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Design Education at the Boundary.

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Abstract: This short paper gathers insight about learning environments in design and leadership in the creative industries. The production of expertise is often highly specialised and domain specific, however this study observes a learning situation that places emphasis on collaborative interaction and group dynamics nested within dense creative networks. Design learning demands complex problem solving and decision making in response to contingent situations. These environments defy brevity of explanation, yet are microcosms of radical transformations in the digital economy. The reciprocal relationship between learning environments and industry are explored. Embedding in a network of learners and experts, using ethnographic methods blend situated insight with theoretical oversight. An ethnographic investigation of a learning organisation is applied to generate insight that reveals a dense network of collaborative practices, the production of experts and complex reciprocal relationships between learning and professional practice. Intense and inevitably participatory ethnographic engagements are indicative the processes of transformative change and challenge our understanding of the nature of learning. The role of innovation and flux in societal structures is reflected in these radically different approaches to learning. The image that appears is highly counterintuitive but prescient, providing foundations of new approaches to design education at the boundary. Learning environments that are responsive to a world that is rapidly moving beyond a stable state.

Keywords: Design, Learning, Innovation, Digital Transformation, Ethnography

1. Introduction

Over fifty years ago, Marshal McLuhan envisioned a world in perpetual flux;

''In the age of electricity and automation, the globe becomes a community of continuous learning, a single campus in which everybody irrespective of age, is involved in learning a living" (1964).

Constant change demands a dynamic response from learning environments. Education and the professions are complexly related, supposedly engaged in the production of expertise and the provision of individuals capable of responding to shifting societal circumstances. Radical learning environments and innovation in this space signify an adaptive response to these challenges and consequently should produce adaptable individuals capable of responding to societal change. To integrate across boundaries between social worlds. Notionally, protean learning environments act as

sensitive indicators of this adaptive response, engaging leading experts in replenishing professional membership. This interface, the boundary between education and work is of significant research interest.

Donald Schön identified an important societal tension, a state of affairs common to advanced technological economies; the flux of change is unavoidable, yet a belief in a stable state is persistent. This drove his pioneering inquiry and contributions to learning in society. This “belief in the unchangeability, the constancy of certain central aspects of our lives, or the belief in the attainability of that kind of constancy, feelings of uncertainty produce considerable anxiety, against which we erect the belief in a stable state” and yet “there’s no established institution, moreover, which now feels adequate to the challenges which confront it. Institutions which were developed in the late years of the 19th and the early years of the 20th century find themselves threatened by complex changes that are now under way” (Schon 1970). Recent events lend Schön’s words added gravitas, a prescient image of socio-economic change. His conception implores us to transcend the stable state, a necessity to develop social systems that could learn and adapt. How do we learn to design these?

In the domain of the professions and their corollary institutions, social structures exist as redoubt to social change, providing important continuity in social life. The professions function as important macrostructural entities that anchor societal activity, bridging the domains of living, learning and working. The continuum of stability remains a powerful organising concept, furthermore it underpins another persistent and pervasive interpretive schema at the core of advance technological society, progress.

The OECD, a typical intergovernmental economic organisation acknowledges this. Espousing an agenda to create the highest sustainable levels of economic growth, employment and rising standards of living whilst, crucially, maintaining economic stability. As social and technological factors drive change, communities evolve and social roles change as we navigate life. People and institutions that display the capability to adapt are resilient, those lacking this ability become vulnerable and dependant (OECD & Canada 2005).

A growing number of organisations and communities of practice have come to apply methods derived from or allied to design. Rapid social and technological change in reciprocal interaction pose existential threats to once seemingly inviolable edifices. Arguably, an inherent plasticity of design methods is harnessed because of their capacity to engender responsive structural change. To transform quickly and with relative economy, but changing structures designed to be both pervasive and obdurate is severely challenging.

The disruptive impacts of technology compound and confound this tension. As Hilbert asserts; digital technology is the most powerful, tangible tool we currently have available to exploit the ensuing opportunities for social change, we must not be afraid of asking the big questions that arise from the incredibly complex dynamic of ongoing digitalization (Hilbert 2015). This complexity also inhibits adaptation, technological systems at once inhere transformative potential but their reality is hard infrastructure and levels of abstraction that impede pliancy.

Adaptability to changing circumstances is arguably determined by learning capability, the capacity to make information intelligible and environmental resources useful. However, “talk about change is as often as not a substitute for engaging in it” (Schon 1970). The rhetoric of perpetual innovation is in tension with our need for stability and resilience. Manzini was amongst the first to deeply connect innovation with resilience. ‘Resilience with reference to sociotechnical systems means the systems capacity to cope with stress and failures without collapsing and, more importantly to learn from the

experience (Manzini & Coad 2015). This reveals the connection between capacity to adapt with capacity to learn. To innovate is to learn to change in response to circumstances.

This tension raises questions. If Schön's call a shift towards social structures that transcend stability is necessary, if not desired, how does the design of learning respond to these challenges? Theories of learning used to design learning environments are crucially important. The strategic relationships at the interface between learning and work demand scrutiny as they can reveal how learning enables change in societal structures? Learning occurs on a personal level but it inevitably happens amongst people, it is shared. Learning environments signify spaces of negotiation of societal change, to speculate upon apposite responses to change. Can we learn to design beyond a stable state, to design learning for what's next? This paper focuses on an organisation engaged in the design of learning, but emerges from the learning of design.

