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HOW DO PEOPLE CONSTRUCT COMFORT WITHIN THEIR INTERIOR SPACES?

A study of objects and circumstances between clothes and the building skin that

influence comfort and the use of energy

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ABSTRACT AND LAY SUMMARY

This interdisciplinary PhD-by-practice examines how people construct comfort within their interior spaces through the study of objects, structures, membranes, situations and circumstances between clothes and the building skin. (In)tangible efficiencies of comfort and movement are problematised in this research. It provides new insights into the desire-lines of comfort, which are the habitual routines and interactions that individual's practice to control their everyday energy use. The audience for this research includes academics, professionals, and those interested in how objects and circumstances influence physical, physiological and psychological interior comfort.
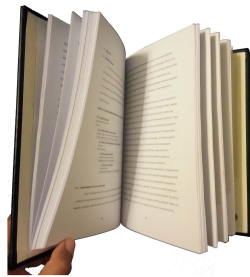
The research methods that were applied included novel experimental interior design techniques of data gathering, demonstrated in the GYRO, AMNIOTIC SAC and COSY workshops. Co-researcher responses were generated in text, image and three-dimensional form. These immersive workshops examined specific interior sites, including: the conceptualisation of a product based structure that utilised gyroscopic principles; the prenatal spatial interior of the amniotic sac membranes were studied to posit how this space of origin influences our lifelong comfort desires. In addition, a range of lifecycle scenarios were created to facilitate the understanding of comfort through various objects and circumstances e.g. a cot, pram, loftbed, train, wheelchair, lounge, ambulance, and coffin. Analysis of the data evidenced representations and patterns of comfort desire-lines. Relationships with animate and inanimate objects were identified, connecting with differing dependent and autonomous comfort aspirations. The outcomes of this research can aid investigations into energy use, relocating efficiency discourses from the building skin to interior interstitial space.

KEYWORDS (In Alphabetical Order)

Comfort, Desire-Lines, Energy Use, (In)Tangible Membranes, Interior, Movement

PHD-BY-PRACTICE OUTCOMES

This research-by-practice has generated interconnected outputs consisting of this narrative thesis and the illuminated research chronology.

research thesis   **research chronology**

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1. INTRODUCTION

1.1. COMFORT WITHIN THE INTERIOR

This PhD-by-practice studies how people construct comfort within their interior spaces by examining objects or circumstances between clothes and the building skin that influence energy use. The dotted red line in Figure 1 illustrates this intermediate situation.

FIGURE 1. (IN)TANGIBLE MEMBRANES BETWEEN CLOTHES AND THE BUILDING SKIN
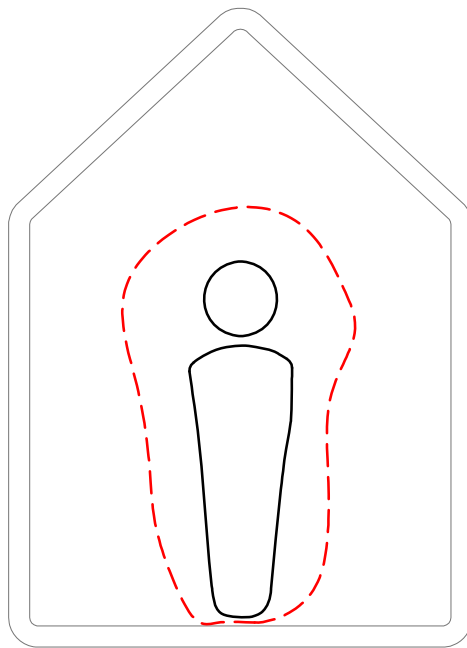
If clothes are considered intimate space, and the bounds of a room social space, this study focuses on developing the concept of personal space; that is a physical, physiological or psychological zone between these two spaces.

The stimulus and justification of the research within a global context, relates to energy efficiency improvements within the existing building stock. Lemmet, Yamamoto and Graham document this by giving the United Nations Environment Programme's statistic that, 'the building sector contributes up to 30% of global annual greenhouse gas emissions and consumes up to 40% of all energy'. They stress that 'if nothing is done, greenhouse gas emissions from buildings will more than double in the next 20 years' because of inherent 'inefficiencies' within the 'existing building stock worldwide' (2009, p.3). Sociologically, Shove relates these energy

goals back to comfort situations, commenting that 'around half the energy in the world is used in buildings and much of that is devoted to keeping people comfortable' (2003, p.3). These inefficiencies connect with the research question of, how people construct comfort within their interior spaces, because the (in)tangible membranes individuals generate, impact on energy use. This shifts the focus of energy efficiency discourses from technical perspectives of comfort and develops a visual-sociological appraisal of people's desire to create and maintain circumstances of interior comfort via interaction with objects. Researchers Tweed, Humes, and Zapata-Lancaster describe this as the gap between 'assumed and actual occupant behaviour' (2015, p.223). Furthermore, architect and designer Caan advocates that 'Designers must endeavour to capture heightened experiences... to reinvent comfort so that it becomes a platform for successful human interaction' (2011, p.181). These provocations have inspired this research journey.

Comfort relationships between realistic and presumptive user behaviour impact on energy use. As a multifaceted issue with an uncertain future, sustainability calls for an interdisciplinary focus. Educationalists, Kreber and Baxter-Magolda, state that 'a critical understanding of how disciplines are different and similar... is crucially important given that the real-life 'subjects'... are complex – one might think of issues such as climate change... calling for more than a single disciplinary lens but multiple lenses to inform them' (2010, p.13). Hence, this PhD-by-practice research explores the research question using a socio-cultural lens and contextualises implicit and explicit comfort motivations and their impacts on energy minimisation, by traversing disciplines such as design, architecture, sociology, psychology, anthropology and material culture.

1.2. A QUESTION OF COMFORT

This research examines people's desire to create and maintain their comfort via interaction with objects and circumstances within their immediate environments. The interpretation of comfort refers to these exchanges, with the term "(in)tangible membrane" denoting intangible or tangible objects and circumstances. This notional expression is used literally and metaphorically throughout this thesis to explore situations of comfort and these nuances are highlighted in the text where relevant. For example, an intangible membrane could be a perceived as a psychological circumstance; whereas a tangible membrane might involve a physical object.

The word "(fe)male" is used to de-normalise the homogenised textual convention of "man" as a standard. It amalgamates the words female and male, attempting to create space to reflect on individuality. Each person has a trajectory of highly personal comfort requirements that change over a lifetime. Philosophically this view is supported by Bachelard who explains how the subjective nature of an individual's experience and memories of their internal spaces creates an outward, 'projected intimacy' (1994, p.3).

To avoid discomfort, individuals create situations of comfort in their proximate environments. Within this thesis "(dis)comfort" as an expression is used to refer to a variable scale, with comfort and discomfort as extremes. Movement between them generates personalised routines of efficiency, and these trails outline overt and tacit comfort desires. Shove demonstrates these behavioural activities by tracing the 'routinized and inconspicuous practices' of comfort that develop into the 'reproduction of habit' (2003, p.4). These patterns and trails, identified in urban

planning as desire-lines, express a person's comfort movements and thus energy efficiency routines. Figure 2 shows a desire-line in a park, where an informal short-cut across the grass was formed.

FIGURE 2. GEORGE SQUARE, EDINBURGH, UK

In this external situation, each contributor to this route had an individualised desire to shorten the prescribed path. The effects of repetitive walking actions constructed tangible comfort efficiency trails in the grass. Social researchers Bechhofer and Paterson describe desire-lines in a museum study. In this public interior the most popular display was ascertained by 'measuring floor wear around various exhibits' (2000, p.62-3). When studying these trails theories are limited when unravelling the implicit nature of comfort and desire. The comfort motivations of each individual have to be surmised, for example, did time constraints or visual stimulus affect the new desire-lines constructed in the instances of the park or museum?

The complexities of human behaviour relating to comfort may be mapped in these simple desire-line examples where trails diverge from prescribed objects or circumstances. Norman, a designer and computer science researcher, argues that although such desire-lines confirm the trails of 'lazy' behaviour or short-cuts, they explicitly demonstrate a 'fundamental law of physics… called the "minimization of energy" principle' (2011, p.129). This idea directly relates to design because these desire-lines are inconsistencies between the designer's original intent and user's interactions with these objects and circumstances. With this knowledge, products and services may be realigned to correspond with user's desire-lines.

Further variables in desire-line constructs need to be considered when investigating comfort in interior space. Past, current, and potential contexts require constant reappraisal as the intricacies of each interaction with an (in)tangible comfort membrane are considered. Thus, each individual may have specific desire-lines with regard to comfort, but in a group, patterns emerge and are more dispersed or diffuse. Yet, both individual and group effects may be connected. This research aims to provide new insights on this topic of interior comfort membranes and their use.

1.3. THE SUBJECT TOPIC AND RESEARCH METHODS

When placing this study in a wider setting, the UK's Research Excellence Framework defines research as 'a process of investigation leading to new insights, effectively shared' (HEFCE, 2011, p.48). The social sciences amongst other disciplines pose a further "so what" question, asking researchers to query the relevance and consequences of their investigations.

