was the first computer generated universal polymer product (Figure 61) to use algorithms and non-uniform rational basis splines (NURBS) to attain a complementary unity in material, technology and form.

Launched at Harrods in 2001, Lovegrove combined its curves with those of fashion model Adriana Sklenarikova to establish a set of models to emphasize a fluid and aesthetic form evoking the motion of flowing water. The direct expression and the delivery of water was the result of his approach to design the water bottle based on organic forms and lines (Figure 62).

²² This bottle was designed for a brand of spring water from Bethania in Wales.

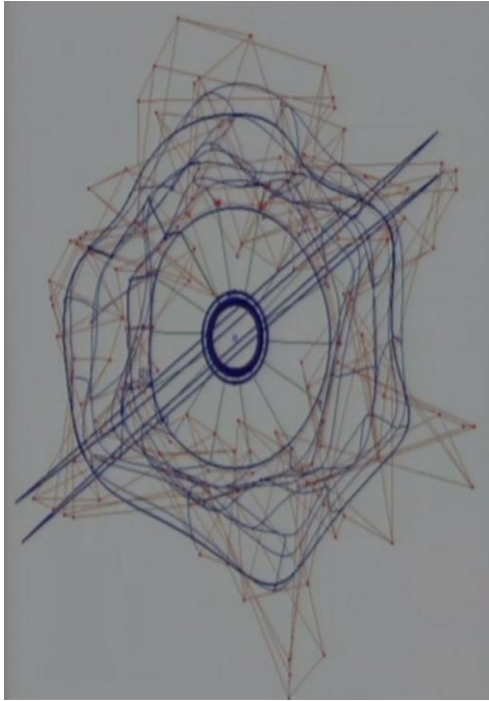


Figure 61 Top view of the digitally generated polymer bottle, showing the 3D sectioning and the layers of the Ripple Range
Image retrieved from The Method Case
<https://www.themethodcase.com/ty-nant-plastic-water-bottle-ross-lovegrove/>

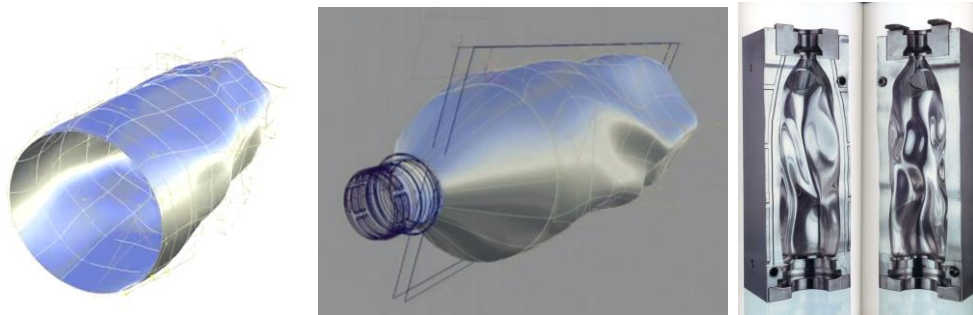


Figure 62 (a) Starting point of the digital generation of the form, (b) 3D rendering of the design of the bottle and (c) casting of the Ripple Range
Image retrieved from The Method Case
<https://www.themethodcase.com/ty-nant-plastic-water-bottle-ross-lovegrove/>

I have used similar methods to explore the relationship between the inside and the outside of the ebreeq by creating a detailed wireframe composed of multiple 3D sectioning which helped me study the form of the neo ebreeq from various angles and modify it accordingly; this relationship conveys the fluidity of water inside the ebreeq as demonstrated through motion design techniques, while harmony between its form, function and interactivity is created as demonstrated in the Ripple Range (Figure 63).



Figure 63 Ripple Range (Plastic) evoking the fluidity and the motion of water
Image retrieved from The Method Case
<https://www.themethodcase.com/ty-nant-plastic-water-bottle-ross-lovegrove/>

In *Supernatural: The Work of Ross Lovegrove*, Eliot Noyes is quoted saying

A design may be called organic when there is an harmonious organization of the parts within the whole, according to structure, material, and purpose. Within this definition there can be no vain ornamentation or superfluity, but the part of beauty is nonetheless great – in ideal choice of material, in visual refinement, and in the rational elegance of things intended for use. (2016, p.33)

In Lovegrove's bottle, the employed fluidity of water brings to mind the form of running water. The form of fluidity is semiotic as it signifies freshness and purity to the user. This evocation strongly relates to the water inside the bottle (function). Users may drink water from ordinary bottles without any particular perception or inspiration; however, with Tÿ Nant's water bottle, they may visualize the perception of water as previously recognised. This signification process becomes a factor that raises the interaction between the user and the product. My research conveys this concept in the ebreeq, which users interact with by filling, drinking and pouring from it. These elements become strongly related to the function or ergonomics while the ebreeq is in use. Also, each of these conditions may be perceived by the user who becomes a factor in viewing the user together with the neo ebreeq.

Peter Pearce is also quoted in *Supernatural: The Work of Ross Lovegrove*: "All forms in nature are determined by the interaction of intrinsic with extrinsic forces" (2016, p. 151).

In the ebreeq, it is the domain of spatial positions and morphological features – through the new wire frame selection and the rotation of the existing wire frames

Draft I – that defines and characterizes the new given form, including minor changes and modifications; the ergonomic aspects interrelated with my research are also taken into consideration (Figure 64).

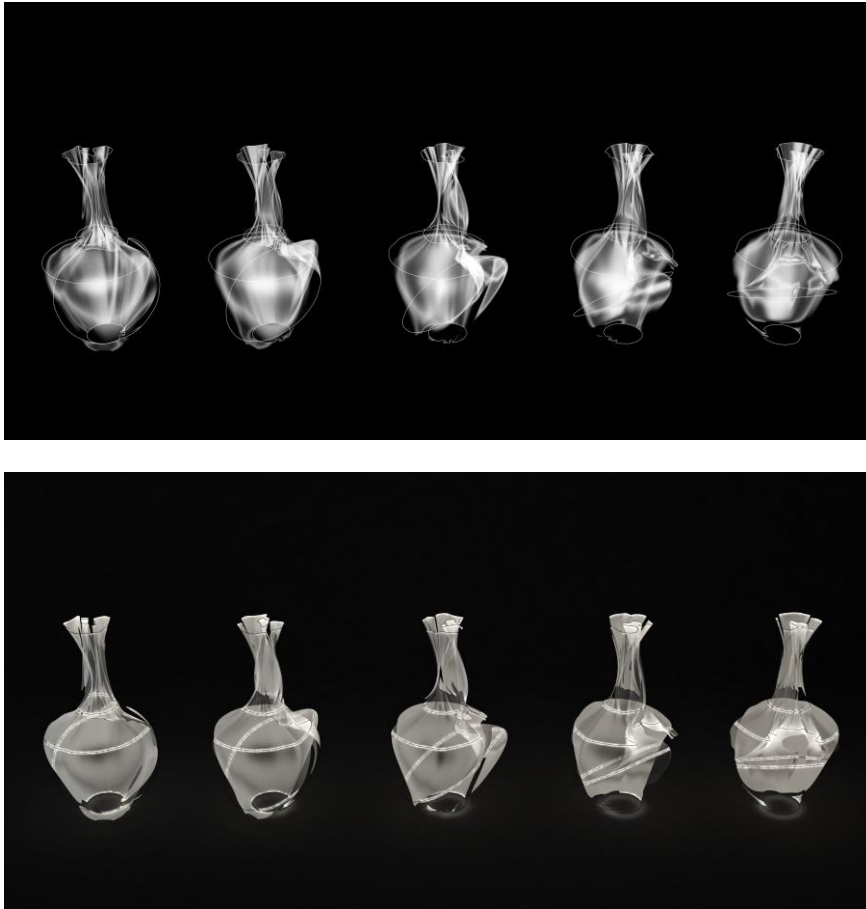


Figure 64 Draft I (D.E.F. based on Z-X axis)

3.4. Findings from the Research to Redesign the Ebreeq

My research has evolved from an understanding of the value of the ebreeq's egg-shape towards insights on porous clay and the ebreeq as an ancient intelligent object, and towards readings of 3D technologies in contemporary art and design. Based on this study, I altered the ebreeq's static and ergonomic elements — the neck, the handle and the spout. These elements were fused together to create a component of the neo ebreeq, representing time or a fourth-dimensional structure. In the process of working on such a structure, I came to the realization regarding the past, present and the potential future experiences of time as a continuous flow. I exported the frames of the first moment of each condition (that is each phase of using the ebreeq, as in Drinking, Emptying, Filling conditions) and blended them to create a moment in a dynamic space. It was interesting to see these moments that are not visible to the naked eye, while unfolding and utilizing them toward

designed elements. The moments were extracted from holding the ebreeq and drinking from it.

Based upon my cumulative research, the following is a synopsis of the key applicable components:

Theoretically: the project moves away from binary oppositions between the traditional and the contemporary, using theories that support using motion design as a bridge between these two positions.

Locomotion: the theory of Dynamism through locomotion and chronophotography supported the first stage of my 3D method of production, capturing the movement of water through design and scientific understanding, which were graphed and rendered in 3D to reveal the unseen. Also, these methods and theories helped me determine the graphic fluid forms obtained from water by separating each condition – the filling, drinking and emptying of water – highlighted by a typological graph, similar to Marey's method of highlighting parts to make them more visible to the naked eye and creating a dematerialized graph.

Futurism (dynamism and movement): this theory has practical applications in my research, because it expresses the idea of dynamism, energy and the movement of modern life, which was the mood of the early 20th century. Considering the importance of values and tradition that accompany the ebreeq, I could bring together elements of the past and the future, which contrasts with the philosophy of Futurism. On the other hand, from a practical method of production, Futurism presents its relevance in showing the progress of forms as a sequential moment in time, taking into consideration the in-depth knowledge, interaction and value of the ebreeq. Like Futurism, the use of motion design reveals the sequential layers which could be separated as multi moments to create the future on one canvas.

Post-structuralism: in terms of tracing elements of the past and reworking them through the present sense of today, post-structuralism has become highly valuable to my research. I used this theoretical framework less as a form of philosophical debate and more as a conceptual reference point that allows me to bring together elements of the past and the future, which stands in contrast with Futurism. It is also a theory that opposes binary opposites and, instead, looks at notions of plurality.

Time-based semiotics: this study benefits from looking into such interrelationships to better understand the ebreeq as intrinsically semiotic in nature. Consequently, I worked on connecting its nominally opposing forces which are: pouring water and drinking; filling water and emptying it from the ebreeq. This has the potential to produce new forms of the ebreeq through this multi-layered quality of time-based semiotics.

Parametricism: as a theory, Parametricism provided an interesting approach towards design. The focus was directed towards a design that is dynamic which (apart from its relevance to motion design) shifts the ebreeq from its perceived status as a relatively static cultural form towards becoming a dynamic object. In this respect, Parametricism addresses concepts related to continuum. It is also relative to the approach towards designing the neo ebreeq through motion and the relation of parametric fluid, revealing the embedded shared interaction of the water while using the traditional ebreeqs' form, function and usability which becomes a coherent system of signification.

Practically: the project improves the ebreeq's original function and form through new digital function(s), where parametric design theory blends a new form without losing the object's essence, in the form of its egg shape. It also demonstrates how motion design can serve as a methodology that combines notions of locomotion, Futurism, post-structuralism, time-based semiotics and Parametricism towards product design.

Moreover, this conceptual framework has become the bond between the theoretical and the practical components of this research that improve the ebreeq in multiple ways and evolves its semiotic meaning. The new form of a redesigned ebreeq can extend beyond its traditional physical form. Through motion design, the water and the space within the ebreeq accompany and are shared with the viewer. The design is based on the visible and invisible, the known and the unknown. The ebreeq is not alone; its physical presence is accompanied by implicit or explicit significance, which is better perceived and recognized through redesign.

My research and observation of the ebreeq in its detailed examination gave me a better understanding of the ebreeq, such as the reason behind the use of natural

materials, the craftsmen's techniques and processes used in the production of the ebreeq. This is in addition to understanding its aesthetics including the egg-shape, the neck, the spout and the handle. Also, this method helped evaluate how well the ebreeq has functioned during its life and why people stopped using it. Based on my observations, motion photography and filming a person drinking from the ebreeq, I also realized that people tilted the ebreeq sideways so the neck of the ebreeq does not touch the forehead of a person.

In conclusion, the egg-shape of the ebreeq is a valuable element in this intelligent object especially when it comes to the application of motion design and 3D technology, the combination of which is representative of its dynamic space and the continuous flow of time. In other words, motion design connects the traditional and modern aspects of this project, based on the specific moments of a person's interaction with the ebreeq when drinking from it. Apart from showcasing the internal and integral value of the ebreeq by visually exposing its value and using it to aesthetically and conceptually reimagine the design, this project demonstrates how motion design can serve as a methodology towards revitalizing product design and provides a framework for others interested in reviving traditional (Lebanese or non-Lebanese) objects.

From this standpoint, Chapter 4 tackles the range of techniques that were employed to undertake this project. A process of manual pottery was used alongside an exploration of 2D and 3D digital technologies. This research allows the opportunity to explore the relationship between the handmade and the digital through motion design. This comes across through the application of locomotion, Futurism and post-structuralism theory (moments of in-betweens) with the use of motion design, 3D technology and parametric design theory to redesign of the handle, spout and the neck and create new forms that readdress the function and the form of the ebreeq. Therefore, the research represents and invigorates traditional objects using 3D digital technology through enhancing, extending and invigorating the object's original function and form.

Chapter 4: Motion Design as a Practical Framework for Invigorating Traditional Objects

4.1. Introduction: The Values of Traditional Objects and 3D Technologies

The concept of domain shift refers to the application of the guiding principles and tools of a certain practice or activity to another task; consequently, type-forms transform when domain shifts allow practitioners to reach across the border of their field of knowledge (Sennett, 2009). From this perspective, the practice of adopting new techniques and technological development in, for instance, 3D digital technologies and various software such as CAD/CAM, motion design and 3D printing has facilitated the work of designers to reintroduce traditional objects to contemporary times in a way where the past and the present can meet in a single redesigned product.

Domain shift is also characterized by slowly digressing from the dictated theory and bending the logic of a particular activity towards a practice, which focuses on technique and maintaining form. Although this process could give the impression of being counterproductive, adopting this concept and the slow transformation of a craft discovers and builds new connections within a transformed type-form or an object in question (2009). This direction in the domain shift deviates from the traditional making of an ebreeq. It introduces motion design and technological tools to generate a new design while simultaneously enhancing and maintaining the iconic form of the traditional ebreeq. This progressive transformation re-establishes the relevance of the ebreeq within its environment and builds on new connections between the water and the dynamic space within the ebreeq itself.

Countries with a rich historical background demonstrate numerous ways in which the practical application of traditional knowledge is used to invigorate traditions. The following excerpt from an article “Transforming Tradition for Sustainability through ‘TCUSM’ Tool” by Adhi Nugraha addresses the significance of conventional information and its purpose today:

There are some factors why tradition receives many great concerns. [One] factor is based on concern of the [loss] of valuable knowledge. Most of the traditional knowledge and practices that people carry is silent, known as tacit knowledge. [If] the practitioners fail to pass on their knowledge, there is a risk of losing it. [...] In addition, the [greatest] reason why transforming tradition is worth doing is that it supports things [becoming] sustainable. (Nugraha, 2010, p. 22)

Traditional objects that have social significance are related to the past, stillness, the pre-mechanical, the native, and the embryonic; this can be contrasted with the present-day which can be viewed as dynamic, advanced, digitalized, developed and progressive. However, the connection of these apparently disparate values may create new structures, as designers and creators examine the possibilities of spanning present standards and past customs amicably.

One method for bringing these divergent forces together is through examining approaches that combine contemporary methods for making – 3D technologies for example – with traditional objects. Conventional objects have been constrained to specific structures because of their restricted technical innovation. In the time of computerized change, the process of 3D advancement for a motion designer empowers the making of complex structures that could not have been carried out with conventional methods.

My practical framework approaches object design through the incorporation of motion design and examines a new relationship that is formed between motion design, modern materials and technology to create a new product. It was not a simple methodology to achieve balancing new material, new technology and traditional form. The procedure adopted an interdisciplinary methodology for designing the neo ebreeq, which derived from the interaction of water (interrelating the inside out and outside in) within the traditional ebreeq to find a harmony between the object and the interaction of water while it is in use which brings gesture to the design. The movement of water is perceived by its established connection between the surface of the ebreeq and its interaction with water.

Designing a product based on the movement of water required the use of new 3D technologies. The water inside the ebreeq moves through interaction with the user and these movements were considered in order to redesign the neo ebreeq. Therefore, my approach to the practical framework was explored through the use of new technology and techniques, which has resulted in the selection of the most effective new technology for designing through motion; this derived from 6 years of explorative research into the context and practice of motion design.

The techniques and new technology that relate to adapting motion design for designing a product were primarily elements for revealing the water movement

within the traditional ebreeq. The tools and techniques that are presented were intentionally used as a reference in developing the neo ebreeq. It was important to consider how the movements fit into a form, and what sort of formal properties were needed in order to create the intended movement.

Considering the above led me to raise a question within my own research: which 3D technologies would help redesign the ebreeq within a contemporary context while retaining the traditional ebreeq's function, and how? I consider the application of 3D technologies as enabling methodological tools not only for designers and makers, but also for motion designers.

[D]igital fabrication provides an ideal playground [...] to experiment with entirely new approaches to 2D and 3D design. This is spurring the development of new types of design tools; particularly those in which the knowledge that the end goal is a physical object is deeply integrated into the system. (Schmidt and Ratto, 2013, para. 5)

My research has included a compilation of the most applicable tools for designing from motion, derived from explorative research into the theory and practice of motion design (amalgamation of moments to form) in product design.

These tools and technique are 3D Software for Experiencing Motion, 3D stimulation for depicting the movement of water flow and 3D printing for a rapid prototype in the design product process. It was not intended for the tools and techniques used here to be a prescriptive approach, but rather as a framework to adapt motion design to designing a product.

The engagement of these 3D technologies provided this project with an effective method of making the neo ebreeq. While conducting my research, these 3D technologies have developed an increasing momentum, with a growth in the number of designers using 3D printers. Because of these 3D digital technologies, it is now easier than ever to manufacture a product prototype, which allows makers to create and produce their product design themselves from screen outputting to desktop fabrication machines.

4.2. Digital Technologies and the Maker Movement

What exactly defines a Maker? It's a broad description that encompasses a wide variety of activities, from traditional crafting to high-tech electronics. This chapter

presents artists and designers who have a background as traditional makers in terms of production and the tools they have used. Today, these same artists have introduced digital technology in their field of work and research as a creative approach, expanding the borders of traditional craftsmanship and adopting more flexibility in the produced work. Despite their traditional background in making, their use of new technology has created a new makers movement. I am not a craftsman; as a motion designer, however, I am using motion design and new technology targeted towards a project involving traditional objects like the ebreeq.

[You] can mark the beginnings of the Maker Movement with such signs as the 2005 launch of *Make* magazine, from O'Reilly, a legendary publisher of geek bibles, and the first Maker Faire gatherings in Silicon Valley. (Anderson, 2012, p. 20)

In his book *Makers: The New Industrial Revolution*, Chris Anderson describes Makers as crafters, artists and artisans, technologists, hobbyists, amateur scientists, entrepreneurs, engineers, woodworkers, roboticists and many others engaged in hands-on projects that use these 3D modern digital technologies in innovative ways. Additionally, he demonstrates that Creators are likewise grown-ups who consider themselves to be innovators and experimentalists. Some of them hold PhDs and others are self-taught. Today, anyone with an innovative design can upload files to a service and have that product made in small or large amounts, or make it themselves with increasingly powerful digital desktop fabrication tools such as 3D printers. Makers are no longer at the mercy of large companies to manufacture their ideas.

Nowadays 3D technologies are capable of capturing an object's given geometry, texture and optical material properties. For example, 3D scans are facilitating the documentation and virtual reproduction of cultural assets through a computerized procedure that is able to capture an object in an efficient scanning and making process with micrometer precision (Figure 65).

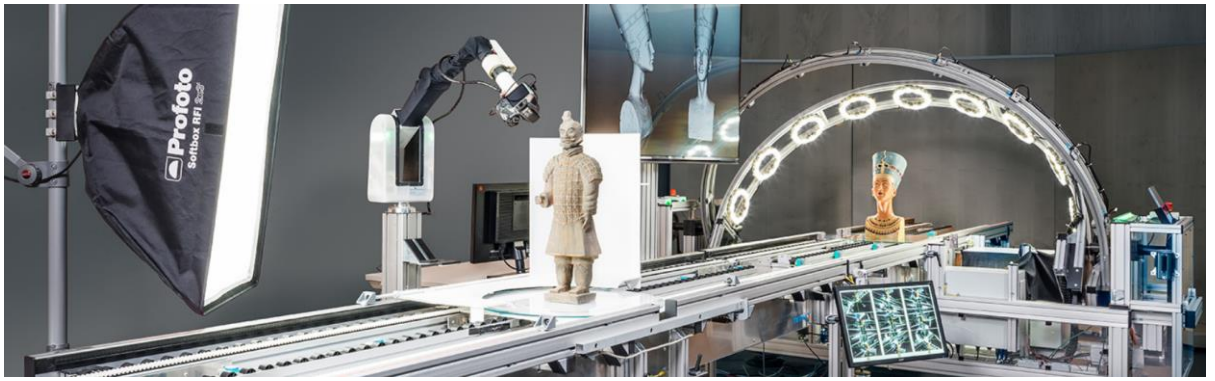


Figure 65 A multi-modular scanning facility using optical scanning technologies
Image retrieved from CULTLAB3D
<https://www.cultlab3d.de/index.php/cultlab3d/?lang=de>

Also, these 3D technological tools can expose researchers to useful applications from digitization via interactive-based visualization all the way to 3D printing. For example, museums can create realistic imitations of objects from their collections with 3D printing.

3D printing holds great potential in terms of its contribution to cultural heritage. It is quickly undergoing technological change and continues to be essential in the reconstruction of objects. In addition, it holds the potential to help in the preservation, documentation, research, and education in obtainable and comprehensive manners (Ioannides and Quak, 2014, p.119).

Visitors can investigate these 3D printed artifacts or valued traditional objects without damaging the originals. 3D printing likewise offers the chance to make physical portrayals of 3D paintings. Ironically, museums have been for centuries a place to look at and learn about the items on display, but not to hold or touch them. An example of this can be seen at the Belvedere Museum in Vienna, where a 3D printed version of Gustav Klimt's (1907–1908) painting *The Kiss* is presented to individuals who are blind or visually impaired as a form of “interactive tactile relief” (“3D Technology in the Restoration of History”, 2017, para. 11) (Figure 66).



Figure 66 (a) *The Kiss* by Gustav Klimt, (b) tactile relief interpretation, (c) first interactive audio guide setup using a tripod
 Image retrieved from ResearchGate
https://www.researchgate.net/figure/Gustav-Klimts-The-Kiss-Der-Kuss-1908-09-From-left-to-right-a-Original-image-C_fig1_323978922

The Metropolitan Museum of Manilla and the Prado Museum (Figure 67) have also taken advantage of such opportunities. In 2009, the Metropolitan Museum of Manilla launched the *Touch the Artist's Vision* program, specifically catering to visually impaired audiences who were invited to touch the exhibited items. In addition to Braille captions and audio guides, visitors could touch tactile diagrams of the displayed artwork. Similarly at *Touching the Prado* exhibition in Spring 2015, blind visitors were given the chance to discover paintings in relief that enabled them to experience the exhibit by feeling the 3D paintings created in an innovative way using 3D printing.



Figure 67 A blind visitor to Spain's Prado Museum runs his fingers across a 3D copy of the Mona Lisa
 Image retrieved from Rediff
<https://www.rediff.com/news/report/at-this-museum-you-can-touch-the-mona-lisa/20150528.htm>

Evidently, there are numerous initiatives today showing how 3D printing contributes to understanding cultural and traditional objects. Contributions may be through creating innovative complex shapes, educating a wider audience or preserving artefacts and traditional objects.