2. Research Methods

Identifying a research site reveals implicit values, in social research, there is a risk that we find exactly what we are looking for, even when circumstances indicate otherwise. Design learning in action is a tremendous source of insight into important phenomena. To be immersed in a studio in flow can be a powerfully transformative experience. The digital economy signifies an important frontier of radical change, integrating disciplines to solve problems that have far reaching societal impacts. To explore this first hand meant situating a research study where these phenomena are being enacted, a situation that might signify a frontline of innovation and transformation. This research engages with a business operating on two fronts, both as a school of creative leadership and consultancy engaging with transformation in organisations. This dense network, operating globally, is arguably embedded in transformations resulting from digital economic and social activity.

Ethnography, a method allied to anthropology, has rapidly become an essential tool applied social researchers and creative practitioners, it applies comparable interpretive methods. If ethnography means writing about groups of people, then it provides a means of building insight, making it intelligible and transmissible. It lends an indispensable ring of direct experience to interpretation, functioning to bridge theory with practice.

This study hinges on its capacity to reveal patterns in complex circumstances. In practice, this tool captures only fleeting glimmers a situation, bridging observation to theory is challenging. The crux of ethnography; is to bridge across this boundary. Furthermore, it acts to blending an inside view with outside perspective, to produce a convincing narrative. To paraphrase; "Ethnography is about telling a credible, rigorous, and authentic story. Often relying on verbatim quotation and 'thick description' of events. The ethnographer adopts a cultural lens to interpret observed behaviour, placing it in a culturally relevant and meaningful context, revealing predictable daily patterns of human though and behaviour. Ethnography is both a research method and a product, typically a written text" (Fetterman 2010).

Studies of this kind embody a central problem in the social sciences, stemming from the debate between sociologists Kenneth J. Gergen and Barry R. Schenkler around the meaning of social research. This debate was encapsulated by Warren Thorngate, whose postulate of commensurate complexity argues that theory about social systems can only resolve two out of three meta-theoretical virtues of generality, accuracy or simplicity. As Thorngate opines 'It is impossible for a theory of social behaviour to be simultaneously general, simple or parsimonious, and accurate' (Thorngate 1976). Simply put, social research is constrained in its ability to understand and explain, the tension between 'in general' vs 'it depends' is inherent to forming viable theoretical

explanations. As Russell Ackoff found ‘analysis yields information about the structure of something, knowledge or know how. Explanations lie outside, that’s synthetic thinking’. Analysis yields knowledge, synthesis yields understanding. He found this distinction was critical for the emergence of systems science. Researcher must apply both, but, particularly when systems involved people, synthetic thinking is required (Ackoff 2005). Design methods arguably hinge upon synthetic thought which is why they remain fundamental to understanding, and causing change, in social systems. Given this, avoiding description and searching for underpinning phenomena is the aim of this short paper.

In practice, gathering insight into complex collaboration is challenging, the flow of embodied experience is rapid, even close attention to individuals is overwhelming, unbounded and messy (Law 2004), group interaction compounds this. Narrative insight has the capacity to cohere tangled circumstances, revealing alluring simplicity whilst eliding detail. The demand to innovate ethnographic methods to account for the complexity encountered in complex environments is pressing. An open participatory method proved indispensable, tracing the narrative arcs of assumptive concepts back through the evolution of an organisation within its changing context. Studying this organisation revealed a guiding vision which to some degree it has had agency in realising, which now finds them asking important questions of how they must adapt. Engaging the innate interpretive expertise of participants (Potts 2015) was crucial to deal with this complexity, eliciting narrative through semi structured reflective interviewing, drawing on the Rubin’s (H. J. Rubin & I. S. Rubin 2011) qualitative interviewing techniques to “hear data” allowed for internal validity to be created alongside a thematic coding process adapted from Grounded Theory (Glaser & Strauss 2009). An image of organising concepts within the organisation emerges. We discuss theoretical connections, rather than addressing the specifying incidents.

3. Learning Environments as Boundary Interfaces

The organisation in question provides advanced vocational training in leadership and design methods supplying professionals and leaders for the creative industries. The communities of practice allied to design are highly relevant for study because of their important role in mediation and signification of cultural meanings. Structuration theory provides one such means to interpret this, by implying that human communication involves the use of interpretive schemes, applying the resources of knowledge to make sense of human action, to produce and reproduce structures of meaning. Human agents utilize power in interactions drawing upon their facility to interpret, their ability to allocate material and human resources, this in turn ramifies their ability to create reinforce or change structure (Giddens 1986). Design cultures, in this way, play an important role in this process of signification as design learning amplifies capacity to shape social interpretive schema. Studying learning expertise in this field connotes understanding actors engaged in change.

Design, generally involves interpretive work, in that it constructs ‘language that constructs and gives order to reality, which it (temporarily) stabilizes, as individuals seek provisional resting-points offering plausible accounts of equivocal situations’ (Weick 2012). Increasingly, design practice is becoming indispensable to new situations expanding its remit into new domains of action. Design learning typifies the demand to realise temporary stability in response to contingency. As design processes are geared towards dealing with uncertainty as they almost always produce emergent responses. Learning this process is a deeply social, collaborative activity, the design learning environment is a stage for the constant negotiation and production of sense. Thus, its applicability is increasingly expanding into new bounds and finds facility in domains facing the impacts of socio-

technical change. This is reflected in the expanding cohort mix of diverse professionals passing through an organisation that originally provided training for professionals in the creative industries.

The research study was of particular relevance because of a counterintuitive assemblage of conditions and unusual attitudes to learning and leadership that stem from the formative concepts applied by the organisation. Investigating the commonalities and divergences between the origin stories of key organisational members (founders and learning strategists) revealed surprising connections to unexpected donor theories of leadership and learning. Through interviewing key informants within the organisation, a narrative emerged that linked research into leadership within the military. Merging insight into teams under stress with theories of learning derived from group dynamics results in approaches unique to the organisation. This seems an unexpected fit for an organisation engaged in civilian vocational education pointed towards transformative change within the digital economy. Tracing these relationships outlines fascinating parallels between leadership in conflict situations and in design situations.