Two principal strands of knowledge materialised in this research; firstly, that of the subject matter, and secondly the research methods. Subjective notions of comfort and person-centred efficiency are tacit in the private sphere of the interior, and the interdisciplinary nature of the subject topic led to questions of scope. Furthermore, methodological questions arose about how to gather data concerning subjective interior comfort desires within a design research environment. When defining concepts of comfort, efficiencies surrounding energy use are influenced by public, private, mental and physical motivations. These reasons could be applied to the grass in a public park revealing desire-lines of comfort. However, when studying comfort desire-lines in private interior spaces, everyday individual and group comfort motivations are implicit.

The underlying research objective was to develop findings about individual and communal comfort trajectories. Such research would influence individuals and groups for whom the functional importance of interior spaces is important. These include not only researchers, policy makers and any interior space dweller, but also members of a range of disciplines that impact on interior design such as architects and product engineers. However, advances in the articulation of comfort desire-lines and innovations in the use of immersive methodologies extend its significance to other potential audiences including educators, psychotherapists, anthropologists and other social scientists.

This research focused its scope on the question of "how do people construct comfort within their interior spaces?" Further supplementary queries were developed to extrapolate research aims as shown in Figure 3.

FIGURE 3. AIMS OF MAIN AND SUPPLEMENTARY RESEARCH QUESTIONS

"HOW DO PEOPLE CONSTRUCT COMFORT WITHIN THEIR INTERIOR SPACES?"	• **Sub-questions were to be posed and resolved in order to develop the subject topic and research methods into praxis**
WHAT IS UNDERSTOOD ABOUT COMFORT IN THIS RESEARCH?	• To categorise research material into contextual, methodological, procedural and analytical strands • To investigate achievable goals in praxis using models and experiential workshops • To theoretically contextualise each research strand
WHAT ARE IMPLICIT AND EXPLICIT COMFORT MOTIVATIONS?	• To develop robust methodologies that would identify comfort across lifetime experiences • To experiment with spatial comfort via life sized props and models (because research about space can be difficult to articulate – in contrast with a product) • To record the elicited subjective responses to interior comfort
WHAT CAN WE LEARN ABOUT INTERRELATIONSHIPS AND THE DESIRE LINES OF ENERGY USE AND COMFORT?	• To investigate connections between a person's comfort and priorities for comfort using immersive research procedures • To create textual and image based research materials • To map the desire-lines of comfort within interior space
HOW CAN NEW KNOWLEDGE ABOUT INDIVIDUAL AND GROUP COMFORT BE GENERATED?	• To enable iterative associations to be assembled about energy use in relation to comfort priorities • To collate individual comfort motivations in order to generate insights into the configurations of group desire-lines with an emphasis on gender and age • To facilitate new knowledge about comfort within the interior through experimental researh procedures
WHAT PATTERNS OF COMFORT ARE EVIDENCED IN THE DATA COLLECTED?	• To cyclically analyse patterns of comfort to inform practical and theoretical knowledge • To chart visual and textural arrangements of comfort to enable multi-layered analysis • To interpret existing and potential influences relating to comfort within our interior spaces
WHAT WILL THE RESEARCH CONTRIBUTE BACK TO DESIGN AND OTHER DISCIPLINES?	• To identify physical, physiological and psychological perspectives of comfort in the interior design discipline • To progress methodological examples to be used for immersive research across disciplines • To develop applied outcomes within the research strands as designed objects or circumstances • To define interdisciplinary queries for future researchers

Patterns of comfort were explored practically and theoretically. Research praxis, that is, the synthesis of practice and theory where each mode influences and responds to the other, was achieved by following an intuitive framework in my research journey. In his research into learning systems, Schön likens praxis to 'two sides of the same coin', describing how the practical and theoretical elements of research do not 'exist in a pure form, independent of each other' (1991, p.21-2). This relevant epistemological standpoint creates a 'knowledgeable doer' who merges theory and practice, by reflecting on and being reflexive about the research. His approach was used to identify experiential research methods to elicit complex, real world responses to my research questions.

To explore these questions, a series of distinctive experimental interior design workshops were developed. Specific interior sites were recreated via life-sized props at research events. These immersive installations were augmented by textual and image based research materials that advanced alternative ways to map comfort in interior space. This innovative approach was highly significant because research about space, as opposed to products, can be difficult to articulate. Subjective co-researcher responses to the research questions were provoked via models or real spatial experiences. Immersive 1:1 experiential workshops, were devised to allow insight into how people construct comfort through (in)tangible membranes between clothes and the building skin.

In this research journey, my designer's problem-solving bias was cultivated into a researcher's problematising tendency. This shift was evidenced in my research process, which initially concentrated on a conceptual product idea, but then developed into the invention of experimental interior design methodology. In his

insights on critical pedagogy, Freire argues that a problem-solving approach dissociates from the reality of the situation in a top-down paradigm, while problematisation organises 'reality into symbols which can generate critical consciousness' (1976, p.ix). Crotty explains this further, stating that in social research perceptions alter because 'rather than accepting the situation, one emerges from it, abandoning a focalised viewpoint' (1998, p.155-156). My research journey developed from attempting to provide a solution to the research question, into generating socio-cultural design methods that mapped representational human comfort behaviour.

This thesis and accompanying visual research illuminations narrate my PhD-by-practice journey however, the major practice elements of this research were actualised in the form of ephemeral workshops. These transitory research events enabled the subject topic questions to be investigated within a design paradigm.

The practical expressions of the research encompass the visual, textual and ephemeral experiential sensory workshops. They were my communication tools, making the design and research process visible. However, these designed objects and circumstances were not the final outcome. They represented the investigational tools in the establishment of an experimental research method process that elicited co-researcher engagement in the workshops.

1.4. THE STRUCTURE OF THIS THESIS

In this first introductory chapter where (in)tangible membranes, the desire-lines of comfort, and human energy minimisation are outlined, constructs of comfort then follow.

The contextual review in Chapter 2 examines the outer, inner, (in)tangible membranes, interaction and bodily elements of comfort in the interior. For signposting in this thesis, Figure 4 is used to communicate about the many layers that affect the constructs of interior membranes because it illustrates how (in)tangible membranes are viewed in the interrelated layers of the human body, the building skin and the wider global context. This image has similarities with developmental psychologist Bronfenbrenner's 'ecological model', which reasons that 'in order to understand human development, one must consider the entire ecological system in which growth occurs' (1994, p.37).

FIGURE 4. SIGNPOSTING VISUAL
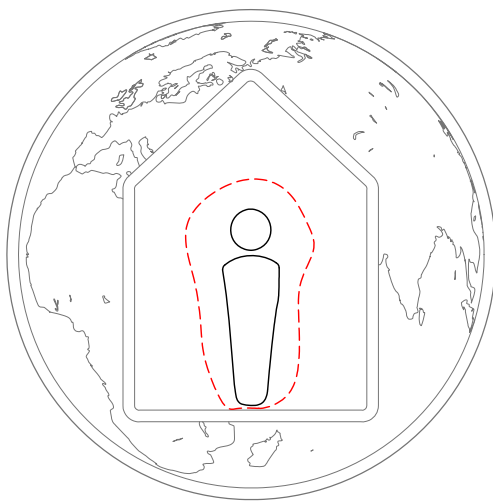
Architecturally, Pallasmaa describes how we interpret visual information, explaining that we comprehend the 'anatomy' of the whole image 'before we are able to identify its details, or understand it intellectually' (2011, p.43).

As well as the contextual review being a separate Chapter, theoretical and practice elements of the research are juxtaposed throughout this dissertation to allow for complex associations to be elicited in the different research streams. This process reflects my design practitioner research approach, where my hypotheses emerged through practical and theoretical iterations and augments the interdisciplinary context of this research. In a case-study, Gillham corroborates this approach by commenting that undertaking 'an extensive literature review first from which you derive a hypothesis to test is a nonsense in real-world research' (2000, p.37).

Chapter 3 gives an account of my methodological framework and research methods. This corresponds to Bechhofer and Paterson's style of action research, which tries 'out techniques to improve practice' (2000, p.26). Visual and verbal metaphors are used to communicate about complex elements within this PhD-by-practice. For example, a war scenario analogy has developed narratives about research-by-practice. A researcher is part of the action and simultaneously negotiates the roles of a soldier by praxis, a critiquing reporter, or a historian reflecting in hindsight.

Chapter 4 provides a detailed description of my research procedures and is divided into subsections for clarity. My iterative research and analysis process enabled creative ways of thinking, doing and learning. This developed a body of research suitable to PhD-by-practice, whilst also facilitating the interdisciplinary nature of the proposal. This approach also gave palpable examples of research development throughout the journey, allowing a balance of long and short-term investigatory aims. Lessons learned in each research stream were translated into

subsequent workshops as data was generated by adjusting and experimenting with existing research methods and procedures.

Section 4.1 discusses my early research pilots and preliminary attempts at data collection. These activities gave timely insights into how best to collect and analyse my data. Consequently, a series of workshops were designed to investigate various interior sites.

My three main research streams are discussed in sections 4.2) GYRO; 4.3) AMNIOTIC SAC; and 4.4) COSY which are outlined below.

Section 4.2 presents my conceptual GYRO product idea. This research stream problem-solved the subject topic, literally attempting to answer the question through the re-purposing of a human gyroscope. Various models and simulations of this idea were used in focus groups and workshops. This product invention enabled sleep, relaxation and work through functional adjustability, furthermore its curved and horizontal membranes facilitated energy-saving.