By recreating a ruined monument, for example, its heritage is preserved, making an interaction with the past possible that would not have been previously feasible. Many faculty members from the Harvard Semitic Museum address this point, stating that:

“modern digital 3D visualization makes possible the full-scale virtual reconstruction of ancient architectural remains which survive today only as damaged or partially preserved ruins. Using digital animation, adding color and lighting effects, it is possible to show how these sites and monuments changed through time, from their original construction and ancient use to their eventual abandonment and destruction.” (“3D Technology in the Restoration of History”, 2017, para. 2)

This brought me to question what technology was being used to represent traditional artifacts and how?

4.2.1. Representing Traditional Objects Using 3D Digital Technologies

In today’s digital age, 3D technologies are progressively supporting the reproduction, preservation and representation of ancient ruins, cultural heritage, traditional objects and sites. Thus, 3D technologies have become a helpful apparatus with regards to representing traditional materials, traditional objects and cultural heritage. The mingled practice of these 3D technologies (i.e. 3D Software for Experiencing Motion, 3D stimulation and 3D printing) allows the chance to produce precise representations of objects, surfaces, structures, complex texture, form and colour. These representations increase the technologies’ utility for a variety of disciplines and have become valuable resources for me when thinking about the representation of the ebreeqs traditional form before invigorating it. In other words, 3D technologies offer the choice of producing replicas of the traditional ebreeq’s precise form that can be utilized both in research and practice. These approaches of 3D technologies offer advantages over traditional methods of making, such as drawing, drafting, hand rendering, film developing and other manufacturing tools. “Traditional models are the sketches and drawings of proposed design solutions, but which in contemporary terms now extend to ‘virtual reality’ models. The use of computer-based models has stimulated a wealth of

research into design processes” (Cross, 2006, p.101) – which is essential to design knowledge – making it possible to alter designs without erasing and redrawing.

Also, these 3D digital technologies offer a "close up high resolution" whereby I can magnify certain elements of the traditional ebreeq, which facilitates looking into specific design details. In addition, a 3D ebreeq model can be rotated on any axis, much as one could rotate an actual three-dimensional model in one's hand, enabling a richer sense of the traditional ebreeq (Figure 68).



Figure 68 3D ebreeq: three- dimensional high resolution model with water

Using these 3D technologies provides remarkable advantages to the documentation, recreation and analysis of the traditional ebreeq. Also, the use of these 3D technologies with my investigation of the traditional ebreeq facilitated the appropriate documentation and the collection of precise data and metadata that can be easily used, analyzed, investigated and archived at a later stage. Furthermore, it enhances ways of preserving and working with the traditional ebreeq using CAM/CAD and 3D printing without causing any damage to the traditional ebreeq.

My investigation into how these 3D technologies allow innovative methods to access traditional assets and traditional information transforms the approaches of individuals and scholars towards traditional objects. On the one hand, this enriches the interaction between a person and traditional objects and, on the other, preserves the physical integrity of the original objects. In brief, it is noted in “3D Technology in the Restoration of History” that these 3D technologies introduce a new sensory dimension into museums and contribute to the understanding of cultural objects through the creation of complex shapes, new designs, the expansion of research and the preservation of artefacts and cultural objects. For example, the recreation of ruined monuments in cities that have suffered from attacks and destruction can preserve its heritage. There becomes a tangible interaction with the past made possible in a manner that would not have been achievable before (2017, para. 1-5).

As elaborated in the above article, in addition to restorations of ancient monuments in the Middle Eastern region (including the city of Palmyra), 3D printing has also been used in Peru. With the use of 3D technology, specifically 3D virtual reality scanning, the mummified remains of the Lady of Cao (one of the first identified rulers of the Moche civilization) were scanned and a 3D image of her was recreated. Milagros Arquíñigo from the Fundación Wise states that this project was accomplished together with a team of experts consisting of archaeologists, anthropologists, forensic scientists, dentists and 3D technology engineers (“3D Technology in the Restoration of History”, 2017, para. 7). 3D printing was also used in France to restore items that were stolen or ruined during the French revolution. Some of these pieces belonged to the ruling monarchs of France at the time. More specifically, the Victoria & Albert Museum in London conducted a project to recreate a chair that was once owned by Marie Antoinette by

scanning the missing parts, [and] they were then able to reverse 3D print them. Using moldings taken from the 3D printed pieces, they were then able to recast it in a non-chemical material. This was then toned and gilded so that it would match the original pieces. (“3D Technology in the Restoration of History”, 2017, para. 8)

These examples demonstrate how 3D technologies enable the reproduction, restoration and representation of traditional objects; they expand the boundaries of research and practice as well. Indeed, 3D technologies change how objects are studied (“3D Technology in the Restoration of History”, 2017, para. 13). Despite

the often limited access to museums because of distance or time, the object being studied becomes more accessible, facilitating the combined use traditional tools of production with the utilization of 3D technologies.

While these examples represent new ways of presenting and studying the pre-existing traditional ebreeq, the following question is raised: How can I move beyond this type of investigation towards “invigorating” the traditional ebreeq? In other words, the question is how to sustain the ebreeq using 3D technologies to modify, redesign and produce the neo ebreeq based on the original or traditional ebreeq, while connecting the object’s cultural values with a contemporary context. This would invigorate the cultural value of the ebreeq through the creation of hybrid material forms that can relate to both the past and the present.

4.2.2. Invigorating Traditional Objects Using 3D Digital Technologies

In the process of my research, I was fascinated by 3D digital technologies that aid designers to invigorate traditional objects, particularly within one’s home or studio. These 3D technologies are aiding present and future designers to merge the past with the present. This aspect of my research led me to the formulation of three types of possible relations between digital and traditional functions to invigorate traditional objects. The relationship may be enhancing, extending or altering through the object’s new digital technology. Furthermore, these relationships can serve as methods to better guide the neo ebreeq design pedagogy.

Herbert Read stated in 1936 that ‘*The real problem is not to adapt machine production to the aesthetics of handicraft, but to think out new aesthetic standards for new methods of production.*’ (“Artefacts of a New History”, 2016, para. 1)

Jonathan Keep is an artist known for his 3D printed porcelain pieces (Figure 69). His work is often received with criticism by the public. He says that the public is perplexed with the idea of a machine making ceramics – ceramics being a field associated with the handmade – and they question the extent of creativity involved in the process. However, Keep explains that the potter’s wheel used for throwing clay is a machine at the disposal of artists as well, whose creativity in *how* they use it stands as a more significant feature in the process of making. He compares 3D printing to digital layer-by-layer coil building, similar to the method used to produce a traditional African pot.

Like Jonathan Keep's work, my new design of the traditional ebreeq is not inclusive of the handmade element and the use of the customary clay, as it has been for centuries; similarly, creativity of machines and technology could also be questioned in crafts, especially when intended for a reinvigoration project. On the other hand, Keep considers technology as a working tool the way I used motion design and 3D technology as an instrument of making in the creating and design process, contrary to employing it as an end in itself. In addition, his comparison of 3D printing to the coiling technique of traditional pots extends its relevance to the observed and recorded layering of the movement of water shaping the neo ebreeq.



Figure 69 Sculpture by Jonathan Keep (left) using ceramic 3D printer (right)
Image retrieved from Design-milk
https://design-milk.com/artist-jonathan-keep-sculpts-pottery-using-ceramic-3d-printer/3d-ceramic_pottery_printer/

3D printing technology is transforming the method in which design objects are created; it is also transforming the field of product design. Tamaryn Greer has addressed numerous industrial designers and artists, including Professor Keith Brown²³ and Jonathan Keep, concerning the way this new technology is being used nowadays, and how it's suitable in respect to the traditional tools for

²³ Keith Brown, professor of Sculpture and Digital Technologies at the Manchester Metropolitan University

industrial designers and artist (“3D Printing Then and Now”, 2013, para. 1). Professor Keith Brown uses 3D CAD modelling software as a digital approach to designing 3D sculptures of complex flowing wave-like forms. His design took the form of 3D computer generated animation, video and installation. He considers that “[...] art occurs in the modelling process, where one’s senses are applied intuitively, along with emotion and intellectual accompaniment.’ ‘It’s not so much the qualities of the process or materials themselves but rather what one does with them” (2013, para. 3). Brown’s first 3D print in 1997, an object called *Continuity of Form* was printed using Durafoam (Figure 70).



Figure 70 Continuity of Form 3D printed using Durafoam
Image retrieved from Creative feel
<https://creativefeel.co.za/2017/02/3d-printing-now/>

Following on from Brown’s perception of 3D technology within the field of art and making in general, the creativity of the neo ebreeq design derives from the modelling process while studying the motion of water as an element directing the reinvigorated design which does not negate the fundamental egg-shape form of the traditional ebreeq. In other words, the design of the neo ebreeq is made to be used by holding it above the head and drink from it without spilling water or the lips touching the spout. Moreover, the new design, the spout in particular, is also redesigned to hinder spillage of water when drinking. Thus, the final outcome of the neo ebreeq is a product accompanied with my intellectual knowledge of the

value as well as the historical and cultural background of the ebreeq, while intuitively maintaining the emotional experience of drinking from it.

A. Enhancing the Object's Original Function and Form

Examples that involve enhancing an object's original function and form through a new digital technology may be found, for instance, in the work of Tavs Jørgensen and Michael Eden. Jørgensen, a designer who works with ceramics and glass, addresses how potters rarely use digital technologies; moreover, such technologies are typically viewed as inherently opposing the handmade value in making ceramics. However, Jørgensen offers reflections on digital methods and outcomes, sharing concerns about human agency and the mark making inherent in the process. His early work unfolded 3D digital models into 2D patterns which were used to enhance the production of molds, through a strong digital aesthetic from the layering process of rapid prototyping machines and the use of CAD (Computer Aided Design software) (Figure 71).



Figure 71 'Ceramic Origami' vases by Tavs Jørgensen
Image retrieved from Binary Tools
file:///C:/Users/Michael%20Kramer/Downloads/230-237-1-PB%20(1).pdf

Michael Eden, a practicing ceramic artist for over twenty years who has used 3D printing in his work, is another designer/maker who relates to enhancing a traditional object's function and form. Before undertaking an MPhil at the Royal College of Art (RCA), Eden worked as a potter, selling functional and decorative ceramic wares to shops. With a growing interest in digital technologies, he began

using CAD software as a design tool for exploring and enhancing the form of traditional objects.

Eden invigorated and redesigned a traditional ceramic tureen, originally designed by Josiah Wedgwood²⁴, by enhancing the form of this iconic symbol of the industrial revolution. He redesigned the tureen using CAD software (Rhino), giving it a delicately pierced surface inspired by the bone structure and the natural objects used by Wedgwood and his contemporaries as a source of inspiration (Figure 72). The work was fabricated by the use of a 3D printer and then coated in a composite ceramic material to alter the surface appearance. The ceramic coating was formulated to closely resemble and enhance the appearance of Wedgwood's black basaltware.

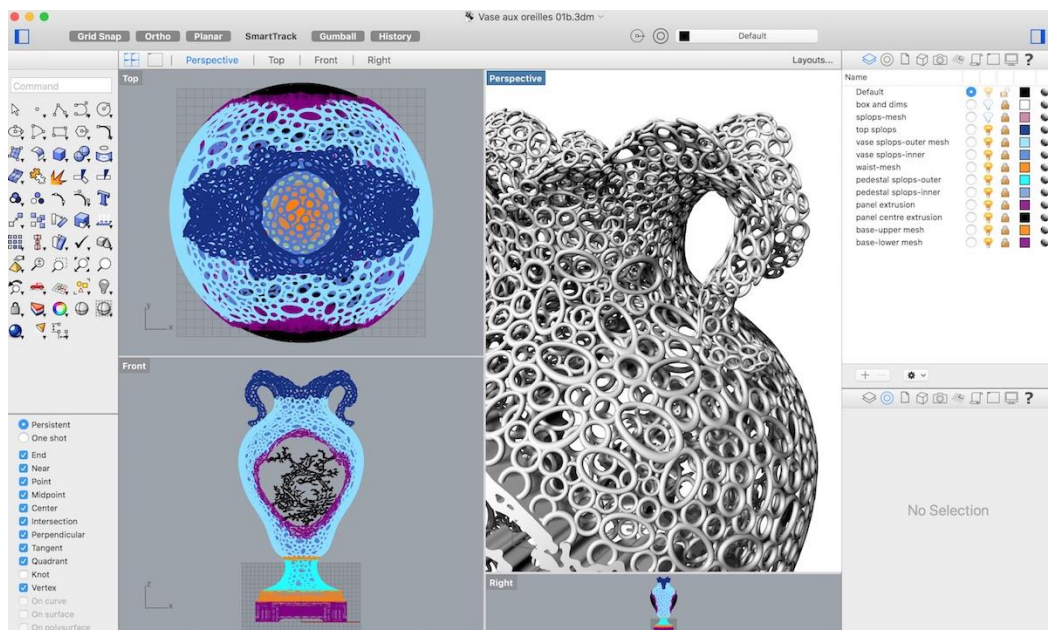


Figure 72 Caillouté Vase design by Michael Eden, using Rhino3D CAD programme
Image retrieved from Journal 18
<http://www.journal18.org/nq/artists-notes-form-transform-at-waddesdon-manor-by-michael-eden/>

Jørgensen's observation regarding the tendency of potters not to employ digital technologies in their work is also valid for traditional Lebanese potters, mostly located in rural areas, who have not experimented with alternative methods in their pottery production especially one that involves modern technology. Other than the turning wheel, the machinery they use is limited to the preparation of clay for throwing. Apart from the uninterrupted handmade production of ceramics, these potters have not been introduced or trained to alternative methods and techniques of pottery making, all of which reflect back on the declined use of the ebreeq in

²⁴ Josiah Wedgwood (1730-1795) was an English pottery designer and manufacturer.

today's households. As in Jørgensen's work, developing the prototypes and finally reaching the aesthetic and functional design of the neo ebreeq was facilitated and made possible through the integration of 3D digital models enhancing the function and form of the traditional ebreeq. On the other hand, like Eden's invigorated tureen, the design of the neo ebreeq reimagined its appearance, but also maintained the essential egg-shape, the extended neck and the spout of the traditional ebreeq through the use of 3D printing and CAD software among others.

While these examples tackle enhancing the design of pre-existing traditional objects, the following question is raised: How can I move beyond this type of invigorating or studying towards *extending the object's original function and form*, which is the traditional ebreeq in this case? In other words, the question addresses the method of how to sustain the ebreeq using 3D technologies to modify, redesign and produce the neo ebreeq; the neo ebreeq is thus based on the original or traditional ebreeq, while connecting the object's cultural values with a contemporary context.

B. Extending the Object's Original Function and Form

These selected examples which extend an object's original function and form through a new digital technology may be seen in the work of Michael Eden, Amit Zoran and Isaïe Bloch.

As mentioned above, Michael Eden's design of the *Caillouté Vase* (Figure 72) enhances the original function and form of a traditional ceramic tureen; however, his iconic *Wedgwoodn't Tureen* (Figure 73) extends the function and form of the tureen in question. The design forms based on the classic piece of Josiah Wedgwood pottery are re-imagined and instilled with a new significance, resulting in a range of objects that could not have been made purely with conventional manual or industrial ceramic process, and creating traditional slip-prototyping technologies that revolutionized his work. Exploring the transition from manual to digital skills and the amalgamation of the two processes, Eden developed a signature style using computer modeling and selective laser-sintering in polyamide nylon. The *Innovo Vase* (Figure 73) reinterpreted the *Stowe Vase*, an ancient Roman marble vase, and Eden's exceptionally detailed resultant piece is one of his most intricate and complex to date (Johnston, 2017).



Figure 73 The *Wedgwoodn't Tureen* (left) and the *Innovo Vase* (right)
Image retrieved from *Digital Handmade* by Lucy Johnston

Eden's tureens are objects that are representative of history and carry the legacy of Wedgwood pottery which certainly makes their invigoration worthwhile; the same applies to the ebreeq, an icon of Lebanese history and cultural heritage, which deserves to be reintroduced to our contemporary society.

Second, Zoran's contemporary 3D printing extends the possibilities of traditional craft, enabling projects and designs that are not feasible with conventional methods of making. As explained in his article "Hybrid Basketry: Interweaving Digital Practice within Contemporary Craft," Zoran developed hybrid basketry using a medium wherein 3D-printed structures were shaped to allow the extension of the growth and development of hand-woven patterns. In other words, *Basket IV* combines Nylon 12 filament for 3D printing, jute, canvas ropes, pigments, and a rosewood plate (Figure 74). He writes:

archetypical artifacts are created using craft and fabrication tools and then transformed through intentional breakage and digital restoration. We argue that this is a new kind of craft process that provides insight into the relationships among traditional craft, modern technology, art and design. (Zoran and Buechley, 2013, p. 5)



Figure 74 Hybrid Basketry
Image retrieved from A Difference in Making
<http://catalogue.a-difference-in-making.com/hybrid-basketry/>

Zoran's work explores and extends the interrelation between 3D digital technologies and traditional craft. By merging these qualities, a hybrid is created where one is extended into the other. 3D software (CAD), scanning and printing (CAM) enables one to extend the making of forms and structures that would be impossible by hand, thereby opening an innovative design outcome. Specifically, he investigated the merging of 3D digital technology and the South African traditional woven pattern. The outcome integrated complex hybrid contemporary parametric forms, which would have been otherwise impossible with traditional tools. In this example, the 3D digital technological methodology and investigation aided my research in exploring the ebreeq's form and structure that extends from the traditional way of making (which involves organic complex fluid forms) to 3D printing.

Lastly Isaïa Bloch's Chroma designs (Figure 75) is a ceramic vase series that extends the objects' original form and develops this with the aid of 3D printing techniques as well. Designing the Chroma series shares a commonality with Zoran's approach towards extending an object's original form and challenging "the traditional conception of 3D printing by hybridizing it with traditional forms of ceramic casting" (Eragatory, 2013, para 1). However, while Zoran combines materials used in traditional weaving (like jute and canvas rope) along with 3D printed parts of the basket, Bloch's design of the Chroma series extends the method of layered surfacing achieved by digital 3D technology and the boundaries of standard design and manufacturing methods.



Figure 75 Chroma vases
Image retrieved from Eragatory
<https://www.eragatory.com/Chroma>

Through the Chroma series, Bloch's intention was to present contradictions that are translated into a final product and an expression of a paradox: the smooth surface of the object is diverged by adding detailed moments captured in high resolution to it. Bloch challenges and extends from traditional form; he also extends the use of material expressions and multiple interpretations of the objects' form and material through the use of digital design tools and 3D printing as part of the design and manufacturing process, but not as a final product.

The final design outcome was extended by the 3D printed prototype and facilitated the production of the external complex geometric forms, which were six piece block molds for traditional ceramic slip casting at a later stage. Despite the fact that the process of the Chroma series began by means of 3D technology, the outcome lent itself to differentiate each item through material behaviour rather than shifting the geometric shape itself (Eragatory, 2013).

The design of the neo ebreeq extends the form of the traditional ebreeq and makes it a hybrid product as well. The neo ebreeq is without the handle which the traditional ebreeq has; the spout is not attached separately the way potters do, but it is an integral element of the shape of its new design. In other words, I have extended the form of the traditional ebreeq based on its original form while maintaining its identity. In addition, the paradoxical aspect of the neo ebreeq is that its smooth surface is shaped according to the internal complex geometric forms and created by the layered surfacing of water captured by 3D technology.

These selected examples demonstrate how digital technologies as design methodological tools could extend creative practices using 3D CAD/CAM to design models of my neo ebreeq as a traditional object. Furthermore, 3D printing (CAM) was used as a rapid prototyping tool to produce the neo ebreeq; this is in contrast to traditional tools of prototyping such as engraving, cutting and drilling methods which can limit the production of highly complex design forms, besides being ineffective and wasteful of materials. Also, these examples invigorating traditional objects were characterized by the approaches of 3D digital technology for production, but do not relate to invigorating their projects through the use of motion design and 3D CAD/CAM technology.

C. Invigorating the Object's Original Function and Form through Motion Design

Selected examples invigorating the object's original function and form through the use of motion in today's context, which is associated with Futurism as mentioned earlier in Chapter 3, include Cedric Ragot and Eyal Gever who experimented with using digital technology to demonstrate motion in a 3D still object. Ragot's Hyper Fast vase, described as "a solid surface molding," ("Hyper Fast", 2003, para. 1) is a project that represents the concept of a classic Ming vase captured in time through digital acceleration (Figure 76). The single blur of each smooth shape was thoroughly rendered and produced using conventional casting and the intricate process of 3D printing.



Figure 76 Hyper Fast
Image retrieved from Cédric Ragot Design Studio
http://www.cedricragot.com/projects-hyper-fast-ymer-malta-19.html#i_0

Similarly, through the use of CAD and 3D video capture technology, Eyal Gever created an abstract 3D printed artwork of two fighters filtered through custom software to produce the piece as if frozen in time (Figure 77). He has also created sculptures from a variety of simulated events from a balloon bursting to waterfalls (Figure 78), preserving the moment of action in “states where rest and motion exist together’ — in an abstracted sculpture born from a computer simulation of the event” (Holmes, 2014, para. 3). Although the neo ebreeq does not demonstrate a surface capturing acceleration, it is shaped to be in a state of rest based on the multiple depiction of water motion captured in high resolution.



Figure 77 3D video capture (left) and Eyal Gever's 3D printed sculpture of two fighters (right)
Image retrieved from Vice
https://www.vice.com/en_us/article/bmymk5/a-kick-to-the-chest-gets-frozen-as-a-3d-printed-motion-sculpture



Figure 78 Sphere Pop (left) and Waterfall (right)
Images retrieved from 3D Print and from Sculpteo
<https://3dprint.com/27130/sublime-moments-3d-sculpted/>
<https://www.sculpteo.com/blog/2012/01/27/eyal-gever-pushing-the-limits-of-3d-printing/>

Other projects adopt the conceptual approach of ‘Design in Motion’ reveal the morphing of the form over time, including the *Gravity Vases* series by Hool and the *Iceberg Field* by Jonathan Keep. As indicated in the name, the vases created by Hool embrace gravity as the shaping factor of form over a period of time (“Gravity”, n.d.). By applying the basic animation technique known as ‘blend model shape’, the left and right vases are known as key pose frames A & B correspondingly, while the middle vase is their in-between (Figure 79). After 3D clay printers produce the object, they are traditionally glazed and fired in a kiln. This example demonstrates how a basic animation technique with 3D digital technologies as the production methodological tool could extend creative practices using 3D CAD to design vases that capture motion as a sequence. Furthermore, 3D printing was used, as a rapid prototyping tool, in parallel with traditional production tools and materials such as clay, glazing and having the items traditionally fired. Considering this within the context of the neo ebreeq, it should be noted here that although I will not be printing it in ceramic at the moment, this is a technical element that I will implement to future versions of the neo ebreeq.



Figure 79 The Gravity Vases
Image retrieved from Hool
<https://www.thehool.com/shop/gravity>

In the case of *Iceberg Field*, Keep produced this artwork using distinctive algorithms which have an integral randomness programmed according to the feature of the natural iceberg formation (Figure 80). His porcelain pots have an underlying coded structure and logic, that are based on algorithm expended to generate forms and structure that have inbuilt randomness, similar to the algorithmic logic of the natural structures of icebergs that computer code can mimic. The cumulative layering of the 3D printer’s extrusion evokes the glacial

strata of icebergs, and offers a sense of process and time, imitating the formation of icebergs. This sense of process and time is also a common dimension in the ebreeq in terms of the dynamism of the water and the process of its interaction with the user captured in the D.E.F. conditions.



Figure 80 Jonathan Keep's *Iceberg Field*
Image retrieved from Classic feel
<http://www.keep-art.co.uk/Journal/Classicfeel%27sDec2013.pdf>

Furthermore, the correlation between traditional wheel thrown pottery techniques with 3D digital technologies (merging of craft and digital making) becomes tangible in another of Johnathan Keep's projects; in collaboration with Unfold studio, he constructed and created ceramic paste extrusion 3D printing, resulting in an installation piece entitled *L'Artisan Electronique*²⁵. The installation was displayed with a simulated potter's wheel combining 3D CAD/CAM digital motion capture technology. Visitors were invited to 'sculpt' using a spinning lump of virtual material by moving their hands through a laser which detected the movement communicated in virtual space, invigorating traditional way of making through new technology that detects motion (Figure 81). Finally, the printer would trace and then print the invigorated form while the participant could view the process of making (Figures 82-83).