At first, this seems to transgress a relatively stable boundary that traditionally differentiate military and civilian life. The application militaristic thinking to design methods seemed a surprising conceptual donor for a learning organisation working in the creative and digital industry. The resultant hybrid approaches however have proven particularly effective, creating an advantage that the organisation skilfully exploits. It perhaps raises important questions regarding the interpretive schema that underpin contemporary approaches to work. Research into group dynamics, particularly teams under stress is highlighted as an important aspect of understanding leadership under duress in the context of conflictual and traumatic situations. This counterintuitively, proves an apposite response to the demands of creative leadership as viewed by the organisation in question. Both domains are seemingly unified by common pattern; the demand to create equivocal responses to contingent situations, often in high stress conditions. These origins are borne out in seemingly inconsequential details; across multiple sites in this global organisation the WIFI password attests to these implicit values, to access the connection, learners parse out the phrase ‘lovenotwar’.

This phenomena bears further scrutiny for what it reveals about how we organise work and respond to change. As George Lakoff insists, the principle organising metaphor implicit to culture is one of contestation, the conceptual metaphor of ‘argument as war’ is profoundly embedded in prevailing cultural interpretive schema (Lakoff & Johnson 2008). In response to this understanding derived from conflict, the organisation proposes and enacts a different metaphor, one of collaboration. Insight from groups in conflict situations reframes leadership as membership. Consequently, the organisation that foregrounds their capacity to lead change in ‘digital’ in reality, focuses heavily on relations within groups and interpersonal interaction. This emphasis on group dynamics is view as fundamental to transformative learning. What Karl Weick, an organisational theorist, who also studied high stress military environment then applied his insights to organisations, refers to as ‘heedful interrelating’ (Weick & Roberts 1993). In response, Deborah Dougherty, the notable scholar of innovation conceptualised that heedful interrelation acts as an important boundary for innovation, expanding on the insight that innovation occurs at boundaries. In this view “play embodies open, improvised, fluid and energized relations, while team play reflects the emergent yet dynamic space of heedful interrelating”. This implicit understanding resonates strongly with observation, curating constant and often disruptive interaction between learners thus drives learning. The learning environment becomes a boundary space, where learning is negotiated. The theories of learning enacted within the organisation bear strong relationships with social psychology.

Equating work situations in the creative industries with those of traumatic conflict might seem dissonant, however professionals working in many industries, particularly those engaged in creative

production, might be the first to attest to the stress implicit in their working environments. We must also note structural patterns in these professions that attest to traces of military organising practices inherent in these professions. These comparisons are more than merely coincidental, innovation in technology and visual perception inevitably coincides with military application, a linkage explored by media theorist Paul Virilio (1989), who discussed 'the deadly harmony that always establishes itself between the functions of eye and weapon', this analysis of the influence of military 'ways of seeing' on civilian culture. Structural and linguistic traces remain in their organisational processes. In advertising, a *campaign* is the principle means of organising communications, in response the public often claim to be *bombarded* with content or subject to a *strategic* sensory *assault*. In another examples of how these concepts pervade civilian thinking; film production is organised in a strictly hierarchical way, production is organised by *scouts* who *reconnoitre* locations then set up a *base* which *deploy* a *unit*. As Lovejoy (2014) contends, the history of innovation of the technologies of visual perception is linked to military innovation, revolving around three principle acts; technique, propaganda and education. This analysis is indicative of how process of signification and power are enacted, the creative industries are implicated in the process of cultural signification, it is therefore important to query these precepts. The interpretive process implicit to many creative industries shares in these precepts. Enacting change upon these precepts, at the metaphorical level, in turn proves itself potentially transformative, but this is perhaps still largely tacit.

Conflict is enacted within a theatre of operations, the learning environment can be conceptualised within a similar logic, as an interface between ideas and perspectives engage one another, a contingent environment where new structural conditions are negotiated. This is only one way to conceive of this process, determined by implicit interpretive schema. Reflecting on the significance of this, Lakoff discusses how metaphors we use to organise activity, structure the ordinary conceptual system of our culture. Interpretive activities fundamental to design; arguing, problem solving, negotiating time and space and synthesizing solutions are profoundly metaphorical in nature. This position argues that metaphorical concepts that characterize these fundamental activities also structure social reality. If a new metaphor enters the conceptual system that we base our actions on, it will alter that conceptual system and the perceptions and actions that the system gives rise to. "Much of cultural change arises from the introduction of new metaphorical concepts and the loss of old ones" (Lakoff & Johnson 2008). This insight highlights the mobility of these conceptual frameworks across disciplinary boundaries. The organisational narrative, as observed, tracks the application of leadership strategies that began in the domain of military leadership crossing domain boundaries to emerge within a learning organisation at the forefront of change in the digital economy.

The starting conditions of the organisation stemmed from an alignment of spatial and geopolitical circumstances, this in turn dictated these learning theories stemmed from the early studies into group dynamics (Lewin 1944). Understanding how teams perform under stress became a preoccupation of military strategists in response to situations where group organisational structures decohere under duress. This insight that teams often need to actively reorganise in stressful situations, finds a position that advocates membership over leadership more successful to the rigours of contingency. This focus of conduct in interaction continues to play an important role in education and leadership.