The second research stream, discussed in section 4.3, problematised the original space of (dis)comfort in utero, within the AMNIOTIC SAC membranes. The premise was that every individual had been through this interior experience and it may inform their ideas of comfort in later life. A design workshop event, enabled co-researchers to explore their subjective constructs of comfort. The practical 2D and 3D feedback from the workshop furthered theoretical understandings of this unique, but universal circumstance.

Subsequently in section 4.4, the third workshop, called "COSY" set up a notional lifetime context of comfort constructs. In this research stream, the hypothesis is that comfort is something you actively re-create in various situations. Sixteen sites were selected to provide insights during aging into (in)tangible membranes and the

desire-lines of comfort. They included the Amniotic Sac, a Pram, a Nursery Cot, a Bicycle, a Teenagers Loftbed, a Bus, a Kitchen, a Train, an Office, a Car, a Shop, a Wheelchair, a Lounge, an Ambulance, a Coffin and a Halo. These lifecycle situations stimulated responses to comfort and movement in recognisable scenarios.

The research procedures developed inclusive data collection techniques, encouraging responses in a range of formats. Over 100 co-researchers were questioned about comfort in their interior spaces. The University of Edinburgh's ethical policies were observed throughout and all data was anonymised in accordance with Level 1 and 2 Ethical Assessments.

Chapter 5 embarks on a multi-layered interpretation and analysis, which identified individual and communal comfort patterns. The research journey generated original findings in this interdisciplinary subject topic, whilst also discovering new research methodologies.

Chapter 6 explores the synthesis between the subject topic and the research methods. When probing whether this research has generated new insights, creative innovations corresponding to practice-centred design research were fostered by the methodologies developed and chosen. Evidence of unique practical application is presented using the input and output of the workshops. This thesis shows how these novel methods elicited (in)tangible constructs of comfort from co-researchers. The immersive experimental interior workshop methods created new spatial design knowledge.

When sharing my research lay dissemination came primarily through the co-researchers in my workshops. Communication with academic audiences took the form of three peer reviewed conference presentations and proceedings including a published chapter. Various talks and respondent roles allowed for dissemination of

the research within a critical interdisciplinary context, reaching both domestic and international audiences.

Finally, in Chapter 7 my thesis concludes with lessons learnt and ideas for further work that this research was unable to unravel due to time, monetary or geographic constraints.

This research transforms the way efficiency is understood by investigating and evidencing the desire-lines of comfort. The everyday implicit and explicit motivations that impact on human energy use have been explored with a design-based lens. Those interested in constructs of comfort within the interior spaces they occupy, the objects they interact with, and circumstances they create, can use my findings to re-address their individualised comfort desire-lines or trajectories.

The consequences of the research also extend to the experimental research methods that take actual human motivations into account. Rather than developing a final answer to the research question, the methods used in this research can be used as stepping-stones for further research into comfort constructs, life experiences and debates about interior (in)tangible membranes and energy use.

2. CONTEXTUAL REVIEW

2.1. Contextual Review Foreword

This contextual review cross-examines the conceptual definitions of how people construct comfort within their interior spaces. Further theoretical reviews occur throughout this thesis, for example, comfort conditions that inform elements of my research methodology or procedures are discussed in chapters 3 and 4 and section numbering facilitates cross-referencing of these contexts.

Comfort is defined differently by various disciplines and situations and summarisation of these interdisciplinary backgrounds is required. In the context of energy use, humans avoid discomfort through (in)tangible actions. These interactions include physical, physiological and psychological approaches to the efficient use of materials and space.

Etymologically comfort is linked to conceptions of strengthening or consoling, but architectural historian Giedon remarks that, in the western world after the 1900's comfort became synonymous with 'convenience' (1969, p.260). In his historical account Crowley terms comfort as 'satisfaction with the relationship between one's body and its immediate physical environment' (2001, p.142).

These recent perceptions of comfort are challenged by the cultural theorist Virilio, who states that 'whether it is a question of furniture or shelter, comfort fools us, it leads us into error in our own experience of our own bodies'. He believes this dependence on 'comfort is nothing other than a collection of ruses that aim to erase these infinitesimal inconveniences which are, however, themselves the proof of the existence of weight, scale, and a natural motility' (2006, p.55).

Thus the meaning and presence of comfort is fluid. It incorporates aspects of movement, dynamism and transience adding to the complexity of its definition.

To study comfort from a variety of angles, this chapter has been structured into interdependent levels, so that multiple contextual discourses can be examined. This corresponds with social psychologist and anthropologist's Low and Altman's idea that places are 'given meaning through personal, group or cultural processes' (1992, p.5). Sociologically Thompson and Thompson advocate that critically reflective practice goes beyond atomism. This is where society is seen 'as simply a collection of individuals, with little or no acknowledgement of the role of social processes and factors' such as 'racism, sexism, ageism and other such forms of discrimination' (2008, p.29). These themes develop a style of 'intersectional' (Crenshaw, 1989) narratives of comfort.

However, problems arise when critiquing and extrapolating individual systems of repression because systems of domination and privilege are interconnected. Feminist author and activist Martinez's term of an 'oppression Olympics' (1993), where the inequalities faced by one group trumps another, will be negotiated in this section as demographic aspects of gender, age, ethnicity are discussed.

Initially this contextual study focuses on the Outer socio-cultural contexts of the workplace and community. This leads onto Inner topographies of the home. (In)tangible membrane and structural precedents are then discussed and potential and effective Interactions with things. Lastly, pedagogies of the Body are given context.

Figure 5 illuminates the section themes. Within each layer, (in)tangible constructs of comfort are contextualised in different orders, respectively outlining the explicit, ambiguous, and implicit aspects of the subject topic.

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FIGURE 5. CONTEXTUAL CHAPTER SECTION THEMES

2.2 OUTER
PLACES

TANGIBLE:	Building Comfort
(IN)TANGIBLE:	Comforting Ritual
INTANGIBLE:	Aspirational Comfort

2.3 INNER
SPACES

INTANGIBLE:	Home Comforts
(IN)TANGIBLE:	Controlling Comfort
TANGIBLE:	Crafting Comfort

2.4 MEMBRANES
BETWEEN CLOTHES AND THE BUILDING SKIN

(IN)TANGIBLE:	(Dis)comforting Boundaries
TANGIBLE:	Comfort Structures
INTANGIBLE:	Comforting Belief

2.5 INTERACTION
POTENTIAL AND EFFECTIVE

INTANGIBLE:	Comforting Currents
(IN)TANGIBLE:	Latent Comfort
TANGIBLE:	Comfortable Things

2.6 BODY
DESIGN AROUND THE HUMAN

INTANGIBLE:	Comforting Moves
(IN)TANGIBILE:	Sensual Comfort
TANGIBLE:	Recreating Comfort

2.2. OUTER: Places

This contextual section considers public, societal and cultural factors that influence the constructs of comfort. Figure 6 visualises this Outer layer.

FIGURE 6. OUTER: CONTEXTUAL REVIEW
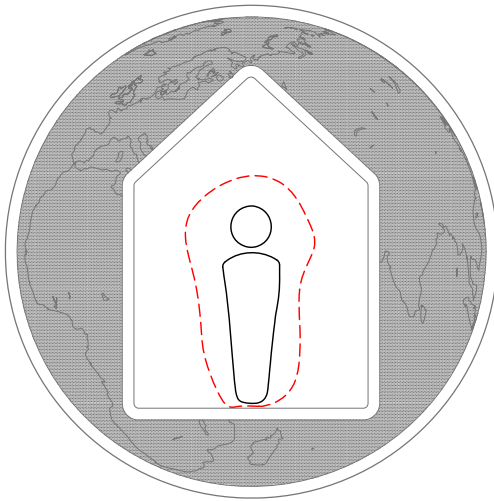
Feminist architect, educator and activist Kanes Weisman links the status symbol of the 'urban skyscraper' of larger cities, with 'the masculine mystique of the big, the erect, the forceful' (Rendell, et. al., eds. 2000, p.1-2). Whose comfort does the public environment advance?

2.2.1. OUTER TANGIBLE: Building Comfort

In this section, public constructs of comfort are explored within the bounds of work and community spaces. Historically these physical places have been chiefly associated with the masculine. The workplace, tavern and the coffee bar were originally designed for male socialisation and comfort with parks and squares providing community and family entertainment.

Spatially the office workplace has reformed towards open-plan areas, which are advocated for visibility, flexibility of function and economic savings. Nonetheless, these suppositions have been contradicted by Kopec whose design research demonstrates the open-plan paradigm is associated with 'economic and psychological costs' (2012, p.242-3). This is explained by environmental psychologists who stress the need for individual workers to be able to personalise their workspace

surroundings so their comfort is maintained. These ideas reflect how employees'

territory is negotiated in order to maintain wellbeing. Architecturally, Rybczynski

describes the employer viewpoint that prioritises economic returns, because

'comfortable surroundings… affect the morale, and hence the productivity, of

workers'. In contrast, he identifies that employees prioritised and 'identified room

temperature, degree of privacy, choice of chair and desk, and lighting intensity'

(1988, p.226-7) as critical for comfort.

Shifts in workplace scenarios, which are heading toward the pre-industrialised

norm of the fusion of home-and-workplace, may not sustain these work-related

comfort requirements. Legally, the commercial office-working environment is

controlled to augment occupational health and safety guidelines. These conditions

have to cater for a variety of postural body modes to be adopted by aid of

specialist equipment. However, in homeworking spaces workers are left to adjust

their spaces to suit. Overheads such as lighting, cooling or heating become the

liability of the employee as do ergonomic and psychological comfort requirements.