²⁵ *L'Artisan Electronique* is an installation in collaboration with Tim Knapen and commissioned for the exhibition Design by Performance by Z33, house for contemporary art. With support from Bits from Bytes and the RepRap community.



Figure 81 Throwing a digital vase
Image retrieved from Unfold
<http://unfold.be/pages/l-artisan-electronique>



Figure 82 Visual pottery wheel
Image retrieved from Unfold
<http://unfold.be/pages/l-artisan-electronique>

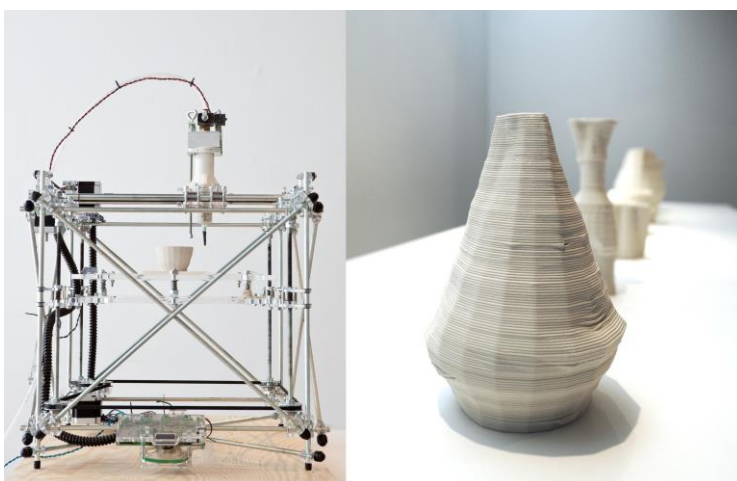


Figure 83 Ceramics 3D printer (left) and the 3D printed vase (right)
Image retrieved from Unfold
<http://unfold.be/pages/l-artisan-electronique>

The digitally recorded movement of the visitors' hands is used in the process of creating forms of vases. This movement of the hands is fundamentally identical to the hand movement of a traditional craftsman making pottery. The element of motion shaping an object is translated in the design process of the neo ebreeq, focusing on the movement of water in the ebreeq instead. In the former, the motion of the visitors' hands is observed as the shaping element of the object. Similarly, the design of the neo ebreeq is influenced with an element shaping its form; however, the observed element lies on the motion of water instead. In addition, my project observes and records multiple moments of interaction with the object instead of a single moment when a visitor creates a design.

A very similar conceptual approach is featured in the work of Tavs Jørgensen, who (in 2007) sought to “humanise digital technology”, through spontaneous movement using 3D technology that is transformed into 3D object prototypes (Jackson, 2007, para. 8). He co-opted a digitizing arm, a free hand tool device for scanning 3D digital drawings by recording movements to invigorate new forms with fluid spontaneous movements, which were then transformed into 3D objects through rapid 3D printing prototyping. This idea of the process of making pottery through time is documented and used through “collaboration between digitally recorded movement and the innate physical properties [for invigorating objects]” (Jackson, 2007, para. 8). Apart from Jørgensen’s choice of the hand device used for scanning, his methodology and application of 3D technology to record fluid spontaneous motion through time is an accurate descriptive representation of the design process to invigorate new forms leading to creation of the neo ebreeq.

GT2P (Great Things to People) is a design studio based in Chile which produced *The Tarrugao Collection*. *Tarrugao* – which in Spanish means “being wrinkled” – are artworks that capture moments taking into consideration the location and pressure they are objected to (Figure 84). The studio questions whether objects could capture a fleeting action or react upon being in contact with people (“Tarrugao Collection”, 2013, para. 1). The Catenary Pottery Printer (Figure 86) is among the techniques they use to produce unconventional items. Liquid clay is poured into the sheets of muslin hanging from the wooden frame, whereby the draining clay drips into a container and the remaining layer of clay in the cloth hardens to become a small dish.

Where a digital approach to parametric design would create an algorithm in response to a given data set and generate forms accordingly, the analogue approach seeks to generate forms based on the behaviour of the clay and muslin in response to a set of physical conditions. (Bennes, 2014, para. 4)

Consequently, the pressure produces a soft wrinkled area awaiting contact with people. The designers of the Chile-based studio write that:

Its DNA of design starts on a surface of revolution, which is cropped successively to control their development. The resulting cuts are duplicated, scaled and subdivided into points. The combination of the points of the original lines and the scaled ones creates “wrinkled” curves. These wrinkles are more pronounced where the fact of taking the object is present. With the wrinkles the surface is reconstructed and finally softened. This collection explores from parametric design and rapid prototyping the potential of local handcraft porcelain, a technique that tends to be increasingly forgotten in Chile. (“Tarrugao Collection”, 2013, para. 4-5).

On the other hand, the Tarrugao Collection is a representation of the passing existence of life through a solid material whereby each item responds to the act of human interaction and embracing each of the items becomes materialized. “The geometric features of all pieces together form a ‘still life’ of parameterized objects of daily use” (“Tarrugao Collection”, 2013, para. 2) (Figure 85).



Figure 84 Tarrugao Collection
Image retrieved from GT2P
<https://www.iconeye.com/design/news/item/10222-design-studio-gt2p>

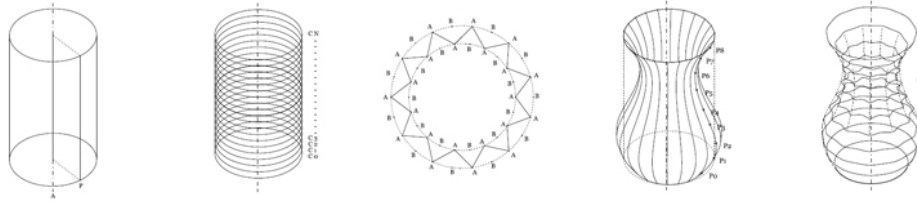


Figure 85 The geometric features of the Tarrugao collection
 Image retrieved from GT2P
<https://www.gt2p.com/Tarrugao-Collection>



Figure 86 Catenary Pottery Printer
 Image retrieved from Icon
<https://www.iconeye.com/design/news/item/10222-design-studio-gt2p>

Thereby, the act of human interaction in drinking from the ebreeq is materialized in the neo ebreeq through digital technology as the motion of water during the process establishes its invigorated design. In other words, the algorithm and method of production of the *Tarrugao Collection* is parallel to the making of the neo ebreeq which, similar to the interaction of the clay with the muslin based on set of conditions, derives from the interaction of the person drinking with the ebreeq and, in return, from the interaction of the water with the ebreeq in multiple moments in time and the conditions of drinking from it, emptying and filling it.

Like this local handcraft which is progressively becoming obsolete, the production of clay pottery in general and that of the ebreeq in particular has a similar status in Lebanon; however, the invigoration of the traditional ebreeq through motion design and prompt prototyping using 3D printing shares the same comprehension as the *Tarrugao Collection*.

Moreover, Del Harrow and Geoffrey Mann are artists who created art pieces representing traits of personification like human breathing and vocal expression or sound capture in the realm of motion design. In *Air-breath*, Harrow approaches the notion of breathing pottery, noting that “breath” itself is a word frequently used by craftsmen to refer to the shape and dimension of an artwork. To begin with, he selected two pots from the many vessels in the collection of Victoria and Albert Museum, London, whereby each item demonstrated the process of breathing in and out. He later produced a series of pots that capture a sequence of moments in the process of breathing, moving from one far end to the other (Figure 87). The sequence of these moments is compatible with the experience of using the ebreeq, in other words drinking from it, emptying it and filling it. Following a CAD animation of the digital breathing of the pot, a 3D file thoroughly put every single one of these captured moments taken from the animation into detail, making the set of shapes (Harrow, 2015).



Figure 87 Air-Breath 2012, slip cast porcelain, glaze, video, large drawing created using a graphite pencil attached to a CNC milling machine
Image retrieved from Studio Potter
<https://studiopotter.org/towards-aesthetic-digital-clay>

Like Del Harrow, Geoffrey Mann's work extends the animation of objects through a connection with the human condition, making *The secret Life of Shadows* an expression of the narrative and the invisible bodily distress that an item experiences in the process of making (Figure 88). This project looks into the appearance of items when given human attributes and how they feel when in use to look into the spirit of the object. "Thinking of objects as things that have moods, gestures and attitudes is an important thought in the worlds of art, architecture, craft and product design. This is certainly true in a world of things that are becoming more generic, disposable and alienating" (Mann, 2013, para. 1).



Figure 88 The Secret Life of Shadows, 2013
Image retrieved from Geoffrey Mann Studio
<http://geoffreymann.com/theseconlifeofshadows>

This personification of a product – particularly the ebreeq – comes across in a literary writing in Arabic where the ebreeq addresses a female customer telling her about the distress it had to go through before transforming from a lump of clay to a remarkable piece of ceramics. The ebreeq narrates saying: When I was still a handful of soil, a man put me in water and started to knead me; I screamed and begged that he would let me go. Later, he threw me on a wheel that started to rotate me round and round. He still wouldn't answer my on-going plead. After studying me, he put me in an oven, ignoring my cries of pain. The man took me out and put me on a shelf; this time, though, he started to draw colorful designs on me and, even worse, put me in an even hotter oven. All the while when I cried for mercy, he told me: "It is not yet time for you to see what you shall become." Finally, when he took me out of the oven and put me back on the shelf, he held a

mirror to me and said: “Aching grains of soil, look and see what you have become” (“You Know the Story of the Clay Ebreeq”, 2015).

Max Fraser says that there are a number of creators who use technologies related to sound capture in the making of their work, as is the case with Geoffrey Mann's teapot from the Cross-fire collection (Crafts Council, 2010) (Figure 89).



Figure 89 Glassware (left) and the teapot (right) from the Cross-fire collection
Image retrieved from Geoffrey Mann Studio
<http://geoffreymann.com/crossfire/>

Mann imitated the sound waves of an accelerating marital dispute of two characters from the movie *American Beauty* and the emotions that arise from it; the sound waves are represented to give the impression that they go around the table affecting the form of the objects set for a meal, including a teapot. In the course of the argument, “the intensity of the conversation deforms their once static existence into objects of unseen familiarity” (Mann, 2010, para. 2). This captures the undetectable moments in people’s routines and materializes in objects which would not have been feasible without digital technologies (2010). It is important to note here that undetectable moments in time were also created in relation to drinking from the ebreeq and were captured with technology, which otherwise would not have been possible to achieve with traditional tools. Furthermore, the Cross-fire project focuses on the elusive characteristics of a verbal conversation and examines the hidden influence of sound upon its occupied surrounding, turning sound waves into form²⁶.

²⁶ To view the above film visit: <https://vimeo.com/9256428>

The above selected examples illustrate methodological approaches and techniques referred to as motion capture. These approaches have influenced my redesign of the ebreeq. It was 3D scanned and filmed through motion simulation of form and the interaction of water inside the traditional ebreeq. A point nodes creating 3D algorithms were used to define the ebreeq's surface (static) and in movement while in use (dynamic). Then, another 3D software turned that point nodes of algorithms into a mesh of interconnected polygons, just like the wireframes that make up the characters in 3D computer animation movies. This mesh was manipulated and modified onscreen to generate multiple 3D typologies and sectioning, depending on the extracted moment in time. I applied this to the production of the neo ebreeq, whereby I used a mesh of typology of water from the traditional ebreeq while it was in use, enabling me generate and modify multiple forms. Also, this conceptual method of understanding the emotional and the gesture quality of interaction and the qualities of movement behavior of the water within the traditional ebreeq creates a unique approach involving methods of unfolding moments of the past and the present to produce a new design of the ebreeq.

Could this approach of looking at the sequential frames (process and time) investigation of a person's interaction with the traditional ebreeq while in use form a wider state of time to become a sequential unfolding of the past, the present and the future, creating the neo ebreeq while retaining the traditional form?

The projects discussed above have been influential in my development of the design of the neo ebreeq. Like Ragot's and Gever's use of 3D video capture technology to represent arrested motion through an object, the neo ebreeq is designed based on the simulated and captured in-between moments of drinking and the movement of water. Like the *Gravity Vases* by Hool, the neo ebreeq offers the possibility of rapid prototyping combined with traditional production; in addition, Hool's vases and the *Iceberg Field* by Jonathan Keep represent the process of morphing of form over time by means of 3D digital technologies as evident in the captured D.E.F. condition of the dynamism of water in the ebreeq. On the other hand, like Jonathan Keep's artwork and the initiative of digitally molding vases, the neo ebreeq is designed based on the association of traditional making of the ebreeq (in terms of the functionality of its egg-shaped form) and of the digital technologies and 3D printing, especially when printing in clay: like the potter's

wheel, 3D printing gradually produces the item in question in an upward rotating manner until completion. This builds on Tavs Jørgensen's work in terms of the collaboration of digitally recording motion with the distinctive characteristics of the object being invigorated. The role of 3D scanning – transforming real objects into 3D models – is reflected in capturing an object through filming and further transforming the obtained 3D model through digital technology.

Moreover, the interaction between the person drinking and the ebreeq captured in the D.E.F. condition (Drinking, Emptying, Filling) employs a similar interaction to the Tarrugao collection. This sense of human presence comes across in the personification of Del Harrow's and Geoffrey Mann's artwork. Harrow's series represents a sequence of moments while breathing; this sequence is evident in the moments of drinking, emptying and filling an ebreeq captured through digital software, transforming animation to form. As mentioned above, technology enabled the animation, sound capture and the documentation of sound waves in Geoffrey Mann's work; it affects the shape of the object through undetectable moments, which is complementary to the design of the neo ebreeq. The technology used is fundamental to creating and capturing the invisible in-between moments and making them visible.

Lastly, it should be noted that the application of 3D technology facilitated the motion design process and developed the methods to attend to 3D soft and hard modelling.

4.3. Neo Ebreeq Production: Amalgamation of Moments to Form

When designing in motion, I needed to explore and identify different programs and digital tools that could be used within the design process. It was important to design in 3D (time and movement) from an early stage in the process, as movement is a sequence and not static; therefore, fundamental techniques in motion design (such as frame-by-frame moments) have been modified and are presented as a set of 2D photography and filming techniques as a first stage.

As a second stage, I used 3D digital technologies. Through my research, I realized that 3D digital technologies could aid the motion design practice to develop

innovative tools and techniques to manipulate sequence, frames, typology and 3D soft and hard modeling.

The third stage was looking at properties using 3D CAD software for reenacting water stimulation, modeling, 3D typology and sectioning of movement, which became a fundamental vision of the breakdown of movement into key parts. As a result of studying this breakdown of movement, I quickly realized that special emphasis of each moment of the traditional ebreeq while in use is necessary in terms of the sequential unfolding for comprehending and manipulating qualities of movement within the traditional ebreeq's form in context.

The above three stages comprise an overview of methods, approaches and techniques that derived from the research process, representing the key phases of designing, starting from the water movement inside the traditional ebreeq and ending with the neo ebreeq. Consequently, the neo ebreeq is visualized as a cross-pollination of the interaction of the traditional ebreeq with water improvisation and choreography inside it. Design through movement of the water becomes as a systematic embodiment of 'Sequential Unfolding'.

Both the design process and the design outcome are approached through sequential unfolding of the water interaction while the traditional ebreeq is in use. This unfolding integrates the human gestural involvement, and the expression of materiality and dynamic quality. Using the water flow was an explorative approach which developed through practical experience and 3D experimentation that is embedded neither in a typical design research nor purely in a design practice; however, it involves both. In other words, while making an artifact or a product is a core characteristic of practice-based research, "it is equally important to recognize that practice-based research *is* research and not practice alone" (Candy and Edmonds, 2018, p. 68).

Thus, motion has to be maintained without the destruction of the traditional ebreeq as a static object. Basically, through adopting methods from locomotion and chronophotography, I came to a fundamental approach for redesigning and invigorating the traditional ebreeq by taking into consideration the inner and outer reality of the ebreeq and the water movement expressing the change of water, based on the interaction of the ebreeq while in use. Following the theory that

everything we see is an arrangement of what is occurring right now and what occurred an instant before, several “film-makers and animators refer to persistence of vision as a phenomenon whereby the human eye (and/or brain) always retains images for a fraction of a second” (Purves, 2010, p. 18). To investigate this, I created my home photography studio based on Marey’s method of production, using contemporary technology and photography equipment (Figure 90) as mentioned in Chapter 3.



Figure 90 Home studio photography and filming setup

My purpose was to render what is not seen to register the living sensation of the water’s movement that is rich with remarkable hidden depth and multiple emotive sources.

Hence, I could re-experience the dynamic sensation of the gesture while the ebreeq is in use. My aim was to render the dynamic result of the water while in use, that is the separation of the entire gesture and a rendering of the moment in which that gesture was created.

Also, these methods and theory helped me determine the graphic fluid forms obtained from water by separating each condition – the drinking, emptying and filling the water – which were highlighted by a typological graph, which adopted Marey’s method of highlighting parts to become more visible to the naked eye and creating a dematerialized graph.

I began this stage of my research with the presumption that I could use motion to simulate gestural behavior in the ebreeq’s new form. However, I realized that the ebreeq cannot represent gesture by itself; however, a person should rather introduce gesture while using the ebreeq, which creates water movement as a

response to the combination of the static and dynamic ambience of the ebreeq based on an anticipation of an equivalent behavior. I created a new typology of the traditional ebreeq using contemporary methods and processes, keeping in mind not to step too far away from people's current understanding of the traditional ebreeq's form.

So, I was not concerned with the literal reconstruction of movement, which was broken down and analyzed; on the contrary, I focused on the condition of the movement that produces gestural sensation while the ebreeq is in use. As mentioned above, the interaction with the traditional ebreeq that creates this emotional sensation can be divided into the three conditions of D.E.F. which are: D for drinking, E for emptying E, and F for filling F (Figure 91).

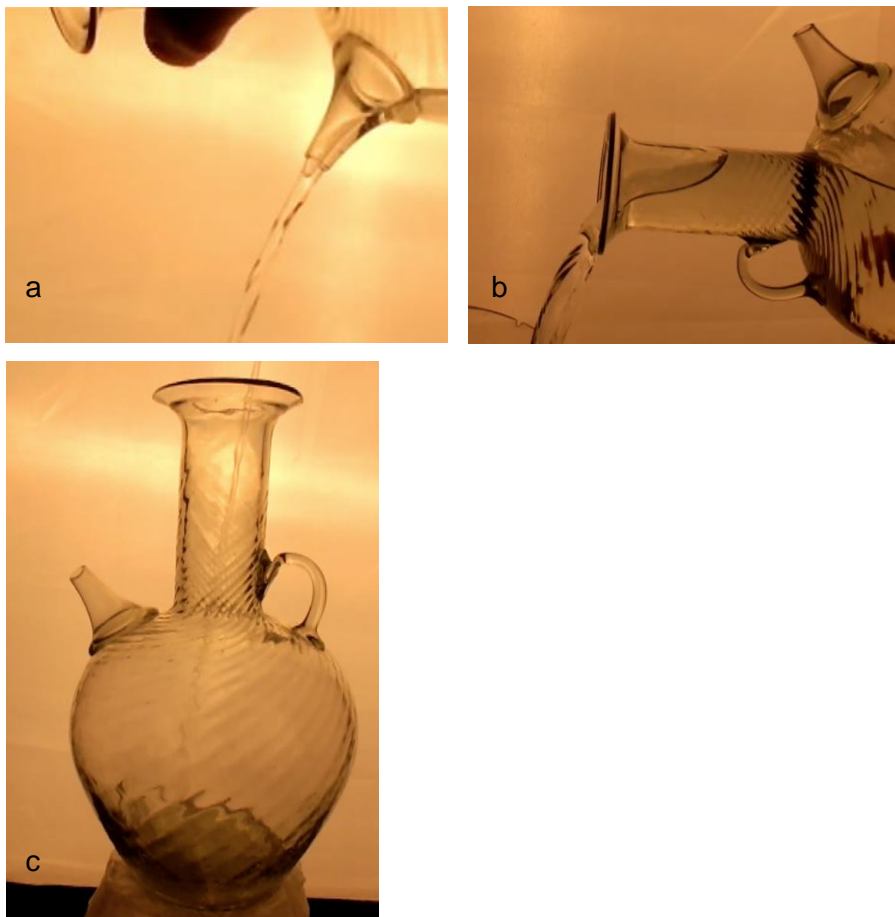


Figure 91 D.E.F. conditions of (a) Drinking, (b) Emptying and (c) Filling

4.3.1. Neo Ebreeq: CAD for 3D Design Prototype

The tools and techniques which were used for designing from the movement of water in the neo ebreeq are CAD (Computer-Aided Design) and CAM (Computer-Aided Manufacturing). CAD/CAM technology was used to design and manufacture 3D prototypes of the neo ebreeq. These are also the applications that were used to:

- Model the traditional ebreeq.
- Render and study the water movement.
- Design the neo ebreeq.
- Produce the neo ebreeq prototypes and 3D printing.

CAM software, such as Cura, uses the neo ebreeq prototype models created in CAD software to guide the 3D printer (CAM) to manufacture prototypes. The project progressed from the 2D photography and filming of the traditional ebreeq to its 3D modeling, using the CAD 3D Max software. At first, vertical and horizontal axes of the traditional ebreeq form were developed with accurate measurements and then transformed into 3D wire frame modeling. The wire frame is the initial rendering of 3D modeling, viewed as a fine line highlighted by a typological graph line contour of the ebreeq's exterior and interior surfaces. It connects the ebreeq's main vertices using straight lines and curves. It allowed me to easily navigate or rotate the ebreeq to a desired view without long delays with high rendering resolution (Figure 92).

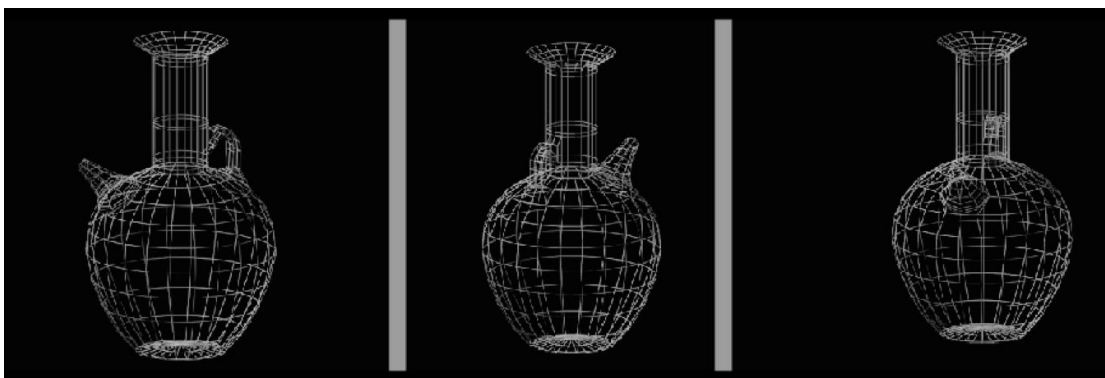


Figure 92 Wire frame of the ebreeq rotated to various angles

Furthermore, I studied the ebreeq to also have key frames that literally record the motion of the ebreeq. Like the study of locomotion and the theory of persistence of vision, my study indicates that the ebreeq and the water within have more to reveal than what is merely perceived by the naked eye.

This study stems from a personal reflection as a motion designer on the correlation between the space within the ebreeq being occupied by water and the typology of this fluid. This raises a question to be investigated: How does the ebreeq shape the water movement and how does the water movement in return affect the ebreeq? Researching these issues created the need to study the relationship between the ebreeq and the movement of water from within to experiment anew on it.

At first, I recorded each movement through chronophotography (locomotion) using 2D and 3D technology, which formed the core for the analysis of the structural and essential elements of the water movement when the ebreeq is in use. This is very similar to the traditional tools like locomotion and cinematography that analyze movement using shutters to create frames of the filmstrip. On the one hand, I used Muybridge's approach to extract frames that the naked eye could not capture, as was the case with the debate whether a horse lifts all four of its legs while running. On the other hand, modern technology gave me the advantage that was not available then; I depicted more than twice the amount of frames per second and used CAD/CAM to analyze form and movement in precise detail to make these moments in time visible.