The theoretical foundations of this mode of organising are codified in the functional principles of group dynamics set out by Kurt Lewin (Lewin 1951), the founder of social psychology. The development of group dynamics was intrinsically connected to Lewin's experiments with T-Groups. Carl Rogers reportedly described the T (for training) Groups as the most significant social invention of

the century. These early experiments, as narrated by Crosby, stemmed from workshops aimed at improving interracial relationships and resolving conflicts in state governance (Crosby 2013). The core insight was surprisingly simple; to refocus away from the content of discussions onto how participants interacted with one another. The process of reflecting on how a group formed was more edifying than simply being in one. “Lewin and the others realized that a group that scrutinized its own process as it formed and changed was something new and valuable” (Bennis & Biederman 2010). This signifies a movement from passive participant to proactive creator providing agency to interact with social structure. Providing an ability to manage conflict, in turn constructively bodes well for the wellbeing of individuals and in turn, organisations. A refocus from content to conduct was an innovation that provided a strategy for participants to engage in meta-cognition, is comparable to the practice of reflection investigation by Schön, but focusing on the interrelationships between individuals, rather than a notional internal world. This paper contends that this is central to the value of design learning, these learning environments create a discursive space where meaning (and learning) can be negotiated. This discursive space as such, acts as interface, learning occurs through interaction at these boundaries.

These investigations were influential in the development of person centred therapy (PCT) by Elias Porter and Carl Rogers (Rogers 1995) at the University of Chicago. Rogerian theory was principally developed in collaboration with Porter, a military officer who worked with the Systems Development Corporation an affiliate of the RAND corporation, originally a think tank set up to offer research for the US armed forces. Person-centred approaches were in turn formative of student centred learning models. Lewin’s legacy shaped the formation of both Tavistock and Esalen Institutes, which explored the foundational concepts of social psychology and resulted in core structures of the Human Potential Movement. No doubt, a growing consensus around the value of human centred design in multiple domains is founded in similar principles. The perceived importance given to interpersonal interaction, in terms of time and considerable organisational resources reflects an attitude towards learning. The observation that this is unmistakably important both in the learning environments but also amongst the internal organisational network, reflects an important stance towards learning and leadership driven by group dynamics.

Other important threads in organisation’s fabric of learning strategies draws heavily on pioneering work into group development by Susan Wheelan (Wheelan et al. 2003) which itself was also heavily influenced by Lewin’s research into T-Groups. Consequently, as these theories emerged in the period of technological and social flux in the post war period they were intrinsically tied to responding to the disorienting fallout of conflict. As we have seen, these thematic insights into leadership have shown surprising resilience as they have transferred across disciplinary domains.

The practical explorations by Lewin, that focused on group dynamics and the subsequent development of ‘social field theory’ revolve around the central insight from Lewin that “to understand or to predict behaviour, the person and his environment have to be considered as one constellation of interdependent factors” (Lewin 1946:338). Coincidentally, the functional principles that underpin the paradigm of participatory action research (PAR) that has had deep impacts on methodologies employed by social researchers framing this practice as "communities of inquiry and action evolve and address questions and issues that are significant for those who participate as co-researchers" (Reason & Bradbury 2001).

Learning activity inevitably means intersecting thought worlds. The investigation of this organisational structure, permitted peering closer at a variety of situations that together comprise the activity of the organisation. The patterns this revealed were quite counterintuitive. The set of organisational processes that result in production of the learning environments which the study

focuses on is founded on complexly nested clusters of other interfaces within the organisation. These nested networks become necessary, in general these situations necessitate circumstances where individuals with radically different expertise collaborate on a given task. The decidedly networked structure of the organisation is notable as is its reliance on fostering interpersonal relationships. This results in a situation where the organisation is continually coproduces itself through multiple boundary spaces where structures are actively negotiated. Interactions between a dense network of experts engaged simultaneously in peripheral and central organising activity.

Investigating the origins of the theories and methodologies that underpin the organisation, that at first seem counterintuitive within a learning organisation concerned the activity of the digital economy, reveal themselves as efficacious. Rather than evince a highly technical response, through the tendency to focus of group dynamics, empathy and interpersonal interaction is actively amplified through internal processes. This in turn, is seen to support wellbeing but also the capacity to rapidly adapt and therefore innovate. This shared organisational narrative was found to be deeply important and acted as a stabilising anchor, in a networked organisation at the zenith of far reaching digital disruption. Interpersonal relationships rather than structural relationship provide stability. This paper is too concise to bring much of the unprocessed observation into play directly, it does deal directly with the highly level thematic patterns arising from direct interface with boundary-like spaces. The theoretical origins of the organisation in social psychology and the human potential movement are quite revealing, they set out clear precedents for adaptive learning processes demanded by highly contingent, technically demanding environments. Observation affirms need for flexible conceptual models that account for this, in turn would benefit general theories of learning stemming from the leading edge of practice.

Contemporary design learning environments should be conceptualised as a boundary spaces, they are plural and poly-contextual. The observation reinforces a growing scholarly impetus that existing methods of understanding collaborative activity are insufficient and that learning practices may require a ground-up reconceptualization of expertise. A stance advocated by activity theorist Yrjö Engeström who argues “for a broader, multi-dimensional view of expertise”. The principle insight is that models of expertise that assume a vertical dimension of mastery remain important, however the horizontal dimension is rapidly becoming increasingly relevant for the acquisition and integration of expertise. This is a principle insight of the observation of learners and experts in this study; that the integrative component of learning activity is foundation for resilient social structures and the wellspring of innovation. As Engestrom observes “in their work, experts operate in and move between multiple parallel activity contexts. These multiple contexts demand and afford different, complementary but also conflicting cognitive tools, rules, and patterns of social interaction. The criteria of expert knowledge and skill are different in the various contexts. Experts face the challenge of negotiating and combining ingredients from different contexts to achieve hybrid solutions” (Engeström et al. 1995). In another view, learning environments can be meaningfully conceptualised as *third spaces*. Soja’s thirdspace concerns the creation of space where change and otherness can be enacted, to enable the contestation and re-negotiation of boundaries and cultural identity, as “a space of extraordinary openness, a place of critical exchange” (Soja 1996).