Within the physical built environment, urban sociologist Oldenburg considers

the changing nature of Outer public 'community spaces' (1999, p.xvii). He posits that

the evaporation of community comfort was stimulated by the home's emergence

as a place of leisure. To counter these trends, he promotes independent localised

services within walking distance, so that the wider community can develop and

maintain social bonds. However, socio-economic influences such as market forces

and land privatisation, have established commercial community spaces that

outcompete public institutional spaces such as parks and playgrounds.

When studying gendered constructs of spatial comfort within the built environment, Kanes Weisman's declaration on 'Women's Environmental Rights' states:

> *'Be it affirmed: The built environment is largely the creation of white, masculine subjectivity. It is neither value-free nor inclusively human. Feminism implies that we fully recognize this environmental inadequacy and proceed to think and act out of that recognition.' (Rendell, et. al., eds. 2000, p.4)*

She recommends that a woman must become her 'own architect' applying 'environmental judgement and… decisions about the nature of spaces in which she lives and works'. This is because over half of users have had a 'negligible influence on the architectural forms' that surround and enclose them (ibid, p.4). This manifesto, sets out guidelines for 'women' to construct their own forms of comfort, because she feels these have not been adequately met. These debates show that Outer, public constructs of spatial comfort are skewed.

Currently, the architectural profession creates buildings that 'are then discussed by critics, theorists and historians as completed, self-contained objects in terms of style and aesthetics' (ibid, p.11). These accounts only speculate about the actual invention of comfort the building users undertake, post completion. However, Kanes Weisman describes that 'architecture is constituted through its occupation, and that experiential aspects of the occupation of architecture are important in the construction of identity' (ibid, p.10). Moreover, author, feminist, and social activist Watkins' (known as "hooks") describes that 'women's rhetorical theory… arises not only from public, academic, or philosophical spaces but also from the material reality of women's lives' (1990, p.382); giving insight into the psychology of otherness or the 'politics of location' (1989, p.203). This side-lining of the everyday occupation

of spaces relates to understandings of perceived and actual comfort and accounts for substantial time and energy use within the Outer built environment.

2.2.2. OUTER (IN)TANGIBLE: Comforting Ritual

(In)tangible contexts of socio-cultural comfort are explored in this section by focusing on the rituals around work and community spaces. Ambiguous implicit and explicit societal roles influence the public dynamics of comfort within these ideally neutral territories. Norman describes that ceremonies 'provide meaning and a sense of membership in a culture' (2011, p.19), providing comforting rituals. Huizinga a historian and cultural theorist, describes how 'the function of the rite' is not 'merely imitative', but is 'a helping-out of the action' (1998, p.33-4). We get tangible glimpses of these ritualised comfort conditions in public situations, such as graduation ceremonies. For example, some groups mark this valediction via specific ceremonial objects such as a certificate, mortarboard and gown; or by immersing themselves in circumstances like a dinner or ball. In societies where ritual behaviour is in flux, the manufacturing of provenance can vary in complexity, diverging from the comfortable to the formal.

Hendry, a social anthropologist, points out that ritualised behaviour 'prescribed by society' has consequences on individuals that leave them 'little choice about their actions' (2008, p.66). From a psychological developmental point of view, she describes that 'the acquisition of rites and beliefs precedes the emotions which are said to accompany them later in adult life'. Her stance is that the individual has little say in ceremonial relationships because, as with many cultural conditions, 'it imposes itself… from the outside' (ibid, p.121). These Outer constructs impact on individual comfort behaviours, because external prescriptive forms of

ritual comfort are stealthily imposed. For example, Hendry relates how teachers 'encourage children to discipline one another' so that they learn to subordinate 'self-interest to the needs of a wider group'. This principle has 'long-term benefits' as it 'underpins the success of the whole educational system and later working life' (2008, p.161). Although implicit, pre-school education creates a foundation for future workplace relations.

In pre-industrialised societies, workspaces comprised the home or farm for all genders. However, the onset of large-scale urbanism produced a spatial rupture where (re)productive spaces were split into the workplace and the homeplace. From a Marxist feminist perspective, Rothschild and Cheng claim that the 'city and its opportunities for remunerated work constitute the domain of men' (1999, p.69) whereas the home evolved into a space where unpaid female 'domestic work' was undertaken. They add 'Western culture fosters the belief that most women become part of society's "productive forces" by stealing time away from their domestic responsibilities' (ibid, p.67-8). Yet, from an environmental psychology angle, Kopec delineates a workplace as 'every environment in which work of any kind is carried out', portraying a kitchen as a workplace 'whether it is located in a restaurant or residence, or on a catering truck or cruise ship' (2012, p.235). Nevertheless, this viewpoint omits childrearing and overlooks the socio-cultural issues that influence implicit comfort barriers that affect gender in the waged workplace.

2.2.3. OUTER INTANGIBLE: Aspirational Comfort

When defining aspirational contexts of socio-cultural (dis)comfort the concept of desire and change, through movement, influences discourses.

Lefebvre a Marxist philosopher and sociologist, marks out the vacillation within industrialised countries between 'abundance, waste… extreme productivity' and 'uneasiness, insecurity' and 'anxiety' evidencing (dis)comforting aspirations of ''satisfaction and dissatisfaction' (2014, p.16-7). Furthermore, the social psychologist Fromm distinguishes between two aspects affecting humans, 'the mode of having' and the 'quality of being'. The latter quality assumes a holistic approach, where 'experiences and learning' allow an individual 'to leave a mark through… work and deeds' (Walker and Giard, eds. 2013, p.324-5). This search for meaning is mythologised in the concept of affluence.

Constructs of comfort can be represented by the word 'affluence' that defines beneficial (in)tangible objects or circumstances flowing toward a society or individual. Aspirational understandings of comfort within societies have connotations with the words, wealth, ease or luxury, which are associated with monetary, material goods or time.

In early ethnological and anthropological studies, hunter-gatherers, 'savages', or 'primitives', are considered the 'original affluent society'. Sahlins and Jaulin justify this by evidencing hunter-gatherer's desired time spent accruing 'free time in preference to wealth' because they 'spend less time in subsistence activities' (Barnard, 2006, p.33-4). Notions of leisure time and affluence provide insights into socio-cultural aspirations influencing energy use within behavioural contexts.

In our Outer places, the formation of aspirational expectations about comfort is set up in age related discourses. Hendry provides a strata of age-sets that consist of 'elders' who are accountable for 'political decisions and dispute resolution'; 'warriors' whose purview is 'defence and protection'; and 'youths' who study 'the ways of their people' (2008, p.176). In rituals around death, she designates

instances of 'lineage authority', where seniors 'sustain their authority against their juniors' claim to independence' by shrouding ensuing conflicts 'in mystical and ritual terms' (ibid, p.127). Jamieson gives a Vietnamese cultural anthropological account where children were expected to 'please his or her parents all the time and in every way, to increase their comfort' by conforming 'with their wishes in all matters, great and small' (1993, p.17). These ritualised identities allow for comfort bonds to form within and between societal groups. Yet, they instill a particular perspective of comfort construct, which may lead to others' discomfort.

Anthropologically, age-sets purportedly occur mainly within males. For example, within Papua New Guinea, Kwoma society, Bowden describes that women's marriage trajectories exclude them from their primary, childhood familial cores resulting in them forming 'the links between groups' (Coote and Shelton, eds., 1992, p.80) as they leave their ancestral ties behind in order to make new families.

In contrast to this societal gender bias, feminist scholar Oyewumi, advocates the inculcation of ritual through the idea of seniority within Nigerian Yoruba society. This is the concept that chronological age difference is used to mark status within some kinship structures. She believes this 'cuts through the distinctions of wealth, of rank, and of sex'. In this context seniority is relative as 'it all depends on who is present in any given situation' (1997, p.41-2). However, these constructs of power are critiqued by consultant Yusuf, who identifies that 'the boundaries between different modes of power are often irreducibly blurred' (2003, p.2, 5). This leads back to the question of which intersectional relationships of gender, age, ethnicity and class influence the power dynamics of societal comfort membranes.

In this Outer context, a range of (in)tangible constructs of work and community places influence public perceptions and understandings of comfort.

34

Culturally and societally, the built environment, routines of ritual and aspirational identifications of comfort are in flux.

The next subchapter contextualises Inner (in)tangible comfort constructs. From European and American perspectives, Kopec states that 'westerners spend an estimated 70 years of their life inside a manmade structure' within a 'secure habitat… we call home' (2012, p.190). This (in)tangible homely site of interior comfort is discussed next.

2.3. INNER: Spaces

Given that we have been contextualising constructs of comfort within the Outer public sphere; we will move onto discourses that encompass Inner, personal interior spaces and the notion of home. Figure 7 visually emphasises this Inner space.

FIGURE 7. INNER: CONTEXTUAL REVIEW

Architectural historian Colomina describes the home as a place where 'comfort is paradoxically produced by two seemingly opposing conditions, intimacy and control' (1992, p.79).

This leads us to consider these complex dynamics when looking at the home from an intersectional lens.