Marey's system was also used in, for instance, the teaching of gymnastics; it captures only a few out of the hundred images that might trace a man while jumping, just enough to describe and to teach students the principal stages of a jump. Marey's system seizes and freezes the action in its principal stages that best serve its purpose. It, thus, makes visible a theory that could be equally presumed from a series of snapshots.

However, chronophotography does not render a figure's dematerialization and does not portray its rhythm, since it captures only occasional elements and cannot render any dynamic emotion. In contrast, I pursued the interior essence of the traditional ebreeq with the purity of the water movement with the flexibility of looking into the ebreeq from multiple perspective XYZ and the fourth dimension, (i.e. time), which was not feasible with Marey's method at that time. Considering each condition in motion, I could divide it through layers while still retaining the ebreeq's traditional structure.

The interconnected relationship between the movement and the behavior of water with the egg-shape form of the ebreeq is at the core of the redesign of the ebreeq as an invigorated product. This movement of water is common with Philips Design's hypothesis about elevating product behavior by looking into integrating designed physical movements to the present movement possibilities in a product (Feijs et al., 2005, p. 6).

To reveal the unseen, I used 3D MAX software to create a 3D simulation of the ebreeq in use and the flow of water re-enacting the drinking process. Afterwards, I used RealFlow 3D software, which enabled me to investigate the moving water; that was an innovative inspiration in terms of looking at the breakdown of the person's movement interacting with the traditional ebreeq and also the water movement while in use into key parts. This brought me to question what the main key interactions with the ebreeq are and how can these key gesture conditions affect the water inside of the traditional ebreeq.

Filling condition

The images below are based on 3D simulation animation of the water while being filled. It is important to mention here that the first step of a person's interaction with the ebreeq is filling it with water – the “F” Condition (Figure 93).



Figure 93 Filling the ebreeq and what happens to the water

Drinking condition

The second step is drinking from the ebreeq, based on my previous observation of motion photography and filming a person drinking (D) from the ebreeq (Figure 94).

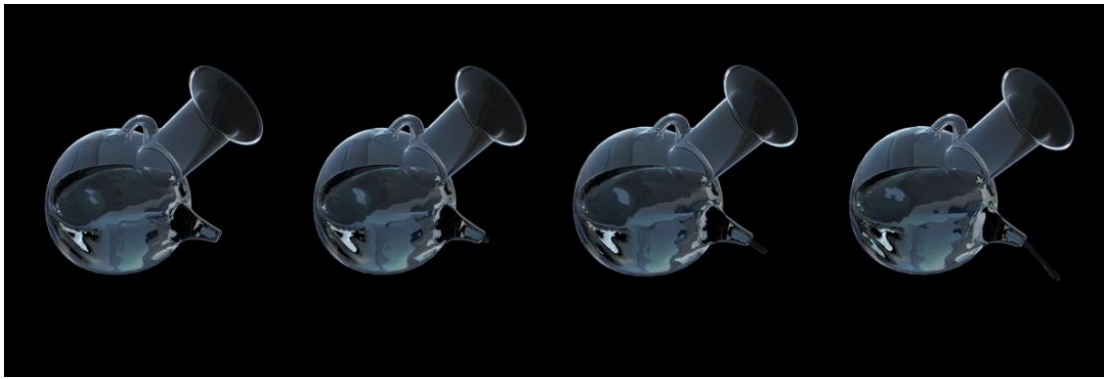


Figure 94 Drinking and what happens to the water

Emptying condition

The third step is emptying (E) the remaining water after filling and drinking from the ebreeq (Figure 95).



Figure 95 Emptying and what happens to the water

As a result, I examined the ebreeq's three-dimensional and animated visual characteristics through digital technologies to sequentially unfold the first moment of each condition. The result was a new visual language of overlapping, angular and three-dimensional organic forms, which were determined by the motion of water detached from the traditional ebreeq that produced them.

The new technology tools I used include high resolution 3D simulation of the water and the ebreeq along with high quality 3D solid modeling of pouring water, video simulation, using 3D Max and RealFlow 3D software. The frames were extracted through 3D software in order to study the water formation through space geometry principles, which are: vertex, edge, face, polygon and 3D mesh, typology and sectioning. This is in addition to the single extracted frame of 3D mesh of the pouring water, analyzing and investigating the water formation without the ebreeq. The polygon mesh (same as the 3D mesh) has proven to be easier to work with than the fully rendered 3D water simulation.

Through this investigation, I became aware of the necessary emphasis of products

design in order to comprehend and manipulate qualities of movement in the product based on traditional form. In brief, the use of these 3D technologies aided me to sequentially reveal and unfold features that are impossible to reveal with traditional tools. The use of motion design techniques with the help of these new technologies also facilitated the underlying pattern changes in time. These patterns created multiple forms that have great possibilities to be developed as a product/object.

The above images (Figures 93-95) are based on a method I used, which is a water simulation mesh sectioning (3D MAX) of: drinking/pouring water, emptying water and filling water (D.E.F). Then the use of RealFlow software allowed me to create three-dimensional snapshots of the particular movements of the water inside the traditional ebreeq forming territorial traces of each condition.

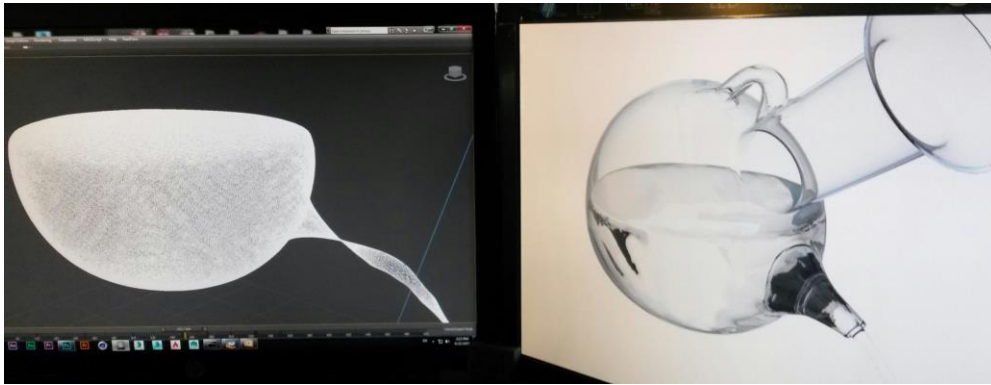


Figure 96 Snapshots from RealFlow of water movement inside the traditional ebreeq

The process included selecting the first moment of the each of the (D.E.F.) conditions interacting with the ebreeq. First, I created a 3D model water simulation using RealFlow software and then 3D Max software to extract the main key wire frame (z-axis); each of these wire frames creates multiple sectioning to the above condition, which are a sequential unfolding of gestural moments in time while in use. I further adapted this method through motion design in relation to time-based semiotics. The connection between two key frames discussed in the previous section is very similar to the in-betweens used in motion design and animation (Figure 96).

[A] falling drop of liquid, for example, will become a splat (round disk) or splash (crown shape). Smaller and slower droplets come to rest as splats. Larger and faster droplets come to rest as splashes. (Bejan and Zane, 2012, p. 11)

The idea addressed in the above quote points at the scientific aspect of the motion of drops of water, how they react and interact with the shape of the container depending on their size, velocity, acceleration, density and so forth; it should be noted here that these drops behave differently if they are drops of water or other types of liquids. In other words, each of these elements affects the shape of the first moment of the drop of water in the ebreeq based on these given circumstances which becomes accessible through 3D technology.

After studying these factors, I concluded that when filling the ebreeq, a person has to tilt the ebreeq so the water does not go straight down and splash. This resembles emptying the ebreeq; if a person flips the ebreeq to 180 degrees, the water will splash in all directions; yet, when the ebreeq is held at an angle, the water pours out in a flow (Figure 97).

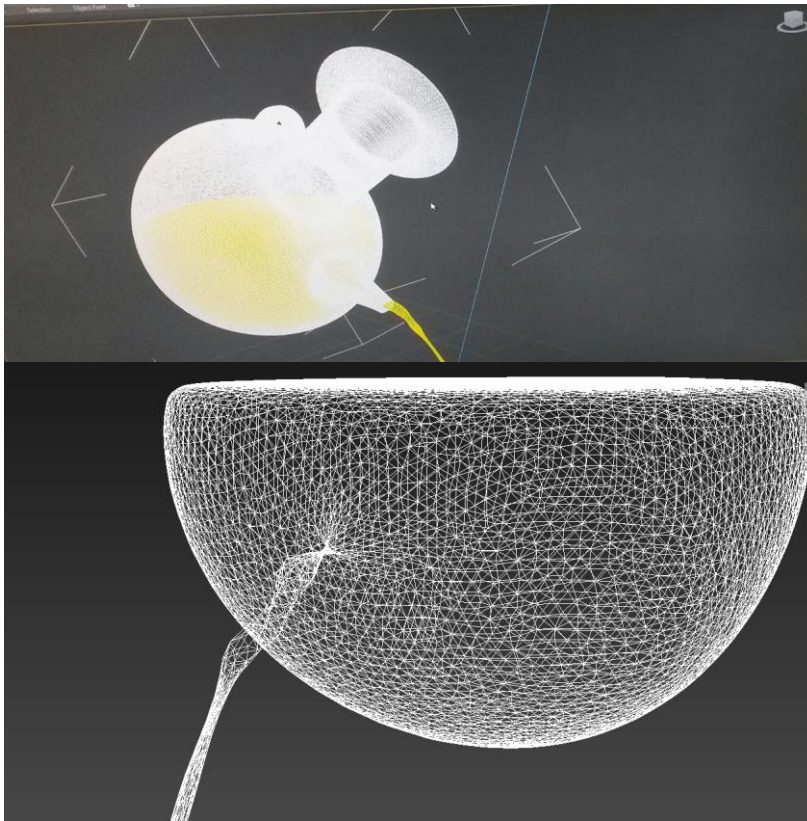


Figure 97 One of the early steps in the investigation of the traditional ebreeq, mesh rendered on 3D Max and using RealFlow to create the flow of the fluid (selected liquid in yellow)

Based on the above discovery and in relation to my recent 3D sectioning of the drinking (D) condition, I concluded that there is a direct relationship between the D.E.F. being tilted for emptying and the 3D sectioning of the drinking condition (D), which also shows the water at an angle based on how much it is tilted.

Furthermore, I concluded that the Drinking condition has a different angle from the original because the water leaving the spout creates an angle in the water when drinking. In the original ebreeq, the water surface inside the ebreeq is perpendicular to the neck; however, when it is in use, the water coming out of the spout has a different angle. So, I shifted the neck (F condition) to be perpendicular to the Drinking (D) condition.

Finally, by examining the different behaviors of water in space, I focused my research both on the different generated morphologies and the type of relations arising between the ebreeq and water in its space. The neo ebreeqs' form is understood to be an interrelation of its multilayered sectioning and typologies; thus, the form of the neo ebreeq cannot be understood as an end in itself but rather as a means to lucidate the significant sections of the 3D simulation of fluid "water" that visualizes the function of the space within the ebreeq. Through the use of motion design of 3D techniques, the ebreeq's different sections and layers within the form creates one coherent spatial connection (Figure 98).

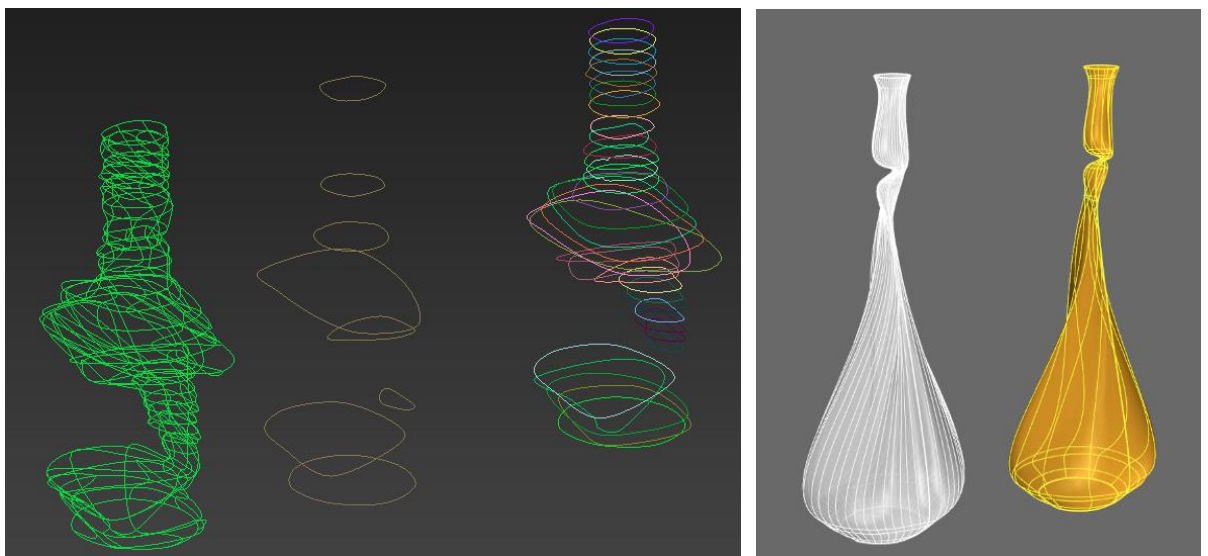


Figure 98 3D Max software extraction of the main key wire frame of each D.E.F. condition

An important step was blending the use of motion design with the original form of the ebreeq through the study of its content and the movement of water by rotating and shifting wire frames. It shows that by rotating layers from the three conditions D.E.F. would create a minor change in its form, resulting in the creation of a generative design based on a single moment of these three conditions.

4.3.2. Neo Ebreeq: CAM for 3D Printing Prototype

I designed and generated multiple neo ebreeqs using the CAD tool, designing onscreen 3D objects as mentioned earlier. Once I designed the neo ebreeq using the CAD program (which most 3D printing techniques start with), 3D printing was the next step. A 3D model file is typically converted to an STL (stereolithography) file, which has become the standard format for 3D printing processes. As per Lipson and Kurman,

The conversion to STL translates the object's form into a mesh surface. The mesh is made up of thousands of interlocking polygons, with each polygon in the mesh holding information about the objects shape. ("3D Printing Introduction and Contextual Review", 2018, p. 68)

When the STL file conversion is complete, the neo ebreeq model must be checked to ensure that there are no holes/gaps or interior/exterior thickness deficiencies. I used Cura software (Figure 99) to check on my STL file of the neo ebreeq model before sending it to be 3D printed; this software aided me to check on a surface mesh that is accurate with complete surfaces, curves and interior form of the neo ebreeq. The final stage before printing the model was to upload or communicate instructions to the 3D printer to execute and fabricate the neo ebreeq.

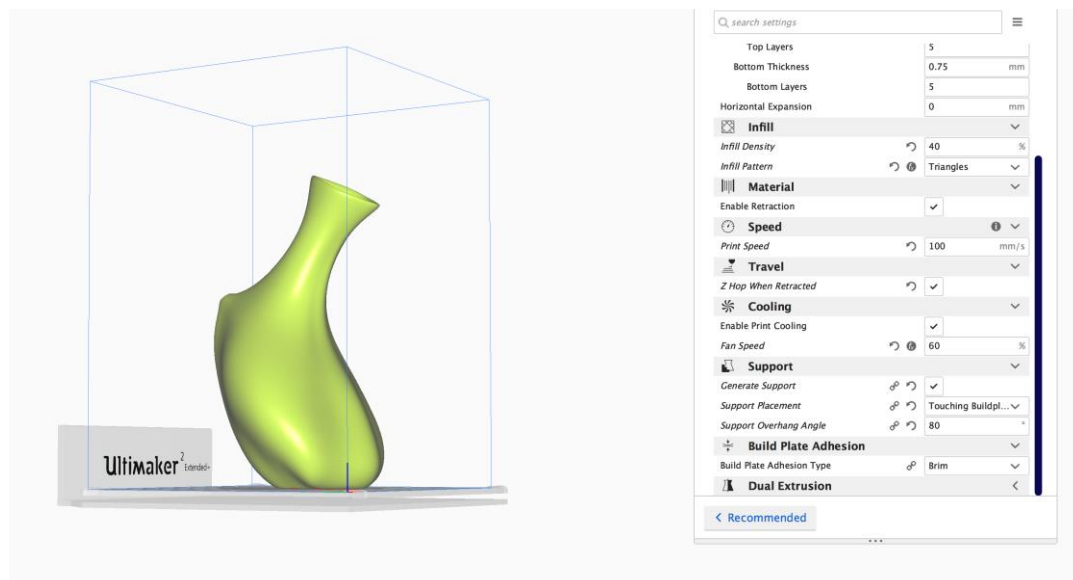


Figure 99 STL file of the neo ebreeq on Cura

3D printing is a term related to additive manufacturing techniques that can be described as the fabrication process of the neo ebreeq transforming the 3D CAD files to be manufactured. Fundamentally, a 3D printer uses the neo ebreeq 3D CAM model, sliced into 2D layers to be printed. The printer then sequentially adds layers of PLA material. Each layer is a cross section of the 2D sliced neo ebreeq,

arranged one layer on top of the other until the neo ebreeq prototype is completely fabricated. 3D printing techniques helped me to produce forms with complex and fluid forms that would be very difficult or even impossible to produce using traditional pottery manufacturing material and fabrication. Thanks to the manufacturing techniques of 3D printing, the fabrication of the neo ebreeq was made possible through the process of transforming the 3D CAD files to a manufactured product (Figure 100).



Figure 100 3D printing the neo ebreeq with layers of PLA material

4.3.3. Neo Ebreeq: Final Prototype Designs

As mentioned above, new techniques based on the 3D technologies were used to customize, extend and modify the physical properties of the traditional ebreeq to invent the neo ebreeq. My techniques revolve around using 3D technology, motion design, 3D modeling and water interaction simulation in order to achieve the new design of the neo ebreeq.

The neo ebreeq developed primarily through transforming this typological water movement into a tangible object, taking into consideration the unity of form and function between the traditional ebreeq and the neo ebreeq (Figure 101). Since this approach addresses sequentially the unfolding of the unseen to become a tangible product, this unfolding process was based on water inside the traditional ebreeq that has a characteristic view on the relation of the product form and the movement of water while they are in interaction. This enabled me to experience and experiment with the three conditions which are based on physical involvement, dynamic quality and emotional personal meaning. This layering of sections became a fundamental approach in motion design which allowed me to explore and realize the possibilities of creating a generative neo ebreeq when

selecting and moving each of the three conditions (3D typology). I was able to create dynamic possibilities based on variations to the meaning of the interaction of the water inside the traditional glass ebreeq.

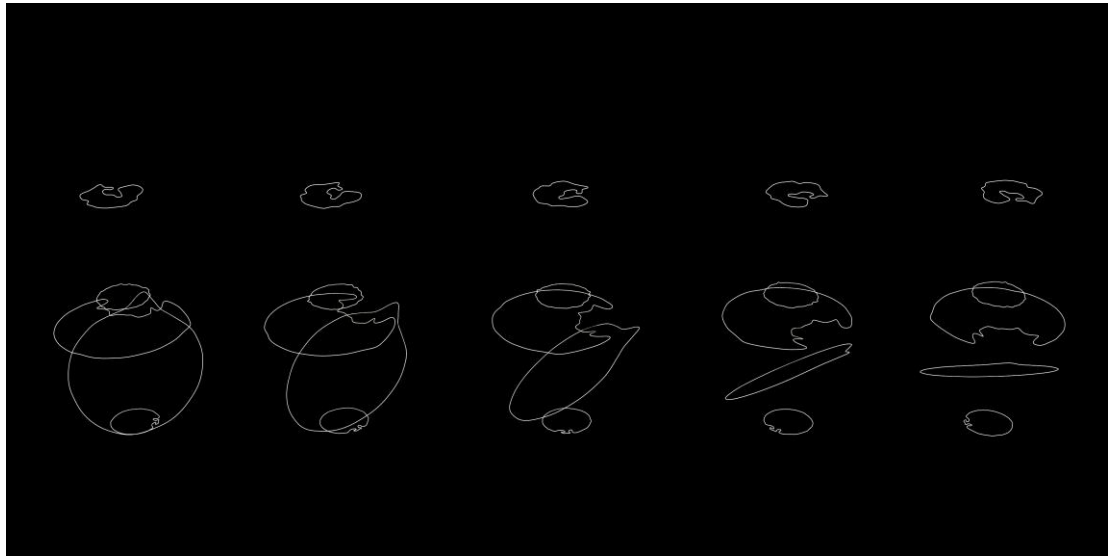


Figure 101 Typologies of the neo ebreeq depicting the first moment of drinking, emptying and pouring: each typology has a changed rotated element, whereby linking them to combine the neck and the body creates new forms based on the traditional ebreeq

The process is entirely focused on the *movement of water*, and thus on its interaction with the *traditional ebreeq's form* as an integral part of it. The *traditional ebreeq's form* evolves as a trace of water through choreography of interaction, capable of forming the many other physical neo ebreeq's with desirable characteristics that are evident in the rich variation of the movement of water. This investigation helped me explore and choose the relevant physical characteristics and the way to involve them within the neo ebreeq. By specifying the embodiment of interaction, I fine-tuned the typology to be linked to the traditional form of the ebreeq (Figures 102-103).

The chronographic process was specifically focused on the typology of water while the ebreeq is in use. These involved three condition typologies are that are based on water with the way it flows or reacts while being filled, used and emptied. This creates physical elements that are connected, proposing possible physical characteristics that fit the interaction and the gesture involvement of the person while using the ebreeq. The neo ebreeq's physical characteristic of dynamic quality meaningfully connects the three conditions to become an interactive unity.

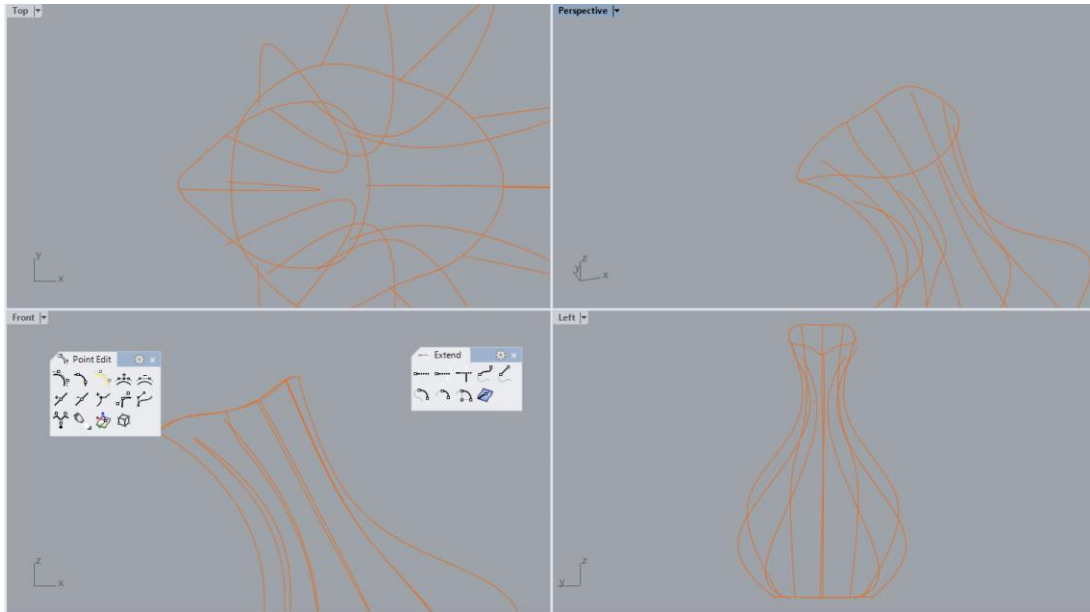


Figure 102 Snapshot from Rhino software of the wire frame used for manipulating new designs through shifting and changing minor aspects of the neo ebreeq

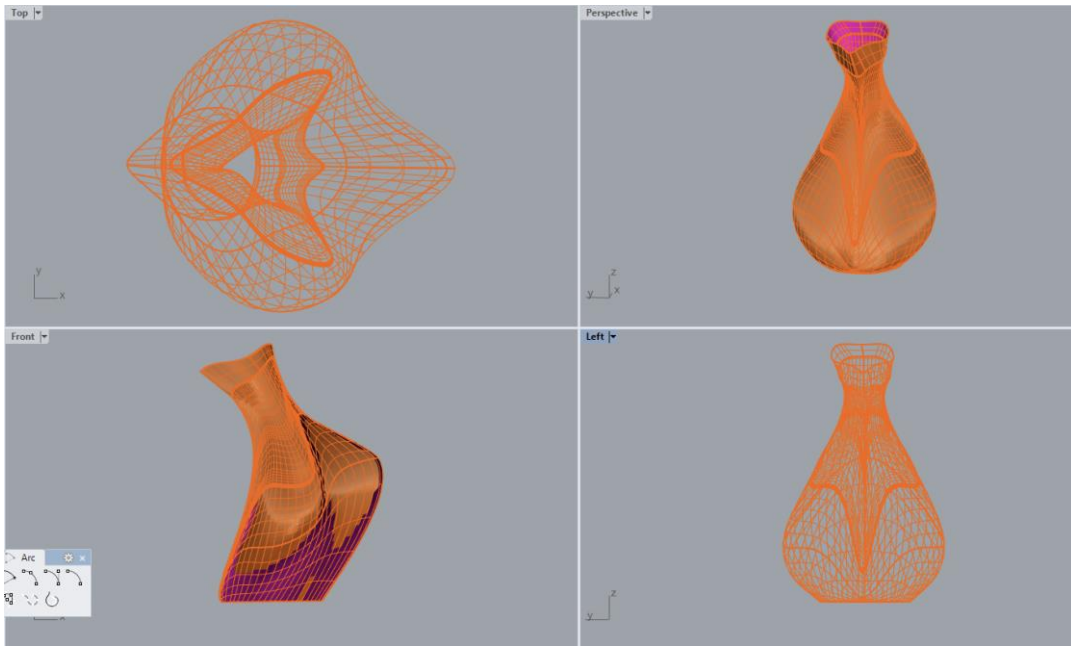


Figure 103 Top, profile, and back views of the complex and detailed wireframe of the neo ebreeq (From top left in counter-clockwise order)

The wireframe and the elements selected in orange are more complex and detailed at this stage than they previously were; the more complex the wireframe, the more I could look into details and change the form by selecting part of the wireframe, modify it, attending to alignments and further details (Figure 104).