The notion of a boundary between lifeworlds is surprisingly recurrent concept in social science and has considerable explanatory power when discussing collaborative interactions. Together, the organising concept of social worlds and boundaries have been applied to a range of contexts and used to support theories that have impacts on multiple domains. The concept of the social world has long been fundamental to Schutzian sociology (Schutz 1967). This concept can be traced further back through the phenomenology of Husserl, where the concept of life world in interaction was used as a

foundational epistemic principle (Husserl 1970). The concept of the social world was also formative of symbolic interactionism articulated by Herbert Blumer (Blumer 1986). Also in the pragmatist view of John Dewey (Dewey 2008) which underpins prevailing theories of experiential learning and concepts such as reflective practice that have become an implicit part learning from practice situations. Intriguingly, Schön insights into reflection stemmed also from the prolonged observation of learning environments (Schön 1992).

One such theory, stemming from anthropology has found wide application in disparate disciplinary domains. Boundary Object Theory (BOT), developed principally by Susan Leigh Star, then scores of other highly significant scholars has been applied to understand collaborative interaction. Specifically, the objects that people create in the context of crossing boundaries between different social worlds and communities. As such, its potential utility in the context of design learning is highly relevant, we take the opportunity to examine these insights with respect to it. Boundary Object Theory adapts concepts used in other frameworks and introduces its own unique concepts, most prominently, the boundary object.

Originating from Susan Leigh Star and other's work in information infrastructure, Boundary Objects are defined as; those scientific objects which both inhabit several intersecting social worlds and satisfy the informational requirements of each of them. In this view, Boundary Objects are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual site use. These objects may be abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, as a means of translation (Star 2010). This theoretical continuum although widely adopted in various research communities has yet to be sufficiently explored in the context of design and learning. Although notable examples of application the creative industry context such as (Sapsed 2004), (Sapsed et al. 2015) and in the context of domains heavily reliant on collaborative design practice such as software development (Carlile 2002). Responding to Star's call to pay attention to boundary objects and also importantly what is not a boundary object (Star 2010) has enormous potential for understanding design learning environment and collaborative communication in organizations.

As a means of evaluating the validity of the theory, Worral's analysis of the prepositions entailed in the theory leads him to identify the theory as a coherent and relational inductive grounded theory, albeit based on contingent factors (Worrall 2010). Worral uses Meleis' model for evaluating theory, judging that BOT, because it considers not just the view of expert but of each implicated social world allows the theory a generalizability, grounded in empiricism, to be applied widely and serve as a macrotheory (Meleis 2011).

This view sets out that the creation and management of boundary objects as a key process in developing and maintaining coherence of action across intersecting social worlds. To study their relevance to this discussion, it is worth unpacking these underpinning concepts. There are four core concepts used in boundary object theory; social worlds, translation, boundary objects and coherence / convergence.

The concept of social worlds draws upon Schutz's (1967) original concept and is rooted in symbolic interactionist sociological stance and thus falls under the banner of interpretive social science. The social world perspective is premised on endless formation of universes of discourse, this presents the metaphor of groups emerging, evolving, developing, splintering, disintegrating or pulling themselves together. This view is highly consonant with the observed activity, to achieve fluid collaboration

individuals engage in the practice of creating and dissolved multiple articulations of a concept in formation, using the surfeit of designerly, linguistic or embodied techniques available to them.

This dynamic fluidity of group formation means the inevitability of boundary interactions, which is difficult to coordinate, but a risk to elide. The observed situation resonates with the idea that meaningful cooperation in these environments necessitates the sharing and translation of expert perspectives into mutually intelligible forms. A focus on processes and interaction is the basis of the social world perspective. Strauss sets out that social worlds consist of; one or more primary activities, locations where these activities occur, technology allowing activities to be enacted and organizations to propagate their activities. From a social world perspective, the size, boundaries, visibility, structure, and topics of a social interaction vary greatly and they intersect under a variety of conditions (Strauss 1978). Strauss views his concept as quite abstract not concrete but applicable because of its generalizability. Consequently, the application of this model to social science research has been pervasive.

Star & Griesemer (Star & Griesemer 1989) directly applied a social world perspective to their theoretical development. Further, boundary object theory overlaps with the Callon-Latour-Law model of translations (Callon & Law, 1982; Law, 1987), a process that links with *interessement* in Actor Network Theory (Latour, 2005) in important ways but also diverges from it, suggesting its own modifications in response to observation. The development of boundary objects urges a more ecological approach, modifying our image of interaction, it is an expanded view of the sites of negotiation and translation as ‘where the action is’ (Latour 1987), (Bowker et al. 2016). Allowing us to peer inside the passage point so crucial in the network view.

This view defines *interessement* as intrinsic to the process of creation of scientific authority, through the process where entrepreneurs gradually enlist participants (Latour says 'allies') from a range of locations, re-interpret their concerns to align with their own programmatic goals and then establish themselves as gatekeepers (p.389). This process of gathering authority, either substantive or methodological is what Latour and Callon term *interessement* to indicate the translation of the concerns of the non-scientist into those of the scientist and vice versa. Activity approximating this was very present in the observed data, where alliances cohere and decohere as collaborative design and learning progresses.