2.3.1.INNER INTANGIBLE: Home Comforts

The definition of the word 'home' and the ideas of abiding, dwelling, and inhabiting, all invoke intangible comfort conceptions. Rybczynski describes how home as an expression 'connotes a physical "place" but also has the more abstract sense of a "state of being"' (1988, p.62). Bachelard states that 'all really inhabited space bears the essence of the notion of home' (1994, p.5). He describes the home as 'our first universe, a real cosmos in every sense of the word' (ibid, p.4), adding that 'we comfort ourselves by reliving memories of protection' (ibid, p.6) within this space.

Troutman, an artist and architectural academic, infers that 'we dwell in the home and the homes dwells in us'. She depicts childhood memories where her

'primal shelter is also a site of primal fears'. These psychoanalytic recollections describe how her 'interiors are a map… with conscious securities and insecurities visible in the main rooms, and unconscious ones lurking in smaller, peripheral spaces' (Taylor and Preston, eds. 2006, p.356). These (dis)comforting constructs of home comforts, enable consideration of the intangible and implicit nature of this situation.

Cultural anthropologist Cieraad explains how the emotional remembrances of 'past homes, present home situations, and projections of future homes also changes with age'. She adds that the 'first… childhood home, retains its special meaning… whether one loved it or hated it', whereas perceptions of 'future homes will change over one's lifetime' (2010, p.93-4).

Age hierarchies require constant reconsideration when identifying individual and communal comfort within the Inner space of the home. With increases in life expectancy and influences of childhood spatial needs, comfort negotiations are increasing. Additionally, constructs of home in relation to younger generations are evolving. When rental and parental housing is the only option for younger adults, due to housing pressures in particular areas, individuals must live in rooms that accommodate a range of public, social, personal and intimate functions.

Technical building regulations in the UK stipulate a requirement for the adaptation of spaces to aging, disabled and infant populations. This includes space on ground floor levels for shower rooms, wheelchair accessible layouts and safety features on stairs. Thermal comfort conditions are also a high priority having varying requirements of heat, coolth and ventilation impact on this Inner space. This environmental comfort influences energy consumption and fuel debates on internal climate management.

Sociologists Munro and Madigan, describe how postmodern 'familial' ideologies and home life constitute 'the main sources of self-identity for both men and women'. This is epitomised in a 'democratic unit based on notions of a companionate marriage, joint decision making... rather than the hierarchical and overtly patriarchal structure of the earlier model' (Cieraad, ed. 1999, p.108). Complexities to this notion of the home as an identifier of comfort come in the form of the non-nuclear family, single households, changing work patterns and dislocations of domesticity, e.g. the car.

Conflicting perceptions of individualistic and communal ideals generate tensions. Munro and Madigan describe how the design of middle and working-class 'housing creates a restrictive and somewhat inflexible locale, even for the nuclear family for which it was designed' (ibid, p.117). They portray how 'women in particular struggle to reconcile' their desires to craft an independent space whilst 'taking on major responsibility for sustaining the family as a collectivity' (ibid, p.107). These frictions are alleviated by being 'constantly on duty, attending to other people's needs... they subsume their own relaxation to fostering it in other members of the family' (ibid, p.116). The postmodern family archetype in this scenario becomes a home for (dis)comfort.

2.3.2. INNER (IN)TANGIBLE: Controlling Comfort

Architect and scholar Teyssot, explains that 'the house is a place saturated by different, overlapping institutions (ownership, sexuality, kinship, family, lineage, technics, servitude, repression, civilization, privacy, intimacy)' (2013, p.2). This quote summarises the contradictions of comfort and control in our Inner spaces. Those individuals or collectives with the power to influence these domestic cultural

topographies, govern the (in)tangible comfort perceptions of home for all. These dynamics are considered in this section.

Kanes Weisman describes how the home was 'intimately connected' with women inculcated 'from early childhood… to assume the role of 'homemaker', 'housekeeper', and 'housewife' (Rendell, et. al., 2000, p.1-2). Mulvey, a feminist film theorist, describes how 'the domestic, is… associated with woman not simply as female, but as wife and mother'. She adds that mothers determine the invisible boundary of privacy within the home 'by maintaining its respectability, as an essential defence against incursion or curiosity as the encompassing walls of the home itself' (1989, p.69). Thus her female is controller, but is also controlled by the construct of home and comfort.

An intangible home comfort membrane has differing cultural connotations. Wigley an architect and author, suggests that the relationship of 'marriage… is instituted to effect… control' and houses are 'the mechanism of, rather than simply the scene for, this control'. He states, 'the house is involved in the production of the gender division it appears to merely secure' (Colomina and Bloomer, eds. 1992, p.336). To illustrate this Kanes Weisman emphasises how the genders occupy space within homes. She explains how 'the 'man of the house/breadwinner' is afforded places of authority, privacy (his own study), and leisure (a hobby shop, a special lounge chair)'; whereas the female 'homemaker' has no sacrosanct place, she 'is attached to spaces of service' and continually metamorphoses into 'a hostess in the living room, a cook in the kitchen, a mother in the children's room, a lover in the bedroom, a chauffeur in the garage' (Rendell, et. al., eds. 2000, p.1-2). This parallels Colomina's views of domesticity where a woman 'controls the interior, yet she is trapped within it' (1992, p.98).

Another perspective is hooks' appreciation of the comfort of the homeplace, because this Inner space circumvented 'the dignity denied' Black Americans 'outside in the public world' (1990, p.42). In circumstances of ethnic, gender and class-based subjugation, she describes the structure of home 'however fragile and tenuous (the slave hut, the wooden shack) had a radical political dimension' (ibid, p.42) because it constituted a 'site of resistance… in the midst of an oppressive and dominating social reality' (ibid, p.46).

Hooks explains that through their actions rather than 'written discourse' black women created comfort membranes by 'caring for one another, for children, for black men, in ways that elevated our spirits, that kept us from despair, that taught some of us to be revolutionaries able to struggle for freedom' (1990, p.44). Control of the private, (in)tangible homeplace fostered restorative circumstances. The home became an Inner space 'where all that truly mattered in life took place – the warmth and comfort of shelter, the feeding of our bodies, the nurturing of our souls' (1990, p.41). This is an alternative viewpoint of gendered home comfort membranes. Nevertheless, hooks concedes that 'black mother worship extols the virtues of self-sacrifice while simultaneously implying that such a gesture is not reflective of choice or will, rather the perfect embodiment of a woman's "natural" role' (1990, p.46). The element of choice is inherent in these opposing comfort membranes.

Underlying this thesis is the hypothesis that people may actively choose their own comfort constructs. Where this is impossible in Outer or Inner spaces, subversive tactics are used to influence these (in)tangible constructs of (dis)comfort. Munro and Madigan describe the (in)tangible bubbles some women create around themselves to alleviate 'conflict by using their role as "housewife" or "carer" to distance… or subordinate themselves, to others in the household'. This type of defensive comfort

could be considered a type of passive-aggressive role to invoke a sense of refuge. Their busy-bubble, in the form of food preparation and cleaning or ironing, actively 'creates a space, without the very pointed separation that would be indicated by deliberately leaving the room' (Cieraad, eds. 1999, p.115). This is described as an attempt to control their comfort, yet evidence is lacking for domination of this space by women.

2.3.3. INNER TANGIBLE: Crafting Comfort

The history of home-making has a tangible link to crafting comfort. Habitually, bivouac and shelter-based dwelling houses were devised as Inner living spaces. The explicit internal and external comfort situations created in this tent construct progressed to a state where the female was associated with inside and the male with outside. In an analogy, Lefebvre describes the shelter of the yurt home as 'a womb', ritually linked to the female who 'transports her microcosm with her' but is imprisoned within its bounds; whereas, the male is 'thrust into an outside existence with his flock and seeks stability as compensation' (2014, p.84-6).

Recently, in the crafting of physical home environments, Lefebvre notes how architects and home dwellers play on urban metaphors, in a spatial design narrative. He depicts how the middle-class 'apartment becomes a microcosm'; 'the kitchen mimics the grocery store, the dining room replaces the restaurant' and the planted patio is reminiscent of 'the countryside and nature' (2014, p.5). These instances of Outer place re-creation in the home situation, create privatised and controlled comfort bubbles. Yet, these crafting patterns may correlate back to the obsolescence of public community spaces, discussed in section 2.2.

Other societal trends have impacted on space planning hierarchies, and conceptions of space as being functionally specific have undergone circular iterations. Historic practicalities of open halls, advanced into the crafting of segregated space. This cellular spatial preference has, in turn, been superceded by the return to open-plan.

This recent tangible construct of comfort, where multi functioning spaces are considered highly adaptable, is questioned by Rybczynski. He calls these open-plan interiors 'a rupture in the evolution of domestic comfort'; he adds that they exclude 'luxury but also ease, not only clutter but also intimacy' and 'its emphasis on space has caused it to ignore privacy' (1988, p.214) such as acoustic and visual comfort. These discomforting spatial trends, parallel similar discomfort in workplace interiors.

Culturally, these space-planning iterations influence social and familial negotiations of comfort. Regarding the democratic family ideal, Cieraad illustrates how open-plan zoning of the 'postmodern living kitchen' distills family life. This space has 'become the battleground of domestic responsibilities' as it brings the collective together for food, but also exposes 'plain domestic labor'. Egalitarian discourses 'may be a cover-up of traditional gender roles', as in reality this space is 'full of illusions, contradictions, and myths' (1999, p.10-11). This physical re-forming of Inner space, creates cultural and circumstantial changes to room types, numbers, and functions, with varying levels of comfort.