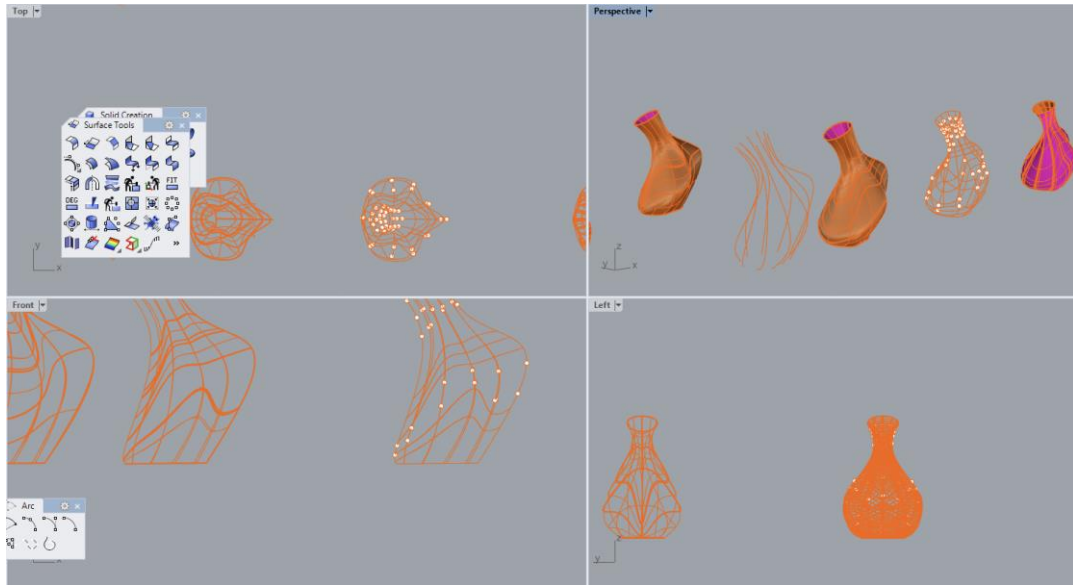


Figure 104 The generation of multiple neo ebreeq versions with minor differences through various modifications

By selecting another typology from each moment of the D.E.F. condition of the moving water while interacting gives a possible new outcome of the neo ebreeq. It guided me to make 3D models, exploring the iterative development of a new alternative based on the layers of water (Figure 105).



Figure 105 First stage neo ebreeq 3D printed prototypes, using PLA filament

The contemporary fluid shape of the new ebreeq reflects not only on the typology and sectioning of the water, but also on the structural occupied space within the traditional ebreeq. The fluid responses to the shape while in use are recognized by the curvilinear typology, which were made possible by the use of motion design techniques and new technology. This process helped me theorize the need to appreciate the concept of qualities of motion that signify the characteristics of the neo ebreeq. This conceptual framework incorporates the sequential unfolding of moments into product design.

We are in an age where the acceleration of innovation across materials, structure and technologies is profound. Designers need to understand and proceed with creative and conceptual thinking when it comes to ideation in order to achieve the correlation in design. The design of the neo ebreeq was not based on mere visual representation or aesthetic redesign of the traditional ebreeq. However, it is closely related to its historical and cultural background. As it is the case in literal verbal communication, the form, function and usability of products should be interrelated in order to achieve users' understanding. Similarly, the egg-shaped form of the neo ebreeq serves as part of its function and use in a way that they cannot be separated. To reach this goal, design should be expressed in relation to quality of the subject and the idea shared between the designer and the user. Then, design and its subject embedded with layers of meaning become a source that touches users' emotions as well. In this case, it translates to the user of the neo ebreeq connecting with this object which derives from Lebanese heritage, history and identity on one hand and continuity on the other.

Chapter 5: Overall Conclusion and Contribution to Knowledge

Digital media has had an assertive relevance and importance for visual culture. The significance of digital media is particularly evident, for example, in the Arab Spring when events were often recorded and photographed by mobile phones and published on social media as they took place; the literature addressing the role of social and digital media in the Middle East in shaping public perception and identity includes, among many, “Virtual Uprisings: On the Interaction of New Social Media, Traditional Media Coverage and Urban Space during the ‘Arab Spring’” by Nezar AlSayyad and Muna Guvenc and *Social Media in the Arab World: Communication and Public Opinion in the Gulf States* by Barrie Gunter, Mokhtar Elareshi and Khalid Al-Jaber.

In 2014, I wrote a book chapter “The Art of the Written Word and New Media Dissemination across the Borders between Syria and Lebanon” (Appendix 2.5) in *Uncommon Grounds: New Media and Critical Practices in North Africa and the Middle East*²⁷. The book examines the role that social media – also referred to as new media – has undertaken in terms of affecting and developing the visual culture in the region, which reinforces the interrelation between digital media and identity. Evidently, technology has a remarkable influence on the perception of visual culture and the use of various forms of technology – including photography – has been fundamental to the revival of the ebreeq and its presentation as part of a visual culture where design becomes an inseparable tool against the oblivion of the ebreeq and its cultural value.

5.1. Recapitulation of Purpose and Findings

Lebanon is among the countries where traditional architecture, crafts and design aesthetics in numerous instances have been replaced in favour of new materials and imported cultural aspects. In addition, the dispersal of cultural communities as a result of civil war (1975-1990) led to the abandonment of time-honoured social objects such as the ebreeq. This investigation about revitalising the ebreeq addresses a small part of a much larger phenomenon: the ongoing disappearance of Lebanese cultural memory accompanying the loss to daily life of social objects

²⁷ “The Art of the Written Word and New Media Dissemination across the Borders between Syria and Lebanon” is a book chapter in *Uncommon Grounds: New Media and Critical Practices in North Africa and the Middle East*, edited by Anthony Downey and published by: IB Tauris.

that reinforce cultural heritage, and the shared values and meanings associated with it. The simple motion of the visitor drinking from the ebreeq is not merely a matter of satisfying thirst; it is a small cultural ceremony using acquired skills—an observance that reminds visitor and host of the obligations of hospitality, and a shared ancestry.

My project-based research has merged historical, technical and design information — diverse yet interrelated data — whereby “the research methods, contexts and outputs [...] involve a significant focus on creative practice” (Skains, 2018, p. 85) as well to help shape a new vision of the ebreeq that is reinvigorated yet retains its traditional meanings. Through the use of motion design and 3D digital technologies, the ebreeq has been redesigned for contemporary society.

This has been a practice-based study drawing upon my skills and experience as a practitioner in the area of motion design. I have also brought to this research a sensibility of seeing via sequences which reveal interrelationships between the past, the present and the future. The research has been composed of multiple critical stages that, when put together, unfolded an historical understanding of the ebreeq and enabled the identification of a series of key points when the ebreeq is in use that could be morphed into new design possibilities. These links between the historical and the contemporary were subdivided into the four previous chapters which related to my research objectives.

5.1.1. Relationship with Previous Research

To understand the identity, legacy and common relations of spouted water jugs through cultural, historical, typological, anthropological and material qualities

Investigations of the connections between spouted water jugs and ebreeq-like traditional vessels and their recent redesigns led me to the conclusion that the core commonality and value among traditional vessels is their egg-shaped body, which is the essential and ‘intelligent’ quality of such vessels. Thus, the egg-shape was the fundamental design principle that was retained. The spout, neck and handle are recognised as ergonomically relevant parts that improve and extend the main egg-shaped jug form.

A number of contemporized traditional drinking vessels, the redesigned *botijo*,

bummulo malandrino and *kendi*, each display distinctive designs in terms of aesthetic form and approach. As in my research, these vessels maintain common design characteristics: their egg-shape, use of porous clay, notions of multiplicity, and the conception of neck, spout and handle as appendages. As discussed in the preceding chapters, Victor Schauburger's design relies on the egg-shape as the basis of his design. The *kendi*'s detachable neck also presents an evident commonality with the appendages of the ebreeq. The fact that both the *kendi* and *La Siesta* (the redesigned traditional *botijo*) are available in a selection of colours is in accordance with notions of multiplicity present in my design of the neo ebreeq. By contrast my research focused on understanding the ebreeq as a culturally significant object, and the importance of the way water interacts with the egg-shape, creating a dynamic movement during use. Multiplicity was explored in materials, texture, surface reflectivity, and form of appendages. Although I incorporated colour in my experiments, this remains to be explored in future versions of the neo ebreeq.

Previous attempts by Lebanese designers to redesign the ebreeq to accommodate contemporary values are relevant to this study. Although the notion of multiplicity and layering in Joubanian's Breeq is common with the approach of my research, it differs in that his use of layers is for aesthetic purposes. As with the neo ebreeq, Raffoul and Moussallem's redesign of the ebreeq stems from an understanding of its history and background, but this is mainly used as a point of departure. Even though the overall shape is preserved, their ebreeq serves as a decanter instead. Although Albi Creation's Breek pays tribute to Lebanese history, it is repurposed to hold Arak (a type of liquor) rather than drinking water. What remains in common among these redesigned ebreeqs is their attempt to contemporize the ebreeq's aesthetic.

To apply a theoretical framework incorporating locomotion, Futurism, post-structuralism, time-based semiotics and parametricism in order to investigate the traditional ebreeq while in use

In this study, the alternative approach to redesigning the ebreeq was by means of motion design which is an aspect that the discussed examples have not adopted within their initiatives of modernizing the traditional ebreeq. Through motion design, this research puts forward a conceptual framework from which

contemporary design can profit—a framework supported by theories of motusthetics, Futurism, semiotics and parametric design.

The theory of dynamism through locomotion and the tool of chronophotography was fundamental to the primary stage involving techniques in 3D production, whereby the movement of water was scientifically captured, then graphed and rendered as 3D to reveal its otherwise invisible characteristics. These methods and concepts paved the way to graphically defining the water's fluid forms by separating the three conditions of drinking, emptying and filling (D.E.F.). Although the chronology of using the ebreeq starts with filling it with water, drinking and emptying the rest, the D.E.F. condition focuses on the parts of the ebreeq involved in this interaction; the drinking condition captures the first drop of water coming out of the spout, emptying captures the first moment when water is poured in the ebreeq from the neck while filling captures the moment when the water first touches the bottom of the ebreeq. Similar to Marey's method, these conditions were highlighted by a typological graph to make matters clearly visible to the human eye.

The relevance of Futurist theory to this research is through its concept of dynamism, energy and contemporary living. As is the case with Futurism, employing motion design exposes the sequential layers as multi-moments, in this case relating to water flow. My project maintains common ground with Futurism in regard to the practical method of production and the visualisation of the development of forms as successive moments in time. Futurism is a theory that opposes binary opposites and looks at notions of plurality; in contrast with Futurism, my project combines elements of the past and the future.

In this way, the theoretical approach of post-structuralism becomes significant to my research in regards to drawing elements of the past and incorporating them into the present time. This was employed less as a philosophical framing than as a conceptual reference point. The ebreeq demands recognition of the intangible knowledge, stories, value and traditions which are associated with its Lebanese heritage. So, the neo ebreeq is created from the contemporary, while maintaining its traditional aspects. Examining the sequential frames (process and time) when a person uses the ebreeq is a form of interaction that produces a sequential unfolding of the past, the present and the future. Each of these depicted moments,

signifies multi-gestures within the process of time-based semiotics.

Time-based semiotics examines similar interrelationships to perceive the ebreeq as intrinsically semiotic in nature. Hence, this study attempts to connect the opposing forces (pouring water and drinking; filling water and emptying it from the ebreeq) which allows the potential creation of novel forms of the ebreeq, exploiting this multi-layered quality. The integral interaction of the water with the form, function and utility of the traditional ebreeq becomes an intelligible system of signification. Parametricism made the connection of these time-based semiotics possible and provided a stimulating approach towards a new and dynamic re-design of the ebreeq. Parametricism tackles notions related to continuum and is relevant to designing the neo ebreeq by means of motion and the relation of parametric fluid, revealing and connecting these time-based semiotics dynamically.

To investigate similar examples presenting their relevance to the design and production of the neo ebreeq which also formulate relationships between the digital and the traditional

Examples were examined in which traditional objects were revived and objects were produced involving motion design in their re-creation process, forming a connection between the digital and the traditional in a similar manner to the neo ebreeq. In addition to my expertise in motion design, the techniques used by others were applied with a new approach to create the final design of the neo ebreeq. Redesigning the ebreeq as a traditional object is intended to revive its everyday use through 3D technologies and motion design which amalgamated several moments in time through a traditional artefact as opposed to any other object or vessel.

Indeed, the neo ebreeq is designed according to the simulated and captured in-between moments of the movement of water while a person drinks, which applies Gever's use of 3D video capture technology. Meanwhile, I adopted Keep's approach in his work, creating the neo ebreeq through merging the conventional method of making the egg-shaped form of the ebreeq with 3D technologies and printing: both produce the ebreeq in a circular manner in the way a potter's wheel is used. I also employed Jørgensen's association of recording motion digitally and the unique traits of the item being revitalized. In addition, the interaction in the

Tarrugao collection carries a resemblance to that of the ebreeq captured in the D.E.F. (Drinking, Emptying, Filling) condition. As elaborated earlier, the documentation of the sound waves in Mann's work and the acceleration in Ragot's affecting the form of the considered object through untraceable moments was made possible through the use of technology. The latter is fundamental to the design and the creation of the neo ebreeq as it captures the invisible in-between moments and renders them visible.

While these examples were important for the development of my research, the originality of this research lies in the neo ebreeq as a product combining motion and product design based on multiple moments during use. The neo ebreeq is characterized by the extraction and the representation of multiple frames as opposed to singular frame-by-frame moments. In addition, the neo ebreeq is a product born from an existing object which has high cultural significance, yet it is not limited to visual re-creation. In fact, the neo ebreeq has readdressed ergonomics in comparison with the traditional ebreeq.

5.2. Neo Ebreeq: Final Design Outcome

Prototypes of the neo ebreeq were embedded with implied motion based upon a fusion of fluidities through the use of motion studies, digital composites and multiple visual outcomes

The sequential unfolding of moments becomes evident in the presentation of the final neo ebreeq design. 3D files in their various modes of presentation indicate the implied multiplicity; a 3D template file was modified for each of these 3D typological moments (D.E.F.) and later lofted²⁸ to create a series of neo ebreeqs. Each time I modified or selected a different typology, I generated a new form that had significant differences from the others. The top view neo ebreeq wireframe reflects the symmetry and balance inside the neo ebreeq, along with the dynamic form of the neo ebreeq from the outside. It also demonstrates the linked sections highlighting the thicker stroke of the neo ebreeq, lofted through a wireframe combined with a flow form connecting the spout, the neck and the egg-shaped container as a single entity (Figures 106-107).

²⁸ Lofting is a drafting technique (sometimes using mathematical tables) whereby curved lines are generated, to be used in plans for streamlined objects. Retrieved from <https://en.wikipedia.org/wiki/Lofting>

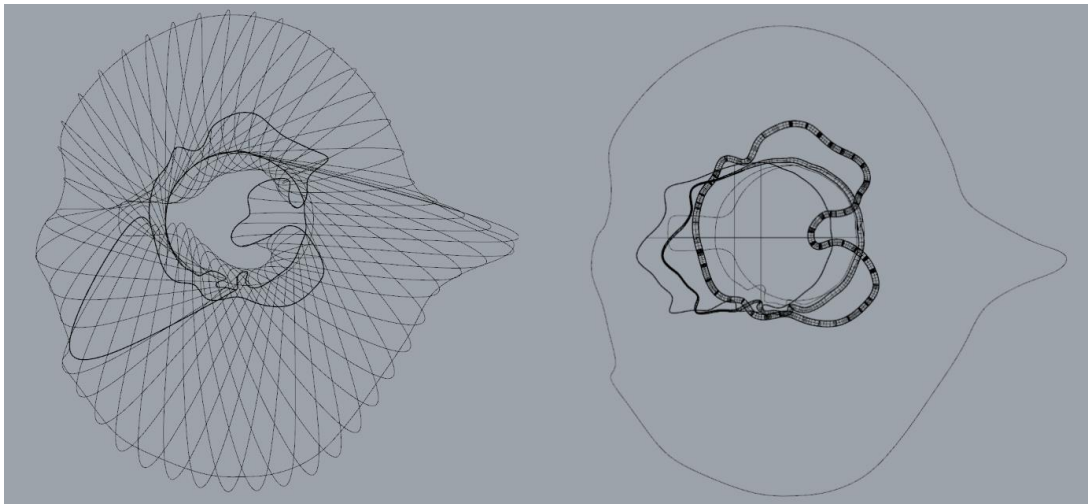


Figure 106 Top view of the formation of the neo ebreeq wireframe (from right to left)

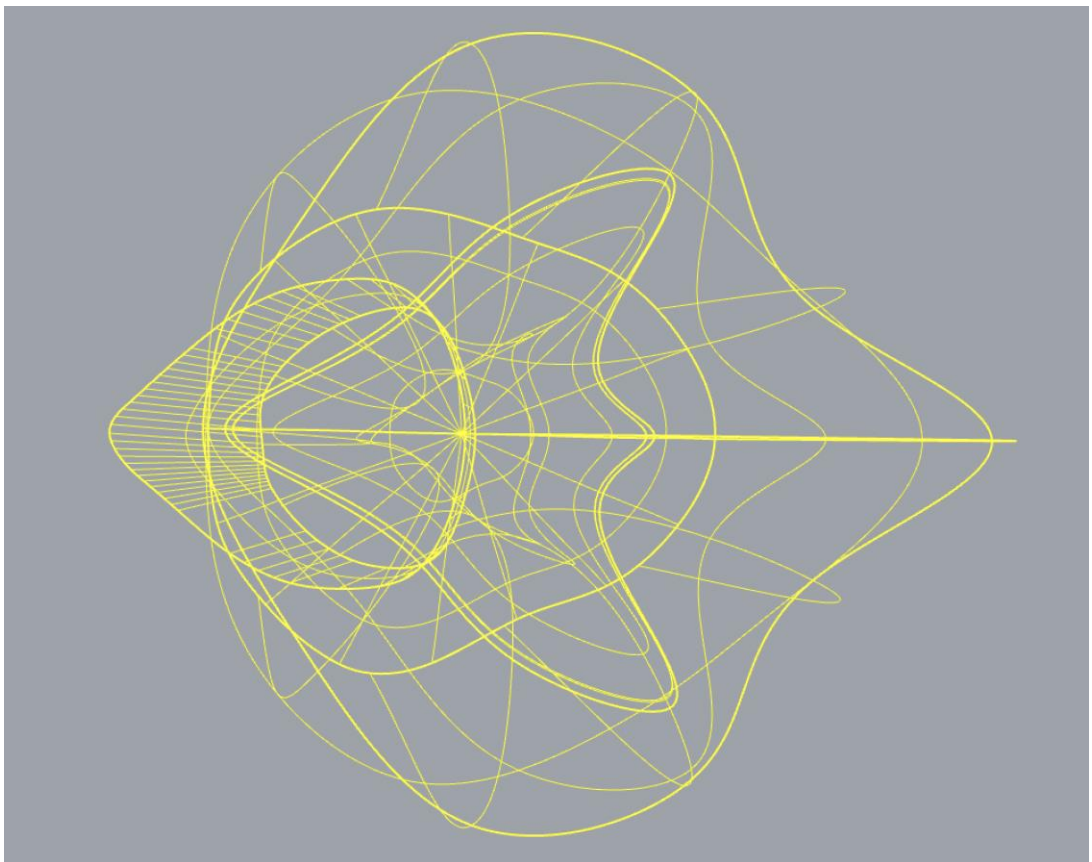


Figure 107 Top view neo ebreeq selected wireframe, showing how the sections are formed

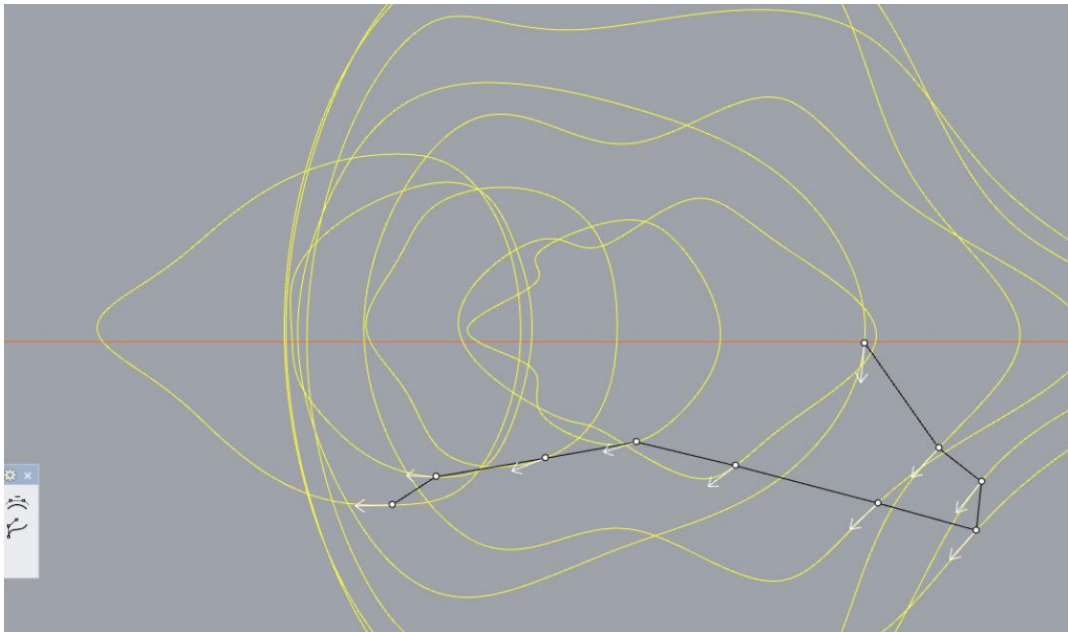


Figure 108 Top view of the neo ebreeq wireframe with aligned anchor points and directional arrows that indicate the combined fluid movement which created the modified neo ebreeq form

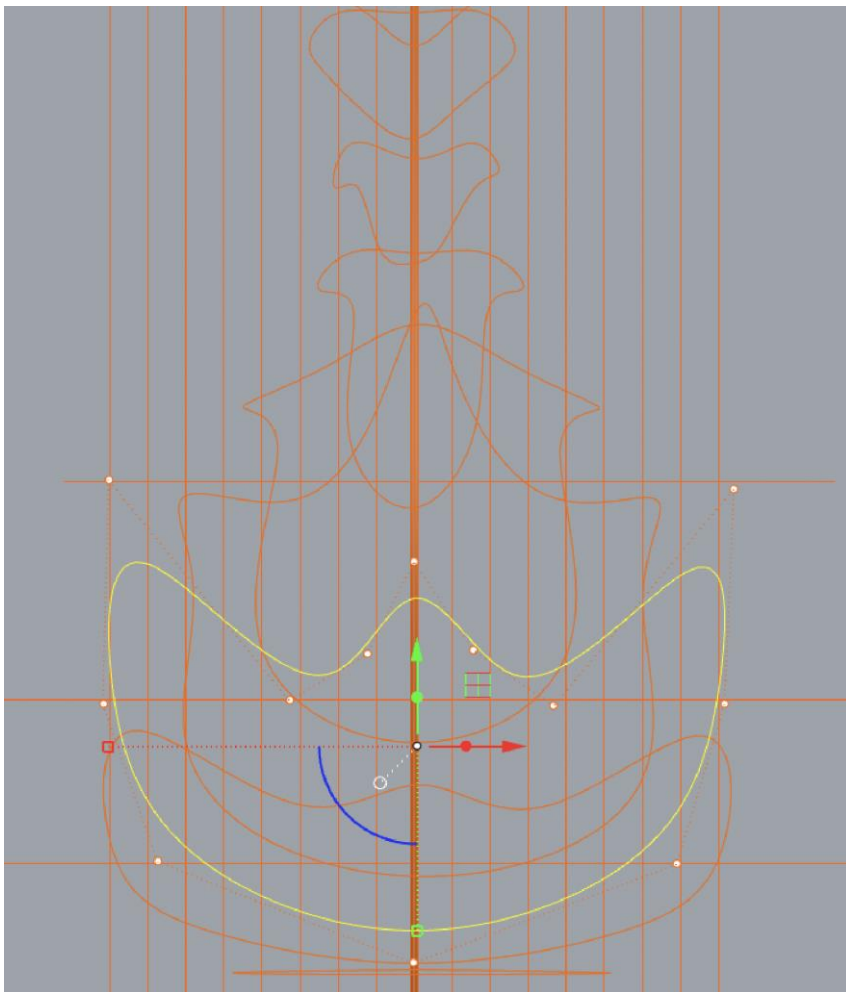


Figure 109 One selected typology showing the side view of the wireframe, indicating the vast potential for minute modifications

In addition, the captured top view of the neo ebreeq wireframe shows the different modified or selected sections with a directional arrow. The yellow colors show how the sections are formed, while the arrows show the direction of lofting (Figure 108). The anchor points are aligned to allow the flowing form to amalgamate with minor changes in each direction potentially producing a new form. To the demonstrated top view of the various sections of the neo ebreeq, a side view of these sections was also captured for a wider perception of the neo ebreeq as a whole; the white circle is the point that provides various modification options, while the red, green and blue components are indicators of the XYZ aspects (Figure 109). Current technologies for making these wireframes and amendments to them (and 3D printing process) facilitated the generation of multiple versions of prototypes which were previously not possible.