In this way, Boundary Object Theory is convinced with Latour’s concern for the flow of objects and concepts through a network of participating allies across social worlds. They argue, however, the problems of translation and the effort required to manage this risks centralization around certain concerns and that is a likely outcome of socio-technical scientific practices, occluding less dominant but important contributions. Instead, can we propose to expand aspects of this model to develop an inductive grounded theory based on observation of design learning environments rather than scientific contexts? This builds on insight into networks but extends this to understand how discursive practice is situated within a wider ecology. This seems particularly good fit learning discourses where the common objective is to design in contingent environments and create innovative structural reconfigurations of existing situations. The interaction of informational requirements of experts with common goals but disparate expertise, inherently necessitates bridging the boundary between social worlds. The learning theory emerging from these insights, yet to be realized has enormous potential. This research strongly contends that this integrative process is fundamental to the future of learning.

Star & Griesemer’s contention is that the challenge intersecting social worlds pose to the coherence of translations cannot be understood from a single perspective. Contending that the advantage of an

ecological analysis is it does not presuppose an epistemological primacy of one view point. This implies that an amateur viewpoint is not inherently worse than a professional one. The actor network perspective similarly places non-human resources and the environment on equal footing with human participants, an important means of understanding relationships within a complex ecology of interaction. This flattened perspective provides explanatory power necessary to understand complex assemblages of people and things in situations.

The BOT approach differs from the Callon-Latour-Law model in that this model is viewed as a kind of 'funelling', reframing or mediating the concerns of several actors into a narrower passage point, whereas BOT theorizes that where social worlds intersect, the effort of translation is required where the phenomena of *interessement* occurs. As such, boundary objects could be considered an expansion of the 'passage points' of Law, but not performing an identical role. Instead boundary objects are conceptualized as (abstract or concrete) space at intersecting boundaries between social worlds, expanding the potential for integrative discourse to take place, enabling effective translation and integration of knowledge.

Finally, BOT sets out the concept of coherence. The coherence of sets of translations depends on the extent to which entrepreneurial efforts from multiple worlds can coexist and that an indeterminate number of coherent sets of translations are possible. This implies coherence is the degree of consistency of translations between social worlds. Boundary Objects play a crucial role in developing and sustaining coherence across intersecting social worlds. The corollary concept of convergence extends coherence, considering how effective 'information artefacts' are as tools, systems, interfaces, and devices for storing, tracking, displaying, and retrieving information. These must fit with the communities of users that create and work with them, emerging as a result not the intent of heedful interaction. This refocuses on the intersections of social worlds but foregrounds how effective boundary objects in the guise of information artefacts are to integrate and produce consistency between interacting communities. BOT begins with social worlds as an abstract ground and uses the coherence of boundary artefacts as a more directly observable means to understand the process of translation. These ideas were practically applied with respect to the framework of communities of practice (CoP). Lave & Wenger's formulation of communities of practice, defined as groups of people who share a concern or a passion for something they do and learn how to do it better through regular interaction interact (Lave & Wenger 1991) is an important insight into how learning is actually enacted. This places emphasis on legitimate peripheral participation and the spread of knowledge through participation. Consequently, it is clear how this view that learning emerges from interaction resonates with what we can observe in this learning environment.

Herbert Simon conceptualised human decision makers as *satisficers*, subject to bounded rationality (Simon 1956). Simon used succinct metaphor of a pair of scissors to explain this, where one blade are the actual cognitive limitations of humans and the other is structure of the environment, minds with limited time, knowledge and resources can nevertheless be successful by exploiting structures in their environment (Gigerenzer & Selten 2002). Consequently, one blade is not enough, both are required to cut. The interface between mind and environment is a primary boundary, influencing the potential for subsequent interaction. Curating the conditions of this interface remains a primary means that human resourcefulness toward complex problems is cultivated. This reveals a primary function of the design learning environment and highlights important, often overlooked consideration for the design of learning. As a typology, the studio provides implicit affordances for different types of interaction. The potential to reconfigure a space impacts the potential for negotiating different forms of interaction. The negotiation of learning thus has important spatial and temporal components.

The central contention of this paper is that technological disruption is exerting incredible tension within learning environments, a tension that is an enormous resource for innovation. We jeopardise learning if stable, prescriptive environments (and people) dominate. Learning situations designed to inhere functional interpretive flexibility are fundamental to engender the capacity of resilience to operate in a post-stable state. The design learning environment is one important social situation where new meaning and structures are negotiated and their features explored. Even if only in metaphorical form, this is an important realisation about their general purpose. The workplaces and institutions of the futures are negotiated in such environments, this gives enormous utility as a site for social research. A perhaps biased view from the inside, is that the behaviours observed at the frontiers of learning today are indicative of social learning and work behaviours that may yet become pervasive norms.

The insight that the movement of intentional activity across a barrier of difference tends to creates novel patterns, succinctly traces an as yet realised theory of learning that maps to closely to observation. Furthermore, the proxy trauma that can be curated by arranging environment and resources carefully acts to stimulate resourceful activity. In practice, constraint and ambiguity are revealed to be important resources to design and learning (Gaver et al. 2003), (Gaver et al. 2004). This capacity to respond to contingency, to design, is innate, but it is an acumen that is infinitely sharpened through attention to collaborative interaction. This ability to align with circumstances, exploiting and reconfiguring the structural resources in the environment, time and again proves most important to the process of design learning. This capacity to integrate those who inhabit different social worlds hinges on developing the interpretive tools to perform the act of boundary crossing effectively. Intentionally producing a degree of porosity at the boundary of one's social world is thus supposed to be the principle determinant of success in design learning. In this organisation, we observe that this strategy is given primacy as the means of learning. Rather than being than corollary to hard skill acquisition or knowledge absorption, collaborative interaction is fundamental to learning. In practice, design is enacted in an inherently physical, contingent cascade of interaction, its flow is halting, suffused with errors, often shared across many individuals and employing resources concrete and abstract equivocally that may be diffuse across time and space. The rapid change and increasing inclusion of multiple communications apparatus has amplified the spatial reach and capacity for impact that even small teams can have. However, design processes and technologies that mediate presence remain a poor proxy for the immediacy of interpersonal contact. This fact remains a challenge for learning designers, hence the durable importance of embodiment and proximity in learning. Perhaps the design of future learning environments may usefully consider insights into boundaries between social world as an important site for learning.