The upkeep of the building fabric impacts on physiological comfort. Polluted air, dampness and lack of sunlight in small domestic apartments generated by physical overcrowding in urban conditions induced tangible health consequences. Cieraad explains how historic sanitary movements of the 19th Century advanced knowledge about the detrimental effects of bacteria; culminating in the re-crafting

of working-class homes to aid routine cleaning of fittings and furniture. Her Dutch example, where 'built-in box beds... closed-off by curtains or doors', were replaced by 'iron bedsteads and hygienic mattresses' (2005, p.168); shows how new materials and spatial constructs influenced cultural comfort habits over time. Nonetheless, these vernacular cupboard beds evolved to control comfort elements such as temperature, drafts, light and privacy. Changing constructs of Inner hygienic comfort contributed to the demise of the box-bed.

Individuals have more control in crafting comfort in their Inner home spaces, but these competing contexts of Inner space show how traditional comfort relationships are mutable through time.

The next section focuses on (In)tangible comfort membranes or structures between clothes and the building skin.

2.4. MEMBRANES: Of Comfort Between Clothes and the Building Skin

This research investigates the constructs of comfort, by studying the (in)tangible boundary layer between clothes and the building skin. Figure 8, highlights the red-dotted line, which signifies these interstitial membranes.

FIGURE 8. MEMBRANES: CONTEXTUAL REVIEW

Serres articulates that 'one must describe the spaces between things that are already marked out – spaces of interference' (1995, p.64).

These indeterminate membranes and structures between clothes and the building skin are endlessly rearranged.

2.4.1. (IN)TANGIBLE MEMBRANE: (Dis)Comforting Boundaries

Precedents of (in)tangible comfort membranes and structures between the building skin and clothes are discussed here. Firstly, (in)tangible interstitial membranes are characterised through physiological aspects of thermal comfort. Secondly, tangible objects and circumstances, represented by furniture and other physical constructions, are then discussed. Thirdly, the intangible circumstances that influence psychological states are briefly discussed by way of comforting constructs of belief; then further psychological concepts of comfort will be developed in the Interactions 2.5, and Body 2.6 sections of this contextual review.

When clarifying the interstitial layer of comfort between clothes and the building skin, architects Duffy and Brand's concept of 'shearing layers', shown in Figure 9, provides a visual framework. Membranes of 'site… structure… skin… services… space plan… stuff' (Brand, 1994, p.13) characterise how the contrasting and shifting elements of a building influence each other over time. This research delineates an interstitial variable within this shearing framework.

FIGURE 9. DUFFY AND BRAND'S SHEARING LAYERS: IMAGE RYAN
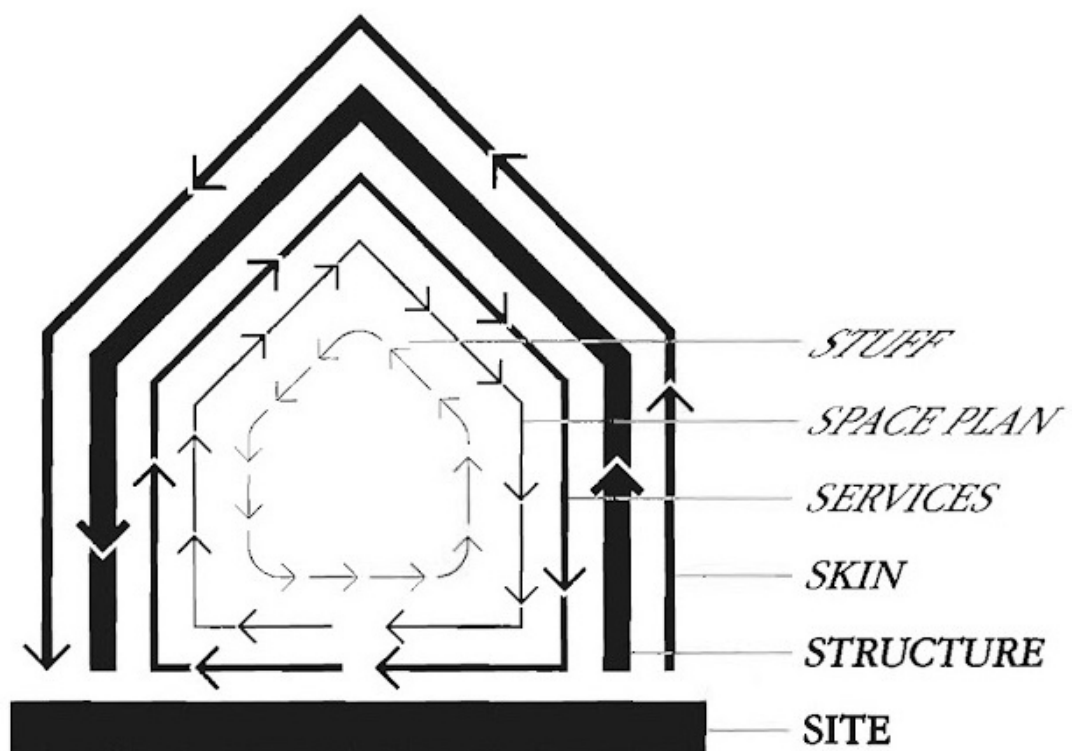
The aim of this research is to study and create ways to map or evidence how humans physically, physiologically and psychologically find comfort within interior space. These implicit and explicit constructs of comfort create insights into individual energy minimisation patterns, which have impacts on wider energy conservation debates. To expand this idea, the (in)tangible elements of thermal membranes rely on experiential knowledge to be fully understood because they are ephemeral.

A pertinent (in)tangible Membrane research-by-practice precedent was theorised and actualised by architect Rahm. With the aim of reducing thermal consumption of energy in buildings he has approached the concept of comfort by interrogating the ... 'standard 20° temperature found in every modern building'. By questioning this 'homogeneous state of comfort' that shields 'building inhabitants from any non-standard environment'. Rahm's investigations explore sensorial spaces that are 'not defined only by walls, matter and color but also by temperature, relative humidity, and light'. He conceives of 'architecture as meteorology' and 'astronomy', using 1:1 prototypes and smaller, to invent interior spaces that 'create temperatures and atmospheres' (Peters, 2009, p.20).

An example of this is the Domestic Astronomy project, shown in Figure 10. It proposes to exploit vertical temperature differentials within a space. In the upper plan and lower sectional views illustrated below, the red coloured 24.6°C heat source is located closest to the lounging and bath spaces.

FIGURE 10. ATMOSPHERIC MEMBRANE DOMESTIC ASTRONOMY: IMAGE RAHM
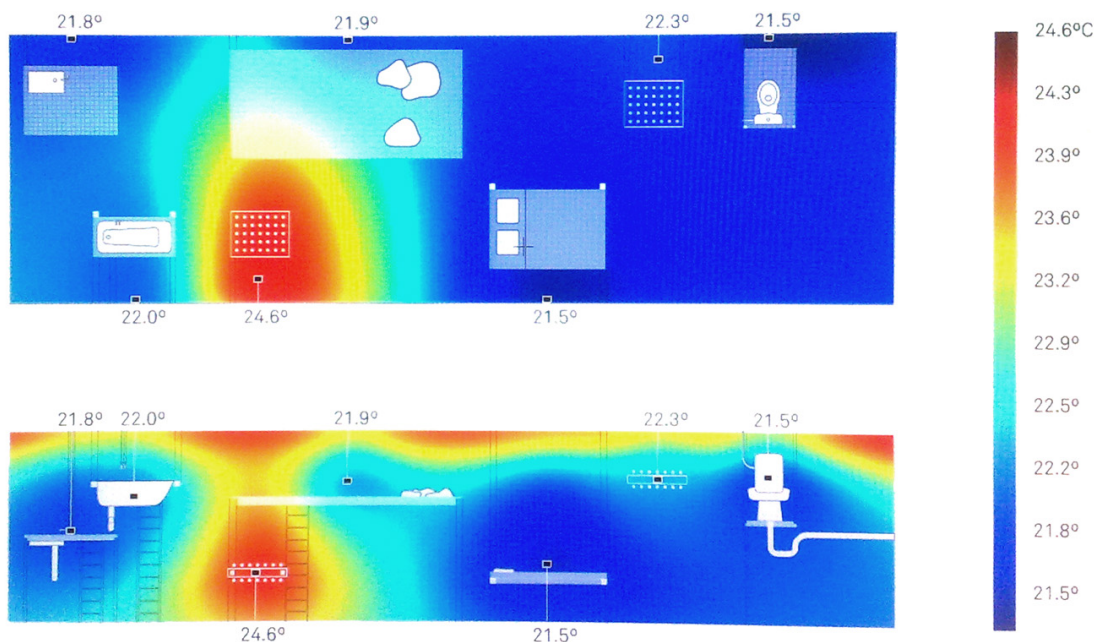
Different domestic spaces and associated activities are juxtaposed with their thermal ranges based on the Swiss standard for construction. A single space is split into activity-based levels so that rising hot air is efficiently used to heat spaces such as lounges and bathrooms. Thus an efficient, vertical way of living is proposed where individualised comfort choices can be selected as occupants migrate across the thermal zones and altitudes.