The 3D blueprints document the sequential modifications to the ergonomics of the neo ebreeq to make it simplified—in the minimalist aesthetic. Corresponding small neo ebreeq prototypes were printed in blue color filament using a common PLA (plastic or polylactic acid filament) material to examine the symmetry, the balance and the ergonomic changes that I needed to apply; the choice of color here indicates a point in the process of amendments. The top view of the interior-exterior wireframe selection shows the thickness of the neo ebreeq, where the black lines represent the interior thickness and the red ones represent the exterior thickness; the neck, here, is still more complex in its shape compared to later stages of its modification process. The white surface is the exterior layer of the neo ebreeq, while the red surface is the interior layer being selected and modified; at this stage, the selected layers are still not attached or linked as one form which is a step applied in the following stage. On the other hand, the dots surrounding the neck and the container of the neo ebreeq could be selected and modified as XYZ to create a simplified flow and form (Figure 110).

Also, the interior-exterior selection of the top view demonstrates the modification of the thickness and the simplification of the upper part and the curve of the neck. At this stage of the selection and modification of the neck and the container, I started linking the layers shown in the top of the neck, taking into consideration the overall form, unity and flow in the neo ebreeq. Meanwhile, the base of the ebreeq has an oval shape and a gap at the central bottom so the ebreeq sits flat on a surface but does not adhere to it; in the base modification, the bottom view perspective

demonstrates the points which can be selected separately and modify the interior and exterior layer. Like the neck, I combined the inner and outer layers of the spout and redesigned it aesthetically at the same time (Figure 111).

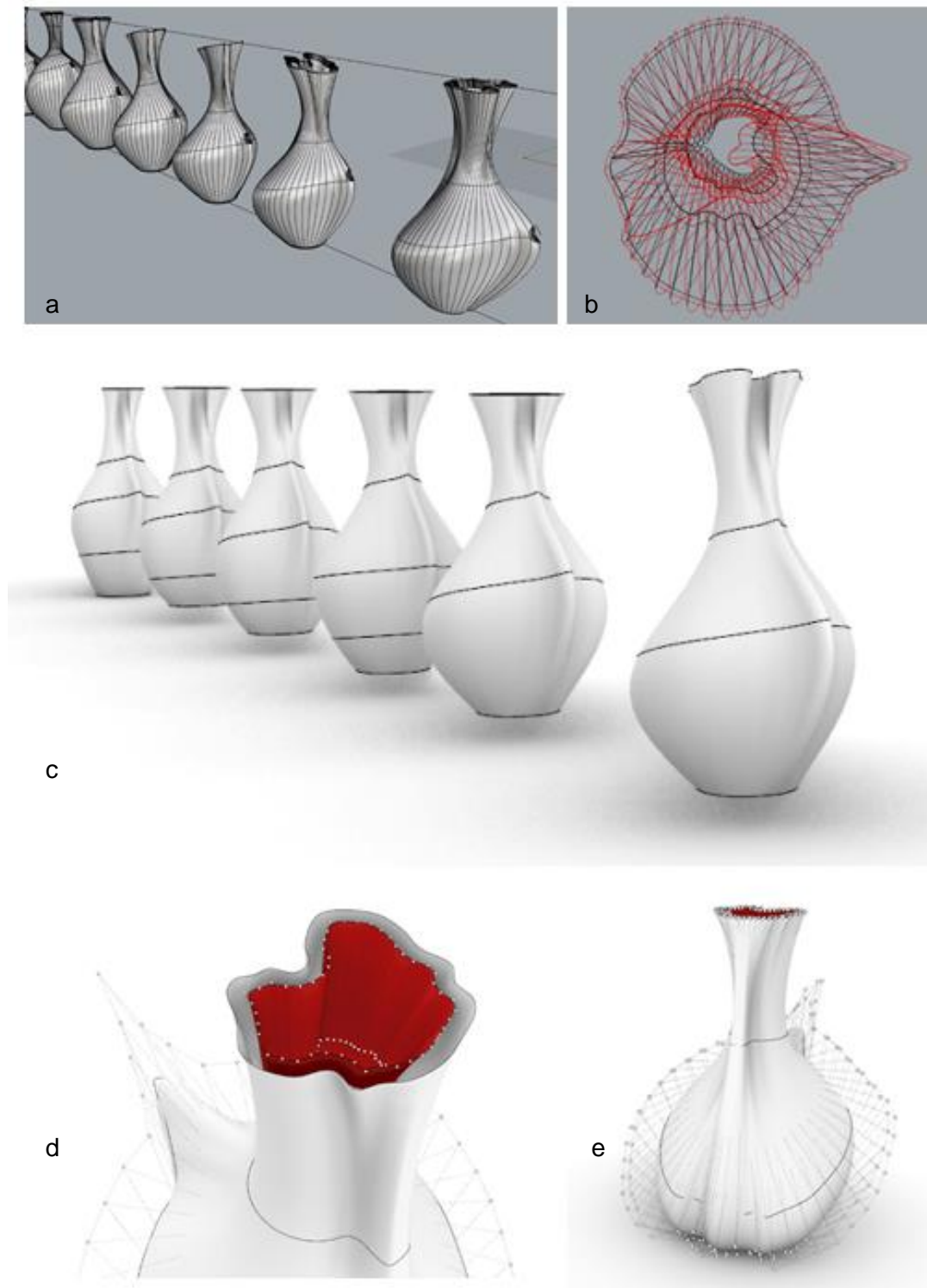


Figure 110 (a) perspective view of the generation of multiple neo ebreeq digital prototypes versions with minor differences through surface layer modification, (b) top view wireframe inner layer (black) and wireframe exterior (red) modification, (c) perspective view of the rendered generation of multiple neo ebreeq, (d) top perspective view, (e) perspective portrait with exterior layer in white and the inner layer in red rendered, stage before merging the two layers.

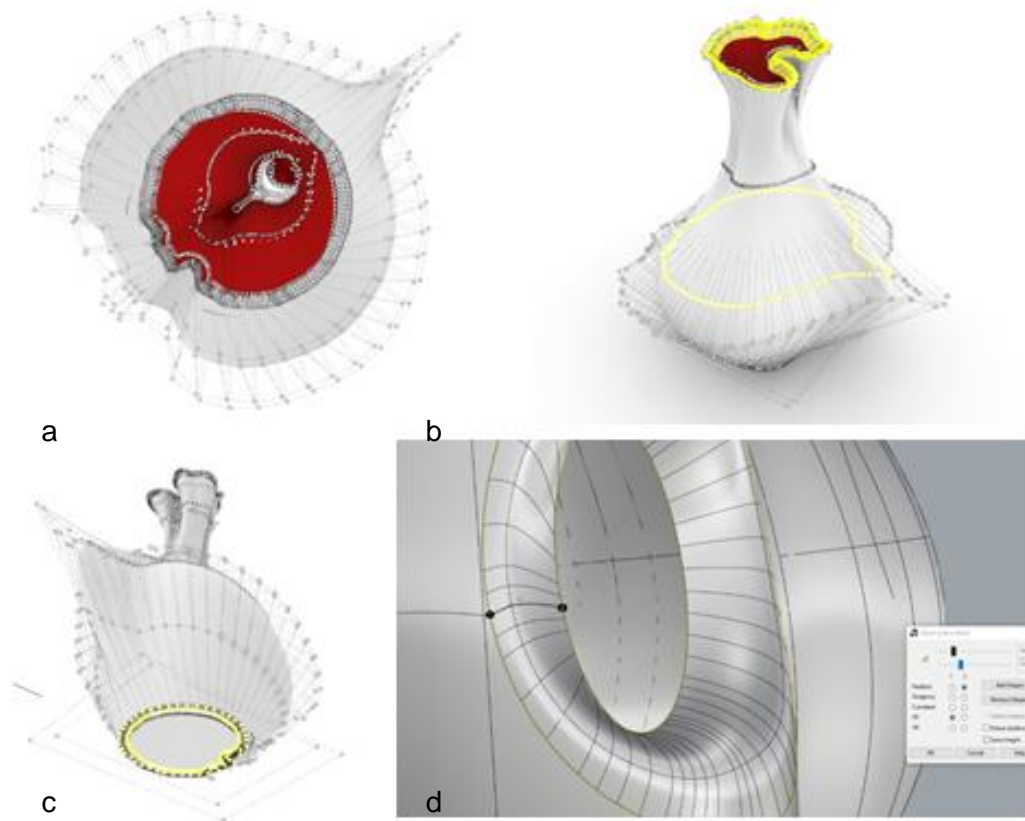


Figure 111 (a) Top, (b) profile, (c) bottom and (d) close up spout views of the neo ebreeq ergonomic modifications also merging the exterior layer (in white) and the inner layer (in red)

In other words, a new neo ebreeq prototype was made by generating multiple versions of the neo ebreeq with minor differences as I modified the orientation of the selected typology from representations of the water movement inside the traditional ebreeq and by selecting, rotating and/or iterating the typology 3D sections. Also, the arrows indicate the direction of lofting, while anchor points are aligned to allow for a more fluid form (Figure 108). Through trial and error using the directional arrows of the modified or selected sections of the neo ebreeq wireframe, I was able to evolve a design solution—the form resulting when all three key moments (D.E.F.) relative to the traditional ebreeq are amalgamated, reaching a designed form that aids the ergonomics and evokes the fluidity of water when in use.

Documenting the evolution of the prototypes demonstrates the sum of years put into the process that led to the final design of the neo ebreeq (Figure 112). This design was achieved based on modification of the ergonomics, flow, details and printing decisions. Through changes in the typology or sections within these files, variations took place in the neo ebreeq prototypes. In the process of 3D printing,

the first printed trials were the golden and silver ones displayed at the right end of Figure 112. They were bulky, thick, overly detailed and consumed a large amount of filament as well as time to print. Hence, they were simplified at a later stage. I made the succeeding prints in blue using my own 3D printer designed to print only small scale projects (Figure 113); thus, additional prototypes were made on a smaller scale, with thinner layers, thinner internal and external shells and smoother interior walls while maintaining details on the outside. The photographed chronological prototypes demonstrate the evolution of the ergonomic perspective of the development process from start to finish. The small prototypes printed in blue represent the possibilities when the sectioning was amended. However, from an ergonomic viewpoint, I preferred to simplify the prints and continued making amendments to the form until I reached a desired outcome—an example of the neo ebreeq with a straight neck and another at a 45-degree angle.



Figure 112 The evolution of the neo ebreeq prototypes (right to left)

Further changes were made to the neo ebreeq with the 45-degree angle. I amended details until I reached the prototypes aligned at the far left of the collective selection (Figures 114-115). Also, the 3D neo ebreeq template helped me redesign the spout to hinder spilling water while drinking. In addition, the 45-degree neck facilitates drinking, filling and pouring while the traditional ebreeq had to be tilted to drink from because of the form of the neck. This neck likewise retained the neo ebreeq's gestural qualities and evoked fluidity. While in the phase of prototyping, I 3D rendered the final design of the neo ebreeq in white ceramic (Figure 115). I also 3D printed it (Figure 116) using PETG filament HD Glass (polyethylene terephthalate glycol-modified) as a reference to the traditional making of the ebreeq in glass while using digital technology and new materials. Prior to printing the final outcome version, the design of the white ceramic neo ebreeq was 3D rendered in a white glazed ceramic effect. The ceramic version maintains the traditional clay material combining it with a modern method of making. When printing future version of the neo ebreeq in ceramics or glass,

further modifications in the ergonomics are required depending on the used material, its given thickness and the different process of printing.



Figure 113 Part of the evolution of the neo ebreeq prototypes, showing minor changes in their form as a result of their improved ergonomics

Due to the novelty of the material, it was challenging to use PETG filament HD Glass to 3D print the final design outcome of the neo ebreeq. My first attempt using MultiMaker Extended 2+ was at Notre Dame University (NDU) in Lebanon; following the product specifications resulted in a deficient outcome. During another attempt, I sought assistance and technical support at The Digital Center (The Shed) at Manchester Metropolitan University (MMU), following the same specifications with the latest MultiMaker Extended 3+ printer; nonetheless, the outcome was once again deficient. Therefore, I experimented with the specifications until I could finally apply my own settings to attain successful results using the 3D printer at NDU; it was a step forward and a personal achievement to

efficiently modify the original specifications. Deducing the ideal specifications regarding the extruder temperature, the material modification settings, the bed temperature and the fan speed enabled me to 3D print the final design of the neo ebreeq with the desired outcome.



Figure 114 Neo ebreeq prototypes 3D printed at the end of the process of making minor amends to the final selections



Figure 115 Final neo ebreeq 3D rendered in white glazed ceramic as one of the possibilities for printing in the future



Figure 116 Final neo ebreeq 3D printed – PETG filament HD Glass (polyethylene terephthalate glycol-modified)

Neo Ebreeq Dimensions:

The Container:

The dimensions of the neo ebreeq are fundamental to its design. The physical properties of pouring water allow the neo ebreeq to be shaped as a 45-degree angle form with a neck that flows from the container (Figure 117). Much like the traditional ebreeq, the neo ebreeq consists of the container, the base, the neck and the spout. It preserves the essential egg-shape of the ebreeq interior (Figure 118) and holds 1 litre of water which is the same amount that the traditional ebreeq holds. In terms of its overall size, the egg-shape of the container is wider at the spout than its lower part with 140 mm at the layer which includes the spout and 122 mm at the lower layer of the container (Figure 119).

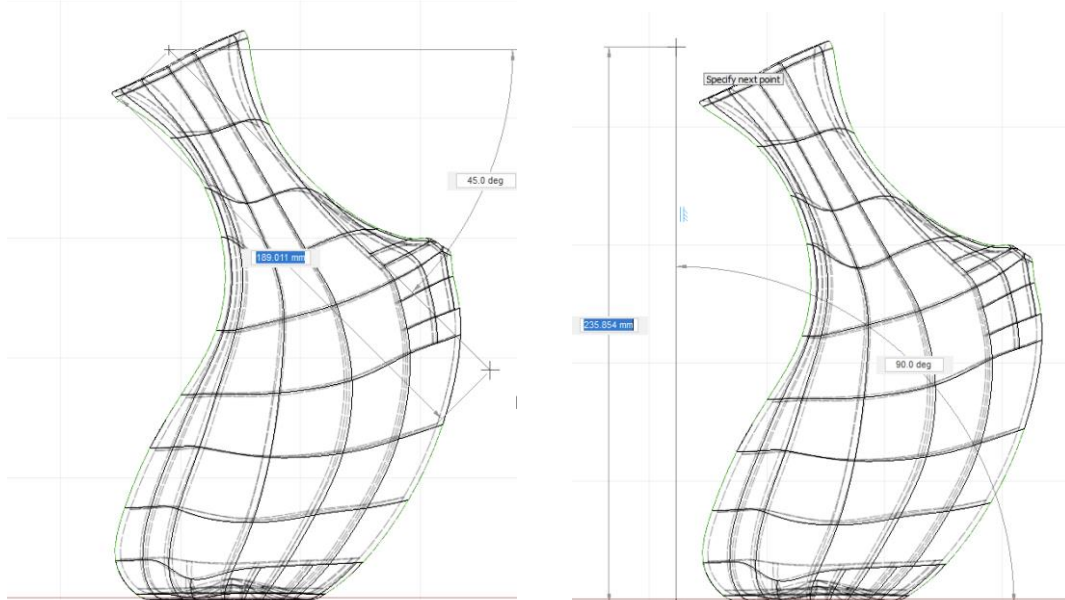


Figure 117 A wire frame side view of the neo ebreeq showing the 45-degree angle and the neck's amalgamation to the container (left). This unified form conveys fluidity (right).

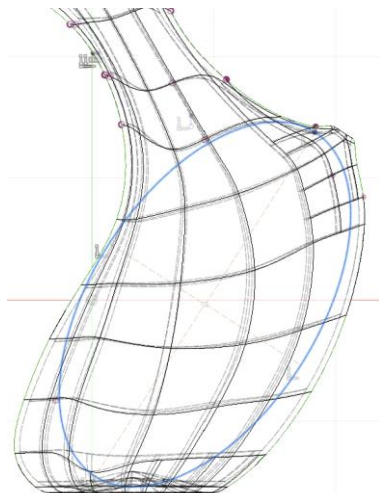


Figure 118 A cropped view of the neo ebreeq wire frame side perspective showing in blue the preservation of the egg-shape

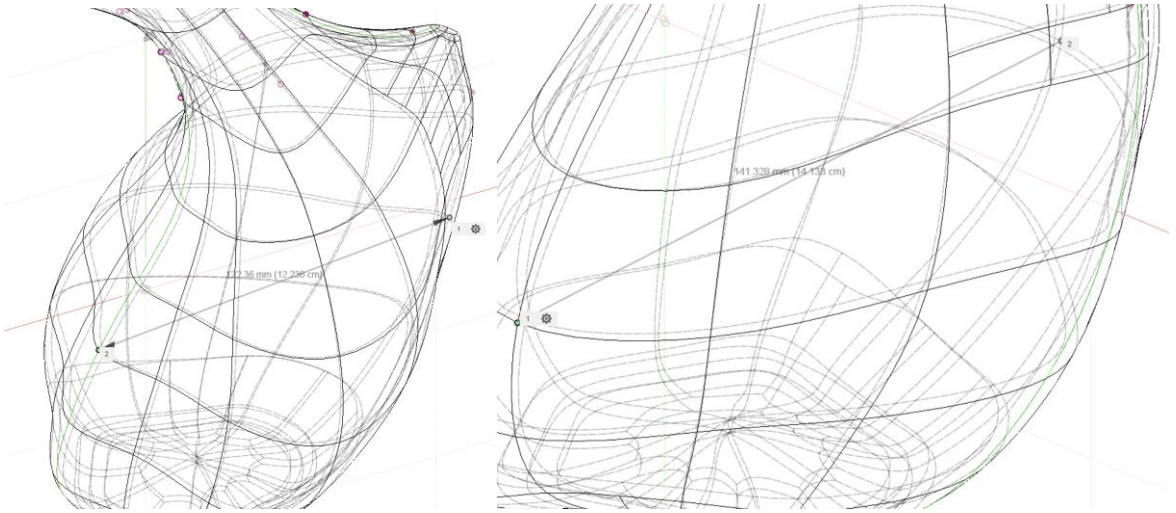


Figure 119 The lower layer of the container is 122 mm in size (left) and the higher layer which includes the spout is 140 mm (right).

The Base:

The base of the neo ebreeq is designed to have a thickness of 8.7 mm to give it some weight when it is empty. It should be noted here that the thickest point creates a balance when the neo ebreeq is empty and allows it to be shaped like flowing water within a constrained organic form (Figure 120). The process of developing and continually amending the ergonomics of the neo ebreeq led me to achieve the dimensions of this bottom portion. The thick bottom creates the necessary weight to balance the neo ebreeq. While, the raised inner portion of the base creates a pocket of air between the neo ebreeq and the surface upon which it rests limiting the amount of condensation that would otherwise adhere to that surface. On the other hand, the distance between the inner and the outer layer of the base is 2,306 mm for the purpose of printing; meanwhile, the rest of the neo ebreeq has 2 mm thickness (Figure 121). Moreover, the outer base is characterized by an organic curvilinear form. Therefore, the two measurement variations in length and width, which are 70 mm and 71.5 mm respectively, reflect the dynamic form of the base in relation to the neo ebreeq as a whole (Figure 122). In others words, these defined measurements, which derived through a process of modification to achieve the precise proportion, are critical to the extent that a single shift affects the symmetry and the details of the entire neo ebreeq, its dynamic function and static stability.

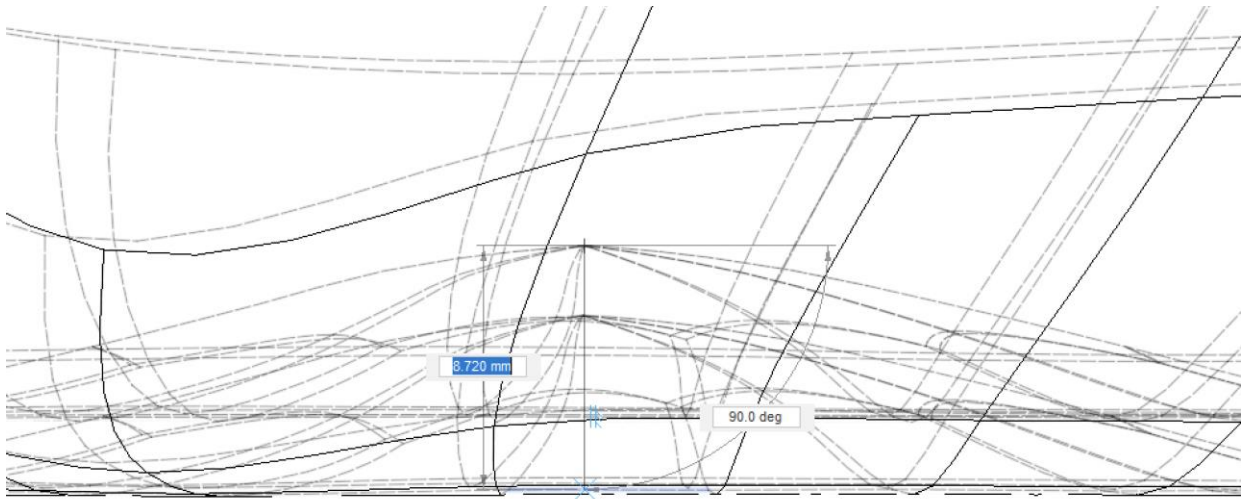


Figure 120 The base thickness gives the neo ebreeq weight when empty and organic form of flowing water.