This theoretical perspective when applied to the observation of collaboration, reveals that there is interpretive flexibility inherent in "designerly ways of knowing" (Cross 2001). This has facilitated the rapid adoption of design methods as a common lingua franca (Erickson 2000) for enacting change in social systems, in this context organisations impacted by digital transformation. Creating and negotiating with interpretive flexibility is implicit to the act of designing. This seemingly contributes to the enormously resilience of design methods to the process of diffusion into professional domains traditionally not allied to design. This approach to design learning, viewed as the capacity to integrate and create value from disparate perspectives learned through collaborative interaction is profoundly relevant in educating resilient people able to respond effectively to change.

This appropriation of methods stemming from design has been accelerated seemingly by the democratisation of design tools and learning resources. The products and process of design culture now occupy a central position within cultural life and carry a cache of sophistication of self-

actualisation and expression. The negotiation of identity has become a principle social pre-occupation facilitated by design tools. Many once durable institutions are now facing situations of insurmountable complexity and are turning to design based processes for light-footed re-mediation of material and human resources. The disruption wrought by digital economic transformation, it seems, does not respect scale or provenance. This co-opting this ameliorative capacity becomes important where contingent or incomplete information is dominant.

The behaviours observed within the organisation reveal surprisingly common patterning, learning interaction centred within a deeply situated, interpersonal domain. A focus on working on live problems in concert with industry partners was prevalent, softening the boundary between learning and work. Rather than direct pedagogy and individual assessment, pastoral attention is instead focused on interrelating whilst rapidly forming, reflecting upon and terminating groups. In practice, this creates profound psychological stress but also powerful learning stressors. This result in the formation of powerful social bonds that aid collaborative learning. The learning environment is used to actively create a social and psychological learning experience focused on interaction and mediation of collaborative relationships. This approach is cognisant but relatively agnostic to technological tools which are recognised as transient. Instead, making use of concrete and abstract resources unequivocally, whether at hand or abstracted within novel technological platforms to share sense and negotiate emerging outcomes. Technical skill acquisition was almost totally relegated to a private activity, subsumed to activity focused on developing acumen in group dynamics.

The learning environment, trenchantly signifies what Whitehead refers to as a *concrescence* of activity (Whitehead 2010). An intense collision of life-worlds after (Schutz 1967), is arguably the principle factor determining the learning value of an experience (perhaps evidenced best by the intense contention between Greek, Norwegian, Italian and Brazilian team members when discussing what time means to them). In these spaces, as Akkerman & Bakker (Akkerman & Bakker 2011) surmise, artefacts become a crucial factor to *enact* a boundary and make this negotiation mutually intelligible. Furthermore, as evidenced by the sheer material volume of ad-hoc boundary spanning artefacts that emerge in these environments just to make daily experience function. This is also only the visible tip of a deep iceberg in terms of the actual interactions that take place to achieve seemingly simple learning activity. The artefactual residues and complex networks of artefacts are “easy to overlook that they are in fact the nexus of perspectives, and that it is often in the meeting of these perspectives that artefacts obtain their meanings” (Wenger 1998).

4. Conclusion

Perhaps this research indicates is merely indicative of an emerging situation where we are becoming aware that the purpose of education must shift in response to seismic societal changes we are only beginning to comprehend. Design Education is certainly still the means of entering membership of a professional network, these professional networks however are no longer stable, so learning environments must anticipate a different future circumstances. Why not entertain a view of learning that premises a learning environment’s capacity to anticipate and renegotiate structural change as vitally important in mediating social innovation? What remains the same is the fact that learners learn through immersion in these all important environments created by these unique professional networks. This space is where individuals can align their poly-dimensional capacities with others practicing at more accomplished levels, poly-contextually. Surrounding yourself with more capable people is still a profound learning experience. The concept of fresh-blood is still relevant as capacity to innovate is fed by a constant input of different perspectives. It is especially fascinating to watch

groups comprised of disparate expert perspectives actively constructing novel approaches to problem solving for one another, abstracted from their own disciplinary domain to deal with more general problem solving situations. This really is collaborative *learning in action.*

The mediation and negotiation of meaning within a group draws deeply on the cognitive resources of team members and forces them to reconfigure their implicit interpretive schema, this in turn becomes a source of durable learning. Disciplinary perspectives, often learned in a domain specific context, are brought into a poly-contextual field to solve often fluid and unbounded problems. The process of abstracting one's knowledge, finding how make a concept intelligible amongst a group so that it can serve to advance towards a solution almost invariably happens through a process of creating multiple iterative inscriptions of sense. In these situations, knowledge is necessarily transformed and learning capacity evaluated in terms of the ability to make it intelligible to others. The resultant narrative inscriptions, those acting to integrate knowledge, are fecund sources of insight into learning. This process of active narrative making serves as a means of making knowledge intelligible, so it can be used by others. Boundary object theory has obvious utility in accounting for this kind of integrative learning situation. This seemingly occurs through actively ascribing meaning to artefacts that support the emergence of solutions as they are developed. Let's not forget that the industries under scrutiny are to lesser and greater degrees charged with the production of cultural meanings on behalf of wider society. Interpretive professionals and their organisations derive their professional leverage from their capacity to sensitise themselves to process of meaning making in society. In their own words to 'lead the change'. This awareness of the processes of change affords this approach to learning a fundamental advantage, which differentiates it from traditional institutes which themselves face the same existential challenges resulting from the unprecedented transformative potential of the internetworking of society.