An iteration of this concept is the Digestible Gulf Stream project where atmospheric architecture enables occupants to 'move around in this invisible landscape between 12°C and 28°C... the two extremities of the concept of comfort'. Figure 11 shows the naked people on the left relaxing in a hotter zone; whilst the clothed person is working in a cooler area. Inhabitants select a 'climate according to... activity, clothing, dietary, sporting or social wishes' (Rahm, 2008).

FIGURE 11. ATMOSPHERIC MEMBRANE DIGESTIBLE GULF STREAM: IMAGE RAHM

However, the immersive nature of the concept is questionable. The project's rhetoric of display counteracts understandings of thermal comfort as the prototype communicates a lack of auditory, olfactory, ergonomic and visual control. Further questions arise about how to preserve the thermal atmosphere, as there is no apparent enclosure. Nevertheless, the idea of a surface based jet-stream membrane, which creates comforting eddies and currents, extends the everyday applications of radiators and underfloor heating and cooling.

Other (in)tangible physiological comfort membranes correspond with sensory regulation and development. In a psychotherapeutic context Maslin, links infant attachment cycles with physiological stress regulation. When a distraught child 'reaches out to human relationship for comfort' (2013, p.94), negative emotions can be reduced and regulated. Psychologists McGrath and McAlpine's research develops strategies for children to communicate concepts of discomfort. This is done by using 'structured play sessions' to find 'ways to alleviate their pain, namely, by seeking hugs and kisses and asking for medicine' or 'distraction' (1993, p.S4).

These contexts are realised in physiological comfort membrane products, such as pressure suits and weighted blankets, which induce an embracing pressure that resembles a hug, a cuddle, a squeeze or being held. Such devices are currently used to alleviate anxiety and provide comfort in settings where users struggle with sensory input, such as individuals with autism or attention deficit disorder. Figure 12 illustrates some of these membrane products, in the form of pressure or squeeze vests and sensory sacks. Within occupational therapy, conclusive evidence about these sensory controlling mechanisms are debated. Occupational Therapists Reynolds, Lane, Shelly and Mullen, determine 'that deep pressure stimulation is capable of eliciting changes in autonomic arousal' (2015). Conversely, recent meta-analysis of this approach queries the positive outcomes of this method of sensory regulation within educational contexts. However, Educationalist and Researcher's Losinski, et.al., concede that 'it is possible, though improbable, that these techniques work on a level that is difficult to measure, and thus could provide a calming effect that our measurement systems cannot detect' (2016 p.15). These (in)tangible constructs of comfort prove difficult to quantify because of their subjectiveness.

FIGURE 12. PRESSURE MEMBRANE "SENSORY SACK" AND "COMPRESSION JACKET"
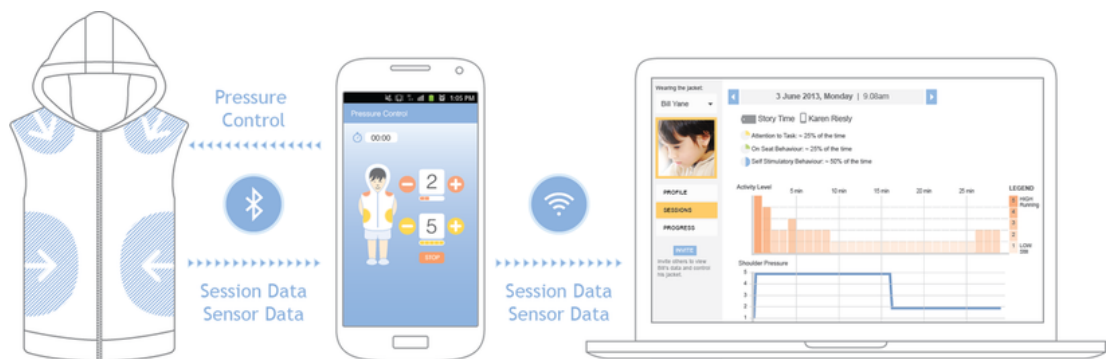
2.4.2. TANGIBLE MEMBRANE: Comfort Structures

When expressing constructs of comfort, some membrane precedents merge

the distinctions of clothes, interstitial membranes and the skin of the building. Yet,

tangible analogies can be distinguished in eggshell structures, as the egg form is usually covered or protected by the body of a parent or the nest walls. A nut-shell, however, does not fully convey the subject topic as it collapses the distinctions of clothes and the building skin into its membrane structure. A range of membrane precedents that correspond with the analogies of the eggshell protective enclosure; the cushioning amniotic fluid atmosphere; or the nutshell that amalgamates clothes and building skin, will be examined to contextualise this research subject topic.

Contexts of physical comfort membranes include instances, such as car seat heaters, mechanical fans, duvets, curtains, tapestries and rugs. Flexible membrane materials like scarfs evolved from being draped over the body, to adorning the bed, the threshold or the floor - becoming clothes for the interior. These become comforting thermal, acoustic and visual screens, represented in a variety of customs and arrangements. These fabrics became denser as their functions became more permanent and, in time, more hardwearing materials were used, alongside these softer textiles. The bed developed a frame, the threshold a shutter, the floor a mat.

These interior fixtures progressed into furnishings, with a well-appointed, idealised example, depicted in Messina's painting of St. Jerome In His Study (1474-5) illustrated in Figure 13. This depiction of a structural room within a room, shows a comfortable work-live object and circumstance. Curatorally, Campbell describes the tangible items around the occupant as a 'wooden desk, part of a fully designed and disconcertingly modern work platform, filled with the paraphernalia of life and study', which elevate it to a 'living space' (2014). From a classical perspective Pollmann describes how the 'slippers at the bottom of the steps' are intangible symbols that denote the space as a spiritual and intellectual sanctuary. This 'studiolo (study and library)' (2012, p.68) incorporates a generously fabricated carrel and

ergonomic lectern, with appropriate footspace, storage - all satisfying a range of

comfort desires.

FIGURE 13. EXPLICIT STRUCTURAL STUDIOLO MEMBRANE: IMAGE MESSINA

Other ubiquitous forms of structural membranes come in the guise of cribs, cradles and cot beds. These devices embody instances of comfort through movement. Figure 14 illustrates an electric model. However, their primary users can only give limited wellbeing responses to their caregivers and so there was a trial-and-error approach to the design of these devices. The rocking motion coupled with, thermal and visual control simulates pre-natal environments, thus assisting the comfort of the baby, and caregivers.

FIGURE 14. EXPLICIT STRUCTURAL "COT" COMFORT AND MOVEMENT MEMBRANE

Nutshell analogy precedents, which incorporate protection from the

elements, include inventor Hiester's hammock tricycle (1883) shown in Figure 15. This

curious conception endeavours to provide comfort whilst travelling.

FIGURE 15. FLEXIBLE CONCEPTUAL MEMBRANE: IMAGE HIESTER

(No Model.)

C. E. HIESTER.

HAMMOCK.

No. 278,431.   Patented May 29, 1883.

Fig 1.

Fig. 2.

Fig. 3.

Fig. 4.

WITNESSES

Chas. R. Bart

W. E. Bowen,

INVENTOR

Chas. E. Hiester

J. N. Adriaans

ATTORNEY
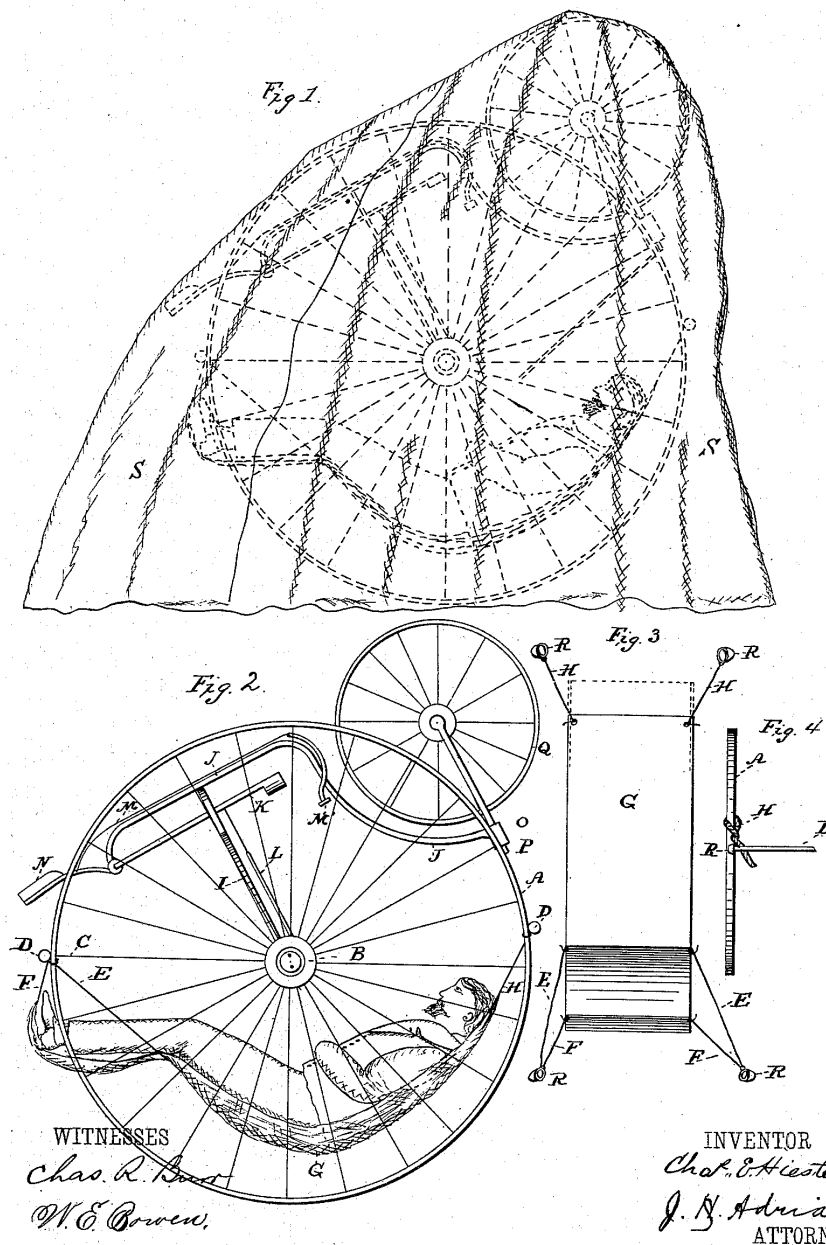
The US patent illustrations of the apparatus, which the supplementary patent text labels as 'an inverted tricycle converted into a sleeping apartment… the whole being covered by a suitable covering, the upper portion of which may be waterproof' (US278431, 1883). A very niche comfort concept.