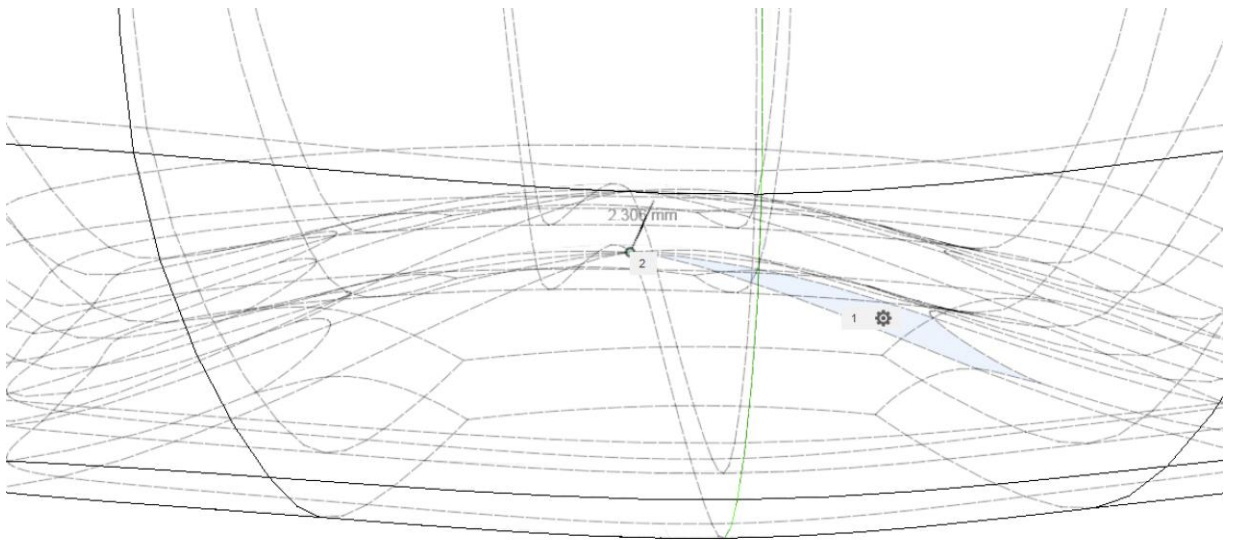


Figure 121 The distance between the inner and the outer layer is 2,306 mm for printing.

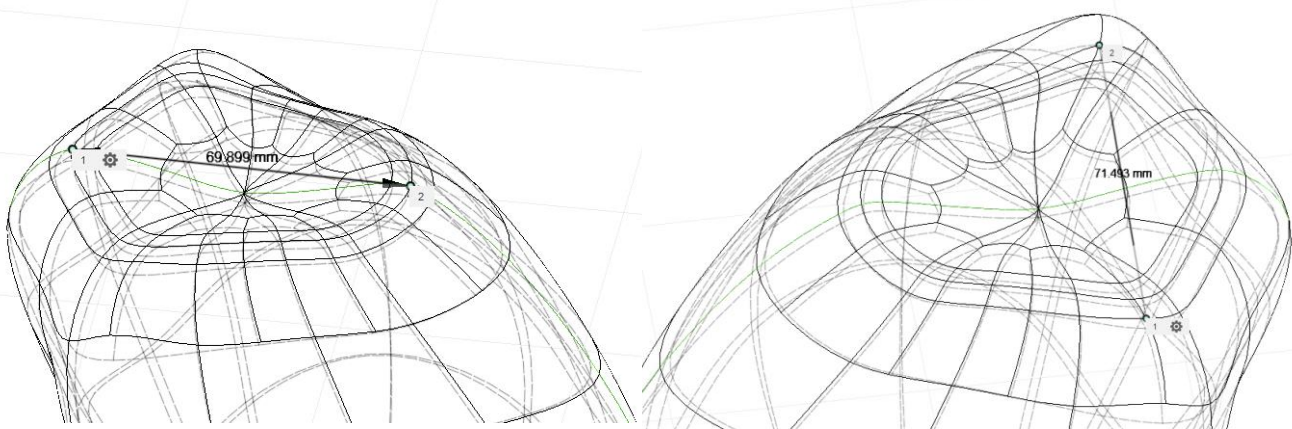


Figure 122 The organic curvilinear form of the base with two measurement variations in length and width: 70 mm (left) and 71.5 mm (right)

The Neck:

The neck of the neo ebreeq has a wider portion at its upper edge and it gradually narrows toward the base, making the narrowest part 39 mm and the widest part of the neck opening 51 mm. The concept behind designing the neck to have a narrowing shape as it moves closer to the containing body is to allow the harmonious flow of water as it is poured or emptied or filled through the narrow opening, gesturally and ergonomically improving the neck when compared to the traditional ebreeq (Figure 123). Also, while the exterior layer of the neo ebreeq opening is 60.5 mm, the neck consists of multiple layers with different measurements each, starting with 36 mm for the first layer (Figure 124), while the following layer is 46 mm and is 86.3 mm in height (Figure 125).

As mentioned above, these measurements are fixed and precise to the point that modifying them changes the balance and the symmetry of the object, affects the efficiency of 3D printing and the overall form of the neo ebreeq. More specifically, since the ergonomics of the neck evolve around filling the ebreeq with water and emptying it, further modification would mainly affect the neck and extend to the neo ebreeq as a whole. The ergonomics of the neck and its narrow end facilitate the flow of pouring water without spilling; in terms of filling, the ebreeq does not need to be bent to fill it with water because it already has a 45-degree angle. As such, the indicated proportions constitute part of the balance and the ergonomics of the neo ebreeq.

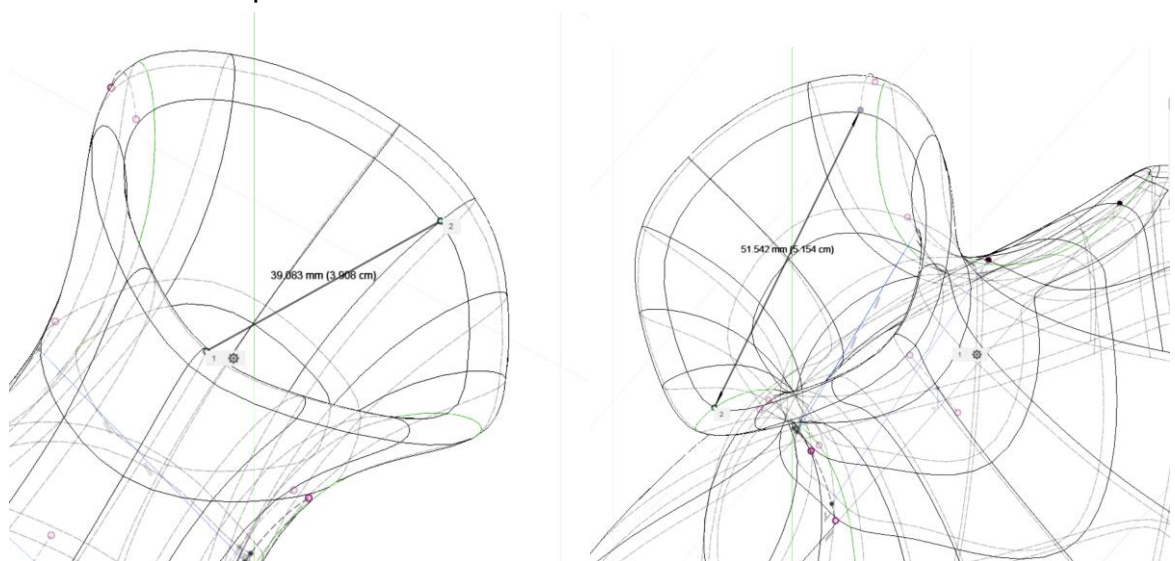


Figure 123 The narrow part is 39 mm (left) and the wider part of the neck opening is 51 mm (right).

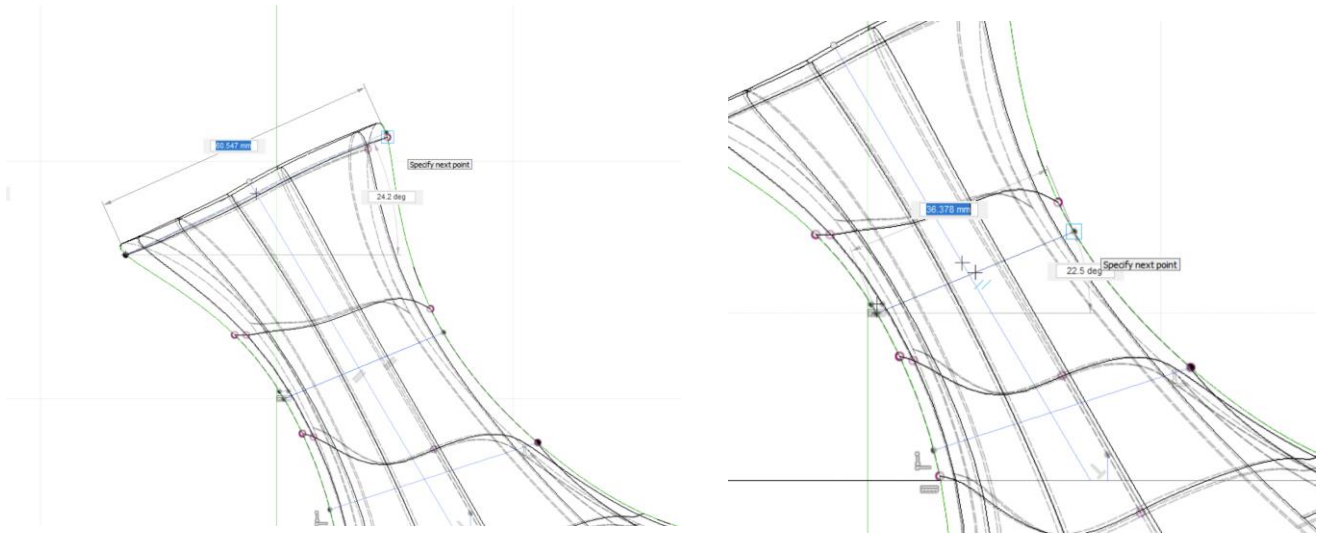


Figure 124 The exterior layer is 60.5 mm (left). The layers of the neck have different measurements; the first layer is 36 mm (right).

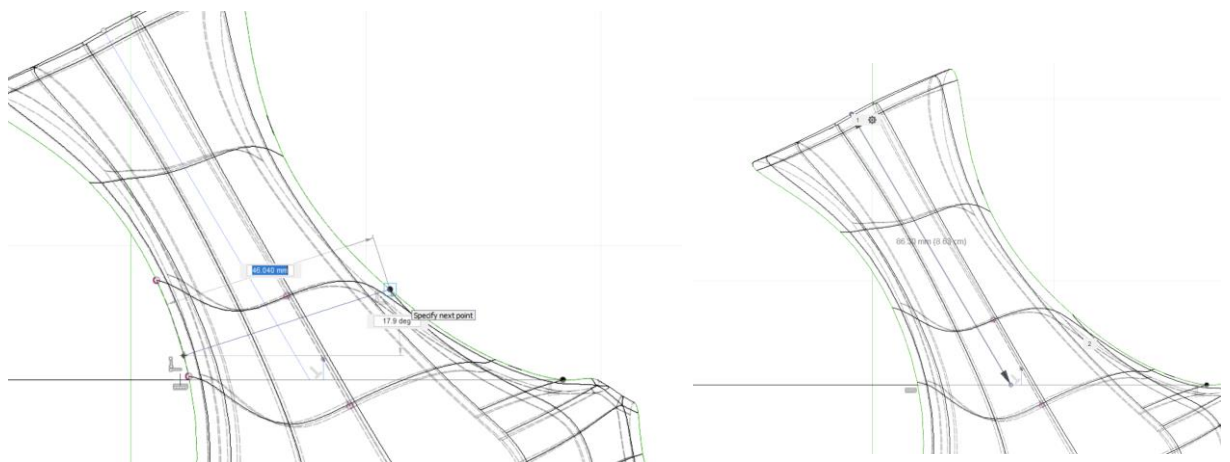


Figure 125 The second section is 46 mm (left) and 86.3 mm in height (right).

The Spout:

The last part of the neo ebreeq is the spout. The distance of the spout opening from the exterior layer is 9.8 mm and from the interior layer is 8.4 mm. Additionally, its width is 3 mm. Meanwhile, the surface just below the spout opening is recessed inward by 1 mm (Figure 126). As a result, if water were to spill in the process of pouring or drinking it would pool in this recess rather than stream down the outer surface of the container. Furthermore, spilling in general is prevented through the redesign of the spout's subtle interior inward curvature. Indeed, spillage should not occur in the process of pouring water because of the design detailing. This has historically and culturally been the way to “properly” drink from the traditional ebreeq—one clean fluid motion of pouring water into the mouth. It should be noted here that the handle which is part of the traditional ebreeq has been removed to

modernize its design. Traditionally, potters attached it at a later stage after shaping the ebreeq and attaching the spout, so the handle is the least integral part of the original design.

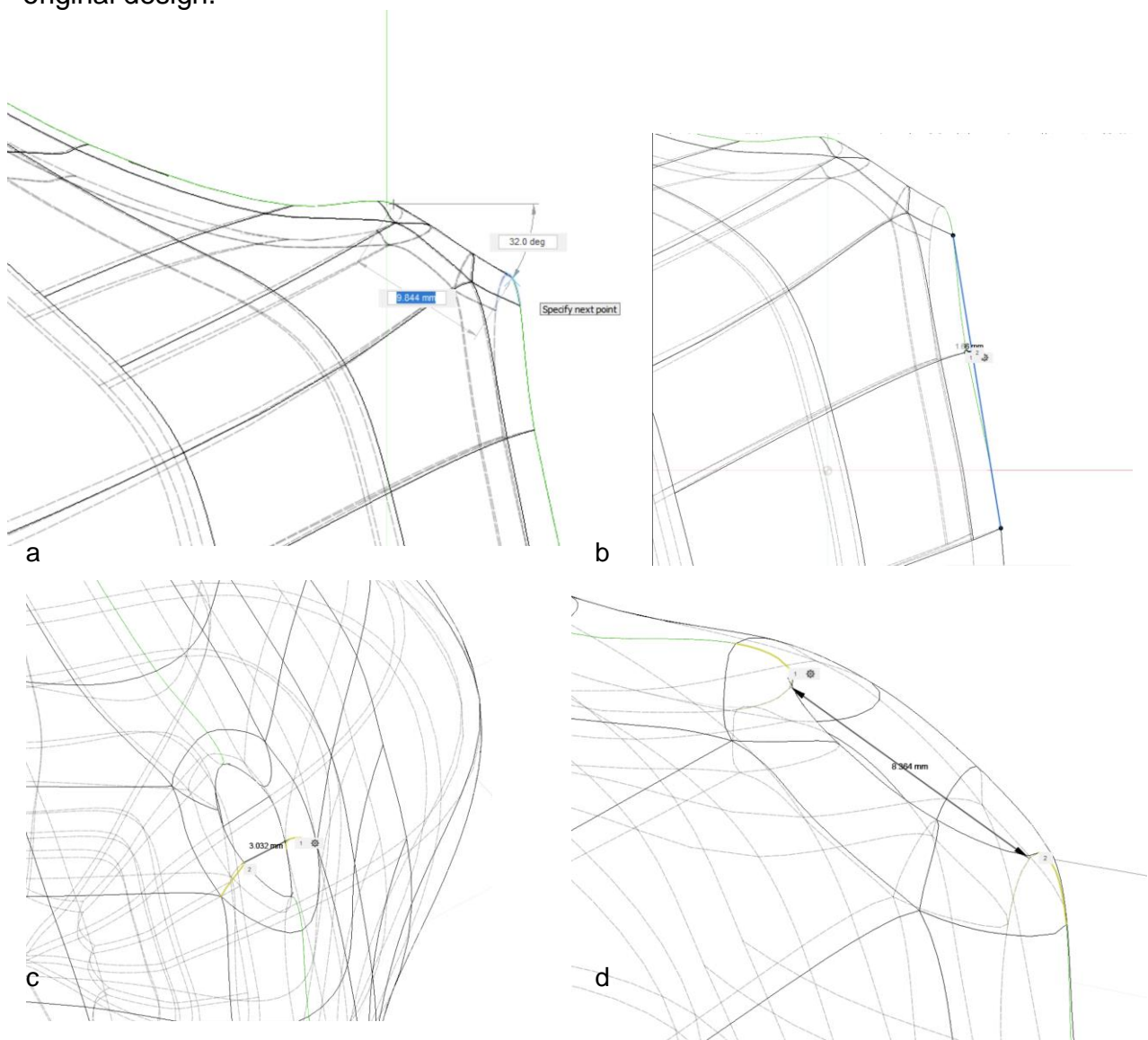


Figure 126 Spout (a) Side view spot (b) side view inward by 1 mm (c) top perspective view width measurement (d) side perspective view, length of the Interior and exterior measurements of the spout

5.2.1. Implications of my Findings

Through this research I have found that the egg-shape is an invaluable intelligent element forming a dynamic space within the continuous flow of time. It remains a core attribute of the neo ebreeq. In addition to the egg-shape, motion design facilitated connections between traditional and modern features of this project, based on the precise moments of a person's interaction with the ebreeq when drinking from it. Apart from the aesthetic and conceptual value of the neo ebreeq, my findings establish how motion design as an amalgamation of moments with

form can function as a method for product design offering a framework for contemporary designers and makers interested in reviving culturally significant objects. In addition, I have demonstrated how motion design can be assisted by concepts of locomotion, Futurism, post-structuralism, time-based semiotics and parametricism in the design of new products.

Moreover, the conceptual framework has bonded the theoretical and the practical components of this research in ways that reconsider the means of production of the ebreeq. Indeed, the neo ebreeq can extend beyond its traditional physical form. The use of motion design enabled me to extend the sequential unfolding of moments related to water to exploit the space within the traditional ebreeq and apply this toward the design of the neo ebreeq. Hence, these moments are likewise shared with those who see and experience the new ebreeq. The neo ebreeq is based on the visible and the invisible, the known and the unknown. Its physical presence is accompanied by implicit and explicit significances — the egg-shape, the interaction of water with the ebreeq, as well as historical and cultural meanings that are carried over into contemporary times.

5.3. Contribution to Knowledge

5.3.1. Contribution 1: Bridging Tradition and Modernity

This design research applied contemporary materials and current technological innovations in motion modelling as well as 3D printing to the analysis of the traditional ebreeq and its redesign, enhancing its value for contemporary experience. Unlike the various examples I examined that considered frameworks for redesigning traditional objects, this research aimed at readdressed functionality and ergonomics as well as aesthetics. The research took as a central element water and its movement in curved containers. While the design outcomes of the research are linked to various advancements at the forefront of present technological development, the core findings of the research have application to past and future technologies. The research has demonstrated that traditional objects can be reinvigorated through design while maintaining their underlying form and function as well as cultural values.

The originality of this practice-based research project derives from bringing together of divergent forces, examined through approaches that combine

contemporary methods of making – 3D technologies for example – with historical and cultural understandings of traditional objects. The traditional ebreeq had been constrained to specific structures because of material and analytical limitations to design. But the availability of 3D advancements for a motion designer enables the redesign and making of the neo ebreeq in ways that could not have been conceptualized or carried out with conventional apparatus.

Traditional ebreeqs have social significance related to the past in terms of stillness, the pre-mechanical, the native and the embryonic. This is in contrast with the neo ebreeq which has an advanced, digitalized, developed and progressive fluid form. The internal dynamic of the traditional form has been applied throughout the design of the neo ebreeq. However, the connection of the traditional ebreeq while in use with water has created new structures and forms, spanning present and past customs amicably and originally. Also, using the characteristics of the traditional ebreeq established a connection among dynamic forces (i.e. pouring water and drinking; filling water and emptying it from the ebreeq) which have been set against one another. This connection of forces has produced a new form of the ebreeq that harmoniously bridges modernity and tradition.

5.3.2. Contribution 2: Combining Motion Design and Product Design

To apply extracted imagery from motion design and 3D generated meshes to redesign the ebreeq towards the creation of multiple neo ebreeqs with enhanced meaning through the development of a contemporized aesthetic

The practice of crafting clay is characterized by potential transformations “through [the] development of a type-form, combination of forms, or domain shift. [Moreover,] marking an object can be a [...] fundamental matter of establishing one’s presence, objectively” (Sennett, 2009, p. 144). The feasibility of this transformation is also the direct outcome of the domain shift which provokes mental engagement to switch and compare habits against monotony and closed systems of routine. It also facilitates dynamic repairs by means of the corrective skill of problem solving which closely relates to the problem finding (2009). As such, the process of redesigning the neo ebreeq has recreated it as a cultural and contemporary vessel, combined its traditional form with a modern and dynamic design through a domain shift merging traditional pottery with 3D technologies and, more importantly, motion design and product design.

In other words, the neo ebreeq is identified not only in terms of its cultural background, but also in relation to my knowledge in motion design; the latter initiated the revival of the traditional ebreeq through a movie and developed it into a tangible product as a result of its transformation. Therefore, motion design has been crucial in the invigoration of this culturally significant object and the approach to reimagine its production beyond customary pottery workshops. Researching and understanding the qualities and characteristics of a traditional ebreeq have been indispensable in order to elude imitating its basic shape where the new design of the product becomes an end itself. On the contrary, reviving the traditional ebreeq and its sustainability in modern times has been at the center of achieving the final design of the neo ebreeq.

None of the redesign examples I examined considered the role of motion design as a method towards their design. My knowledge and experience as a motion designer enabled me to contribute a unique approach to the redesign of the traditional ebreeq. Most product designers would not study an object through filming and frame-by-frame motion analysis of water while the ebreeq is in use. Through this practice-based research, the “creative artefact is considered the embodiment of the new knowledge; emphasis is placed on creative exploration and innovation in the given [...] practice” (Skains, 2018, p. 85). This led me to develop new perspectives in examining, understanding and re-designing the neo ebreeq, which could be applied to other culturally significant objects in the future, by other researchers or myself. It is an unconventional approach towards object design that has led to unconventional results. I see this as a contribution to knowledge in the fields of both motion design and product design.

In my redesign of the ebreeq, inner motion has been maintained although the more static outer presence of the traditional ebreeq had been shed in favour of a form that reflects inner dynamism externally. This fundamental approach for redesigning and invigorating the traditional ebreeq came about through locomotion and chronophotography; the inner and outer reality of the ebreeq and the water movement expressing the change of water were taken into consideration, based on the human interaction with the ebreeq while in use, which brings the gesture.

Furthermore, the contemporary fluid shape of the neo ebreeq reflects not only on the sectioning of the water, but also on the structural occupied space within the

traditional ebreeq. The fluid responses to the shape while in use are recognized by the curvilinear typology, which were made through the use of motion design techniques and 3D digital technology (Figure 127).

This process helped me investigate the motion of water that signifies the characteristics of the neo ebreeq. This concept applies the analysis of motion through the sequential unfolding of moments to product design, phrased as the amalgamation of moments into form. The resultant form portrays the quality of the movement that has engendered its form. The multiple models were intended for producing as many prototypes out of the meshes as possible to enable the creation and the design of the neo ebreeq; modifying the measurements of the ergonomics changes most parts of the neo ebreeq and leads to deficiencies. As such, the final design outcome was selected based on optimal symmetry, balance and ergonomics.