To some degree, this case study is indicative of more general shifts. Can learning organisations function as metonyms for macro-societal change? As a synecdoche for transformation, indicating wider patterns of transformation in social, spatial, technical and cultural circumstances. The studied organisation is an exemplar because it actively both produces learning environments and engages in transformative organisational change. It is active in instantiating and propagating a unique approach to organisational cultures of learning and innovation. The impact of this kind of learning experience perhaps only becomes truly evident when these alumni enter the workplace, applying these approaches within organisational structures, often radically differing from this approach. The follow up feedback pattern reveals that a period of intense contestation is often followed by an steady capitulation to the more resilient learning strategies and approaches to collaborative culture these emerging professionals bring. The focus on the interpersonal connections, supports the rapid formation of expert networks and uses these collaborative alliances as anchors that are able to temporarily subsume more fragile organisational structures ripe for transformation.

Specifically, this can happen in several ways; training professionals who then enter organisations with these capacities can afford distinct advantages derived from their expertise in organisational culture, who then gravitate towards responsibility for management of organisational strategy and culture. This stems from a pedagogical focus on collaboration and enacting change, resulting in a persuasive capacity to enact this. The organisation has developed considerable expertise services in organisational change which it transmits through pedagogy. The organisation's central value proposition is its ability to enact substantive change within organisational structures. This began in the creative industries but is rapidly spreading through corollary sectors as the existential threats posed by digital transformation became apparent. This propagates through a narrative of success and an evidence base mediated through the close-knit inner consultancy network working with

talisman businesses within the digital economy. The evidence points to progressive spread of transformative activity across various industrial sectors, under the moniker of digital transformation. This diffusion, beginning with the creative industries and progressively moving through other sectors such as ICT, related product-service industries and manufacturing as symptoms of disruptive change become increasingly apparent. This narrative of transformation underpins the success of the organisation and the resultant impacts it has had upon the urban-regional, socio-political context it sits within. The ethnographic observation unravels how this learning organisation has propagated a narrative of transformative change and has developed a commensurate approach to pedagogy.

The OECD framework of Innovative Learning Environments is an indicative example that affirms the overlaps between learning and innovation, but is far from value free. It identifies four sources or 'pumps of innovation' regardless of sector; exploitation of science, knowledge or research & development, technological advance, modular reorganisation and the networking or sharing of knowledge (2013).

The resultant image of a learning organisation as network holds implications for the design of future learning environments. As Garud evokes, an image of an organization that maps to this observed experience, an organisation that is "not a series of nested black boxes operating in an immutable environment but, rather, a hyper-text organization that continues to emerge is a radical shift indeed" (Garud et al. 2008). The design problem, then, is not one of developing a static interface (an edge in network terms) that connects the inside with the outside. Rather, it involves the creation of multiple edges between many nodes within a dynamic network. In such an action net, each node can potentially act as a boundary object, "remaining between different realms, belonging to all of them simultaneously, and seen from different points of view" (Czarniawska 2004: 104). Given this, "When such an organization does emerge, it may be both transient and protean" (Jelinek 2004: 115).

Joining again with Soja's concept of *thirdspace*, reveals immediate connective relationships with the observational data. Soja's three eras of space are deliberately provocative, joining with earlier spatial triads of Foucault and Lefebrvre. Differentiating these as history, sociality and spatiality, implying a revision of the traditional geographical dialectic of historicality (as 'firstspace' perspectives focused on the 'real' material world) and sociality (as 'secondspace' perspectives which interprets the 'imagined' representations of the world) through the insertion of a 'thirdspace': spatiality. This concept, an artificial dichotomy designed to do one thing "to open up a distinctive new interpretive realm' where these dichotomies can be discussed a restructured" (Soja 1996). These conceptual frames deliberately conflate the societal and spatial dimensions as a means to offer explanatory reach to the astonishing hybrid forms that contemporary societal situations have begun to take.

Engeström's (Engeström 2014) poly-contextual concept of expertise, frames situations where relationships between elements of a network are ramified through experience. This so-called horizontal expertise emphasises learning skills grounded in group development effectively enables the boundaries between social worlds to become porous, integrating perspectives and amplifying the value of insight. Notably, this also seems to map well to Nicolini's call for more plural theoretical approaches to the role of objects in cross disciplinary collaborative interaction (Nicolini et al. 2012).

The conditions of rapid technological and social upheaval can be harnessed as drivers of learning. Existing conceptual models of expertise and learning theories are found wanting. Contemporary scholarship on the subject, notably Nicolini, advocate a plural view of the roles of environments and objects in cross disciplinary settings such as these. Noting that "a pluralist approach highlights that objects perform at least three types of work in this context: they motivate collaboration; they allow participants to work across different types of boundaries; and they constitute the fundamental

infrastructure of the activity" (Nicolini et al. 2012). Nicolini points out that our frameworks of understanding collaborative learning environments are woefully fragile and tend to apply theoretical understandings such as the boundary objects wholesale as black boxes that explain away the inherent complexity in lieu of fine grained theoretical accounts grounded in observational data. They advocate a plural approach that can reconcile adaptive behaviours in response to changing circumstances. What fascinating territories are yet to revealed if we learn at, and from, the boundary?

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