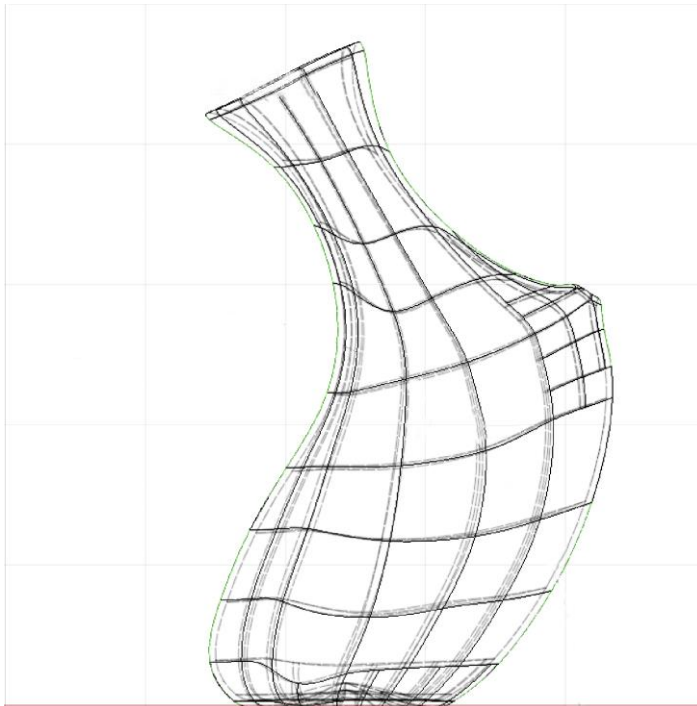


Figure 127 The design of the ebreeq on Fusion 360 (3D software) – the wireframe is used as a last stage before 3D printing to examine the consistency, the correct thickness and the weight of the neo ebreeq which certainly evokes the fluidity of water with the three gestures.

5.3.3. Contribution 3: Combining Digital and Traditional Techniques

The use of digital technologies enables potential outcomes that are impossible to handcraft. They offer innovative possibilities as well as relevance to contemporary society. The use of these innovative 3D technologies with traditional techniques

created a plurality of potentials: the interaction with the neo ebreeq (drinking, emptying and filling) combined with the notions of time (the past, present and future) intersect in multiple 3D typological ways using traditional and new material (Figure 128). This indicates that the neo ebreeq has dynamic qualities offering the possibility of using either ceramics as traditional material or other new materials to craft it through 3D technologies.

It should be noted here that the nature of a practice-based research allowed motion design to answer the research question of how to reinvigorate the traditional ebreeq. “What emerges, then, from this methodology, is the *exegesis* that accompanies the creative work: that knowledge that has remained implicitly within the artist [or designer], made explicit and seated within the context of the scholarly field” (Skains, 2018, p. 86).



Figure 128 Dynamic and harmonious interaction with the traditional ebreeq, showing the three gestural conditions: drinking, emptying and filling



Figure 129 3D rendered, brown ceramic neo ebreeq, inspired by a traditional ebreeq colored in brown clay and fired afterwards



Figure 130 3D rendered glass neo ebreeq, inspired by a traditional ebreeq made from glass



Figure 131 3D rendered glazed ceramic neo ebreeq

The above experimentations are 3D rendered. Since using traditional materials with new technology is at the core of my research, I used materials including glazed ceramic and glass to envision the future possibilities of the neo ebreeq. The examples in brown ceramic (Figure 129) and glass (Figure 130) are interpretations of conventional materials in making the ebreeq, while the neo ebreeq 3D rendered in white glazed ceramic evokes a contemporary alternative image (Figure 131). Due to limitations in possible material experimentations through 3D printing, I have instead envisioned how the neo ebreeq could look in the future if printed in various materials, including titanium and carbon material (Figure 133), in addition to coloured blown glass in graduated warm hues (Figure 132). These samples maintain the aesthetic aspect of the neo ebreeq while merging technology with new materials. They also demonstrate a sequential progressive flow linking the past and the future to create a new dimension that evokes the fluidity of water.



Figure 132 A variation of 3D rendered neo ebreeq, inspired by blown glass ranging from white to brown in gradating hues



Figure 133 A variation of 3D rendered neo ebreeq in carbon material

As a motion designer, I examined methods in which 3D innovative technology within motion design facilitated the capture and analysis of time and motion as it relates to the traditional ebreeq and the water this object contains, that ultimately became the essential aesthetic qualities of the neo ebreeq. Also, this innovative approach led me to contemporize the form of the ebreeq and contribute toward understandings of this object's value as a carrier of water, the symbol of life. This is important in terms of the application of the ergonomic process and decision making to other similar objects. The process of making evolved until the final

design outcome was achieved. “Designing is a process of pattern synthesis, rather than pattern recognition. The solution is [...] actively constructed by the designer’s own efforts” (Cross, 2006, p. 8). Accordingly, “designing proceeds by identifying requirements, or desired functions, [...] suggesting ‘protomodels’ of forms or structures, and evaluating these in order to amplify the requirements or desired functions” (Cross, 2006, p. 55). As such, it has been a long process of trial and error to establish the method and approach for developing this project-based research. However, throughout, the distinctive trait of the neo ebreeq design kept in mind that this is a social object, and adopted the interaction with the water-containing object and its corresponding three gestures of filling, drinking and emptying, creating key moments to produce a new form through amalgamating these moments together.

5.4. Reflections on Future Research

Undertaking the doctoral research practice at Manchester Metropolitan University has been an invaluable learning experience. I have gained a deeper insight into the nature of research and new approaches in practice and learned that there are instances when findings and project applications do not fit neatly into the research, which can be frustrating and at times tedious. Nonetheless, the results are often enormously gratifying and exciting. My PhD research study has aided me with some key concepts which drove me to examine my own professional values and approaches towards possible changes within my own future practice. This study also allowed me to grow as a full-time faculty member teaching Master of Art in Design courses at Notre Dame University (Lebanon) toward the integration of 3D digital technologies and related theories into my teaching. Indeed, I have been able to incorporate my research and practice findings into the courses I teach.

The in-depth process I have undergone lends itself to future plans of publishing research papers which focus on the history of the ebreeq, invigoration of culturally significant objects using new technologies and the use of motion design for product design. First, I believe that the information I have compiled on the history of the ebreeq has the potential to serve as a useful core collection of knowledge for others. I have managed to pull together scattered research from various sources that are at times in different languages. Second, I hope that insights I have gained regarding value finding in traditional materials and forms when translated into 3D technologies and production may aid others by providing

practical methodologies toward the invigorations of traditional objects. Lastly, practitioners in product design may find the application of motion design studies to their field inventive and inspiring. I intend to specifically put forward my insights within this area in paper form to journals.

Such publishing efforts would be in addition the exhibition of my neo ebreeq design at annual events such as Beirut Design Week and Beirut Design Fair. I would also work to participate in other initiatives pertaining to projects that celebrate heritage and the revival of cultural objects in collaboration with local and regional municipalities and organizations.

On the other hand, the application of 3D printing and modern technology paves the way to similar project-based research like the neo ebreeq in the future. I plan to implement my research findings and methodology to further cultural significant objects in Lebanon. After the neo ebreeq, I intend to further examine objects which I found during the restoration of my family house such as a segmented metal lunchbox and a traditional coffee grinder (see Figure 3 in Chapter 1) which are no longer used nowadays. My research has incited me to seek potential future collaborations with designers and makers while adopting the approaches I have learned in making in order to develop a series of redesigned objects. Meanwhile, I will develop and post an online template of the neo ebreeq to make it available for 3D printing on premises equipped with a 3D printer, aiming to extend its impact on a local, regional and international level.

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Appendices

Appendix 1 Sequence

In my MFA thesis, I used film animation sequence to create static images: from a dynamic film, static 2D images immersed. This PhD research, on the other hand, incorporates an advanced level of this motion which starts in 2D and proceeds to become a 3D object combing multiple conditions.

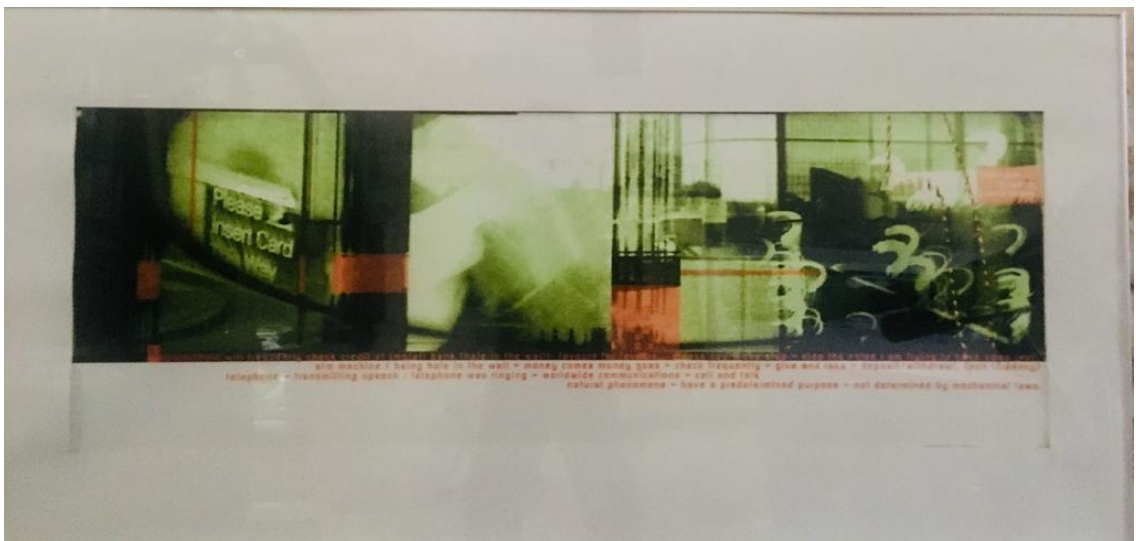




Image 1 The posters from my MFA titled Sequence

Appendix 2 Abstracts from Published Papers and Research

2.1. Writing & Research for Graphic Design within Undergraduate Studies

Numerous questions arise from the topic of writing and research for graphic design. For example: Why do graphic designers often not learn to research and write for design until studying at the Masters or even the PhD level? Why do many faculty of graphic design not have knowledge of common research paper writing? If they were not taught this process and cannot contribute to the future world of design research, who will? Furthermore, how will today's students learn this valuable skill? Research and writing are not simply for the scientist or historian buried in books and publishing for a limited scope. Every publication, printed material and on-line resource regarding design should involve research and writing. Many of today's professional publications on graphic design are little more than image-based "eye-candy" with no, explanation, information or description included. Through the examination of current design research in publications and journals the potential expansion of written research in graphic design is explored.

Problems within pedagogical approaches and graphic design studies are approached. Moreover, the promise of graphic design students as great researchers and writers through combined creativity and logic is investigated. Research paper writing is a means of influence and inspiration for design innovation. Questioning, analysis, and a formulation of ideas into words and solutions benefit not only the growth of the individual designer but also the reputation of the graphic design discipline. The lack of writing and research within contemporary graphic design studies is detrimental to the current state of the profession. However, improvements are possible. The advancement of design writing and research can be made through: modifications to undergraduate graphic design programs, improvements in faculty development and an analysis of contemporary design publications.

To read the above article visit:

<https://laur.lau.edu.lb:8443/xmlui/bitstream/handle/10725/5712/Writing.pdf?sequence=1>

2.2. Cultural Identity Crisis within Contemporary Graphic Design, Case Study: Lebanon

Visual representations of Lebanese culture are rich and diverse. Traditionally, Lebanese culture is a unique mixture of the East and West. However, Westernization jeopardizes this cultural identity in contemporary Lebanese graphic design. Furthermore, today's Lebanese design students commonly refer to Western inspirations and view Middle Eastern influences as conventional. Student designers are integral to the revival of their visual culture. Pedagogical approaches can encourage the incorporation of visual culture into design by embracing change without obliterating the past. Adjustments are necessary in design studies through the modernization of Lebanese visual culture within graphic contexts. The future existence of a Lebanese visual cultural identity is possible through changes in graphic design studies.

To read the above article visit:

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.594.8424&rep=rep1&type=pdf>

2.3. Sustainability and Design Education, Case Study: Lebanon

After twenty years of civil war and continued political and economical turmoil, concern for ecological issues is not a priority to most Lebanese. Lebanese students in higher education design programs are typically not even familiar with the term sustainability. Literary research found that a handful of NGOs, global corporations, local businesses and the Ministry of the Environment are currently addressing ecological issues in Lebanon, but merely on a surface level. Living within an ecologically diverse yet deteriorating country the Lebanese must take action immediately. From this, the question arose: How can design education in Lebanon be modified to encourage sustainability? A qualitative analysis of sustainability progress within design education outside Lebanon was conducted. By having faculty as question-asking facilitators and reference providers, students as content-creators capable of self-run critiques as well as program and course revisions made to be green-focused potential to modify Lebanese design education exists. Examples are provided that combine the literary findings of existing sustainable activities in Lebanon with pedagogy progress outside Lebanon to create program titles, course titles, project descriptions and student actions with community collaborations in a Lebanese context. The integration of sustainability within design education can serve as catalysis for environmental change in Lebanon.

To read the above article visit: https://www.cumulusassociation.org/wp-content/uploads/2015/09/Cumulus_Proceedings_Shanghai.pdf

2.4. Future Design Education: Methodologies Using 3D Technology for Object Design in Higher Education

The use of 3D technologies in conjunction with traditional tools and methods presents great opportunities for developing new ways of designing while utilizing pre-existing theories. Furthermore, it is not simply the way 3D printing, scanning and software can be used as a method to advance new kinds of thinking, practicing, approaching, examining and designing 3D objects that have cultural significance. Culturally significant objects were previously limited to certain forms due to limited technologies. In times of digital change, the use of 3D technologies in higher education enables students to create complex object design that could not be done with traditional tools. Furthermore, these 3D technological tools can

expose students to versatile applications from digitization, via web-based visualization all the way to 3D printing.

This article examines six object design case studies. Each example is a form of professional practice or experimentation related to 3D technologies that are studied through perspectives on object design methodologies. These case studies are examined as holding potential educational purposes. In addition, each example is grounded in historical cultural relevance serving as a potentially valuable design platform in higher education. These case studies depict how 3D technologies are helping reproduce, restore, design and educate. 3D modeling, digitization and printing are changing how we relate to past methodologies of making; indeed, there are three types of possible relations between 3D technology and traditional object design. The relationship may be improved, extended or separated; the object's new design may also result in a combination of the three.

The conceptual framework of this article focuses on methodological approaches within the post-industrial contexts of 3D technologies and communication activities, which are brought together to reveal their common knowledge interests and the potential they hold to be applied in design education for better cultural object design in the future.

The article is available in the conference proceedings of the 5th International Conference on Arts and Humanities 2018.

2.5. The Art of the Written Word and New Media Dissemination across the Borders between Syria and Lebanon

In this essay, Tarek Khoury, Lebanese designer, writer and Assistant Professor in graphic design examines the visual characteristics of Syrian activist images and videos disseminated by way of online media. Through his examination a unique coexistence of old and new media emerges. As Syrian activists handwrite on bits of scrap paper, walls and cardboard their voices are expressed through traditional media forms. However, it is through new media that their expressions are recorded and circulated. The outcome is politically charged imagery disseminated within the realm of new media communications with innately visceral human aesthetic. This essay looks into the interconnections between traditional and new media as well as changing perceptions of each due to their opposing intrinsic characteristics.

Throughout the Middle East and particularly in Syria this combination of media plays a role within the revolt against tyranny.

To read the above book chapter, refer to *Uncommon Grounds: New Media and Critical Practices in North Africa and the Middle East*.

Appendix 3 Personal Correspondence at Mishmish Pottery Workshop

Between the years 2014 and 2015, I visited the pottery workshop in Mishmish where I witnessed the process of how a traditional ebreeq is crafted from beginning to end. The interviews and discussions with the main ceramist Arcangel Moussaand and her colleagues were spontaneous and developed as they molded an ebreeq while I recorded and photographed the process (Figures 34, 36 and 37). It should be noted that

design knowledge resides in products themselves: in the forms and materials and finishes which embody design attributes. Much everyday design work entails the use of precedents or previous exemplars [...] because the exemplars actually contain knowledge of what the product should be. This is certainly true in craft-based design: traditional crafts are based on the knowledge implicit within the object itself of how best to shape, make and use it. This is why craft-made products are usually copied very literally from one example to the next, from one generation to the next. (Cross, 2006, p. 101)

During these visits, I was informed about the long tradition of crafting the body of the ebreeq in an egg-shape and its importance in terms of the water circulation inside the ebreeq. Shedding light on the relevance of the egg shape – which was also indicated in findings like the use of ostrich eggs for carrying water – directed my attention towards looking further into other culturally significant water vessels which, although reinvigorated, maintained the egg-shape of the body. In addition, while one of the ceramists of the workshop made an ebreeq, he pointed that the spout and the handle are elements which are added after the body is molded – and amended depending on the size of the ebreeq; this is an aspect incorporated in the process of decision-making regarding the design of the neo ebreeq. In other words, although my visits to the workshop were not accompanied by formal questionnaire and reports, they were indispensable to closely get acquainted with the production of the traditional ebreeq and its anatomy which is far from arbitrary. Also, filming and photographing how water pours in a glass ebreeq developed the concept of capturing multiple moments of the interaction of water with the ebreeq;

in other words, the decisions involved in the design process of the neo ebreeq emerged through visual answers and personal correspondence.



Image 2 Recording the process of making a clay ebreeq

Appendix 4 Limitations of My Research

4.1. General Limitations

Undertaking this research study has faced limitations which had to be addressed to overcome the challenges they presented. As a faculty member teaching at NDU, I was compelled to use my free time while on campus to conduct this research and proceed at home; this made the availability of time and the necessary devices to edit or save large files an ongoing limitation. Also, language and lack of resources were additional limitations which had to be tackled. The lack of resources about the ebreeq in English directed my search for studies in Arabic, which was a challenge as well in terms of selecting credible entries amidst limited governmental interventions to preserve and promote cultural heritage. On the other hand, visits to pottery workshops and personal correspondence with their potters were a limitation due to the fact that most of them are located at far and considerably insecure areas in southern Lebanon. Lastly, 3D printing and experimenting with prototypes has been a prevailing challenge because of the high cost of not only 3D printers, but also the required filaments which were largely unavailable as well.

4.1.1. Identifying the limitations

- *Alternatives and methods to minimize limitations*

The methods that helped me minimize time limitations include using a USB, Powerbook computer and external hard drive which gave me the flexibility to work both at home and at the Notre Dame University, where I teach. With the latest technology, I was also able to render my files through my Powerbook computer rather than using a large memory desktop computer. Cloud 3D is a technology which enables users to buy credit online and have their files rendered through the network.

- *Identifying additional limitations*

Using an Arabic keyboard was necessary to research and find additional information about the traditional ebreeq due the limited data and the in-depth documentation specifically about the ebreeq. One of the reasons for this limited information regarding such heritage objects is because legislative authorities in Lebanon have ignored many heritage concerns since 1945 when Lebanon gained its independence (Thabet, 1998, para. 5).

Visiting Rachaya el Foukhar, the oldest Lebanese village well-known for its pottery, was another challenge. The village is located in the district of Hasbaya, in the Nabatiye Governorate in southern Lebanon. I was not able to visit the Rachaya el Foukhar due to the critical political situation between Lebanon and its neighbouring countries. Instead, I visited a small local ceramics studio at the Kfarsamaa Monastery in Mishmish, located in Mount Lebanon, where I conducted multiple interviews with the owner Arcangel Moussaand and main ceramist of the studio; during my visits, I also took photographs and videos recording the conventional process of making a clay ebreeq.

4.1.2. The impact on findings

The latest laws that dealt with heritage were issued during the French Mandate (1923–1945). One of the two laws (number 166/L.R., issued in 1933) deals with archaeological ruins and the second is the Environment and Natural Scenery Protection Law (issued in 1936). Apart from these two texts,

Lebanese legislature remains inactive regarding matters related to Lebanese heritage (Thabet, 1998, para. 5). Alternatively, since historical examples and credible resources were difficult to find and study, it was necessary for me to take initiative and conducting personal research were necessary to proceed and gather data to minimize the impact of thin legislative protection of traditional objects on my findings.

4.1.3. Alternative Steps and methods to minimize limitations

The article “A Tophet in Tyre?” documents numerous archaeological items discovered in Tyre (southern Lebanon). From the excavation, several jugs were excavated and documented. Despite the fact that most of them were offering jugs, one was for drinking which is particularly interesting for its built-in filtering system. Also, the collection of the Monastery of Saint Moses the Abyssinian in Syria was documented by Dr. Michael Fuller (2019). The collected archive has numerous artefacts, including an 18th century drinking vessel which is glazed, fragmented and referred to as ‘briq’.

Additional data is derived from a thesis by Fatima Amin Barkawi. In *A Survey of Contemporary Lebanese Pottery*, Barkawi notes that before the mid-1900s, Lebanese craftsmen produced “very massive water jars when the water resource was mainly ‘al ein’ [Arabic for a spring]. Now, after running water has been supplied, they have stopped producing these big jars, and smaller jars have become more practical. The average potter can produce sixty to eighty jars per day” (Barkawi, 1963, p. 18).

Researchers can view very few excavated ebreeqs showcased in Lebanese museums, such as the one at the Nabu museum in the north of Lebanon. The exhibited items are clay handmade vessels, labelled as Islamic ebreeqs. Two of them are from the 14th century AD and one of them is estimated to be from the 12th or the 13th century. Despite the fact that the showcased vessels are to some extent different in their shape and detail, they are similar to one another and have the overall shape of the ebreeq and that is mainly the egg shape at the center, the long neck, the spout and the handle on the side. In other words, although the showcased vessels were made centuries apart, they carry a striking resemblance especially in their maintained egg-shape.

The above resources are among the very few examples of available research related to the ebreeq and its background, especially when it comes to finding studies in English that are also recent. Also, mostly relatively informal resources such as blog entries and personal initiatives inform the readers about the ebreeq in Arabic. Therefore, this study combines these available resources and raises awareness that the topic of the ebreeq as a culturally significant object is not given the attention it requires. This project not only aims to reinvigorate the ebreeq and revive its use in modern times, but it also puts together a recent informative and academic resource which researchers and designers could approach as a reference and extend its implications to other cultural objects.

4.2. Limitations Related to 3D Printing

4.2.1. Identifying limitations related to 3D printing

The prototype and the final production of the neo ebreeq were realised using 3D printing. The filaments in Lebanon cost twice as much as in the UK, and only PLA materials were available to purchase in Lebanon; therefore, the filaments had to be ordered online. The availability of 3D printers in Lebanon was an essential part of my practice and research.

4.2.2. Impact on my findings

It was neither easy to have the neo ebreeq prototype 3D printed nor was it feasible to experiment with filaments. The high cost and the unavailability of the materials were factors that limited the number of prints and experiments. In other words, since the cost of 3D printing within the Lebanese industry is expansive, to print the neo ebreeq using PLA (polylactic acid) costed around 300\$; also, other materials like PETG²⁹ were limited to experiment with.

4.2.3. Alternatives and methods to minimize limitations

Initially, I purchased a fairly priced used 3D printer (a MakerBot) which prints small-scale objects with PLA and ABS material only. This was a good alternative to print the neo ebreeq prototype before proceeding with large scale printing. I was able to print the neo ebreeq in its actual scale in two parts; once put together, I was able to realise the neo ebreeq in its full scale.

²⁹ In PETG (Polyethylene Terephthalate), G stands for Glycol-modified.

At a later stage in the research, I was able to print the neo ebreeq at the Notre Dame University, Lebanon, using Ultimaker extended 2+. Nonetheless, it was still very costly to print.

Although fundamental to the research, 3D printing proved to be a challenge to undertake throughout the design and making process of the neo ebreeq; as mentioned above, 3D printers and the corresponding materials were not commonly available and costly to use for the time-being. However, 3D printing lends itself to the future possibility of becoming more accessible and, even a facility to be made available inside one's households. This opens up the opportunity of printing products in a variety of colors and materials in a domestic context.