With the arrival of new types of transparent membrane materials, the 1960's saw innovations in pneumatic environments. Banham an architectural critic, argued against the presumption that building 'substantial structures' was the only way to create interior comfort. He claimed that humans have 'always known from experience that unaided structure is inadequate' and to make the interior spaces comfortable, 'power has always had to be consumed' (1969, p.22). Fireplaces or water and air ducts denote these power or service infrastructures.

He adds that when the building skin is removed from the debate 'societies… tend to group their activities around some central focus... and inhabit a space whose external boundaries are vague, adjustable according to functional need' (ibid, p.20). These insights enabled the building skin to be reimagined into moveable habitats that shifted the perceptions of conventional architectural construction.

The Archigram group of architects Cook, et. al., proposed a new inhabitation paradigm, as they believed that 'most impressive modern architecture is most often accused (by lay people) of being uncomfortable' (1999, p.76). The biological and mechanical building skin reverted back into a flexible membrane. Occupants autonomously controlled these devices; the literature stated 'the determination of your environment… can be turned over to you yourself. You turn the switches and choose the conditions to sustain you at that point in time' (ibid, p.68).

Webb's mobile architectural projects of the Cushicle (1964), and its successor the Suitaloon (1967), devised psychophysical membranes for individual and

collective use. The Cushicle concept aimed to support 'an explorer, wanderer or other itinerant to have a high standard of comfort with a minimum effort'. This was attained by the Cushicle carrying 'food, water supply, radio, miniature projection television and heating apparatus' (ibid, p.64). It is illustrated in Figure 16, and comprises of a twofold structure with an inflatable envelope surrounding a vertebral frame for interchangeable thermal, visual and auditory comfort appliances.

FIGURE 16. FLEXIBLE CONCEPTUAL MEMBRANES: IMAGE WEBB

Webb's next design iteration was the Suitaloon (1967), illustrated in Figure 17. It incorporated a lounging seat and could be inflated by hand. These adjustments facilitated more communal living as the suits casing was able to connect with similar devices via threshold plugs. This 'Comfort for Two' scenario, postulated that

'returning to the fundamental comfort-instinct, it is reasonable to check designed situations… in terms of whether they make people feel safe or unsafe, propped-up or isolated, happy or unhappy' (ibid, p.68).

FIGURE 17. FLEXIBLE CONCEPTUAL MEMBRANES: IMAGE WEBB
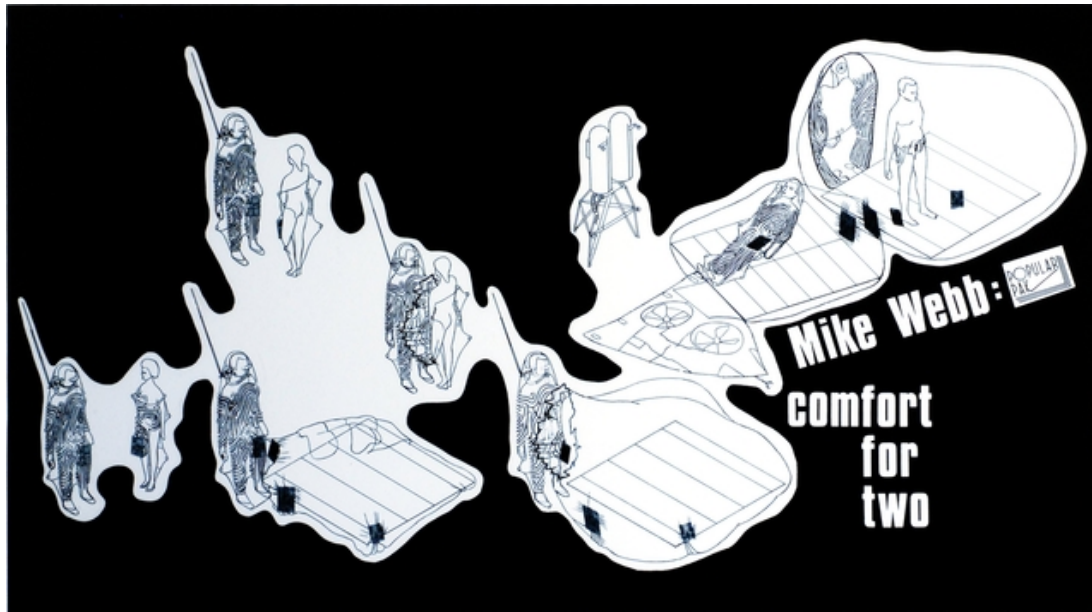
These habitats were reliant on technology; an external energy infrastructure and internal dwelling mechanisms facilitated this bubble-life. The necessity of a separated infrastructure was, in itself, a problem. Physical prototypes of some of these ideas produced debatable results; such as their practical portability, their applicability to the tasks of living, their lack of visual privacy, and the situational dichotomy of living in a petrochemical plastic bag.

Nevertheless, these problem-solving exercises led to a problematising approach in the 1970's from co-operative design studios. These included Coop Himmelblau and Haus-Rucker-Co who developed immersive environments where their audience could playfully experience novel situations. These included the Mind Expander Series (1967-69), which explored sensual deprivation to alter perceptions using curved plastic headpieces. With the aim of progressing social reform through

immersive interaction and fostering new perspectives, these action research

methods developed a practice of experiential architecture, design and art.

Other comfort membrane precedents include the artist's Orta and Orta's

portable architecture objects and circumstances. Through iterative research

workshops, a series of membrane constructs were devised to visualise the

(dis)comfort of individuals at the margins of society. Progressing from individual

creations, designed with homeless co-researchers, and manifested in the Refugee

Wear series; to multi cellular interventions that consider collectivist notions of

supportive comfort. The Siamese Armour project, part of the Urban Lifeguard series,

is illustrated in Figure 18.

FIGURE 18. PERFORMATIVE MEMBRANE "SIAMESE ARMOUR": IMAGE ORTA

Another performative membrane precedent, suitable for experiential

immersive research is the 'Metabody' research project, co-ordinated by De Val. It

uses 'multisensorial laboratories of perception and movement integrated in a mobile

experimental interactive/ intra-active architectural structure' to query why digital

interfaces map human gesture to ultimately develop commercial applications. The

notion that everything is traceable and chartable, links to the forecasting of

imminent consumption desires. Human movement cannot be pre-determined and

De Val attempts to subvert our current 'Big Data society'. His research aims to tackle

'unsustainable... cultural homogenisation' by investigating new performative

ecologies through a range of sensorial modes.

The research prototype 'Metatopia' is conceptualised as an 'ultraportable

interactive & performative environment for outdoors & indoors', this is visualized in

Figure 19. Its flexible modules allow for endless transformations in the 'perception of

form' (De Val, García, 2013).

FIGURE 19. PERFORMATIVE MEMBRANE "METATOPIA": IMAGE REVERSO

At the International Metabody Forum, London (2016) a clearer

understanding of the concept emerged when immersed within the 1:1 Metatopia

membrane model shown in Figure 20. Experientially you inhabit the space by

manipulating four Velcro straps attached to your wrists and ankles. These elastic

cords permitted movement of the flexible structural membranes with space

emerging from each inhabitant like a physical shadow. My bodily positions were

constantly reinvented by experimenting with intentional postural movements. The

netted membrane and flexible structures enabled you to, venture outside, wrap

yourself in knots and untangle yourself. It was a unique, (dis)comforting experience.

FIGURE 20. PERFORMATIVE MEMBRANE IMMERSION EXPERIENCE

The four connected performative membranes introduced the concept of neighbouring, as each inhabitant redefined movements within adjacent cells. These performance-based proprioceptive sensations introduced unpredictable elements; at one point you were being held, but in an instant you were supporting others. The opposing haptic forces and shifts of resistance, pressure and weight, correspond with movement-based perceptions and Lefebvre's notion of sensations and a 'pedagogy of the body' (2014, p.34), which is discussed in section 2.6. Other sensorial aspects of this Metatopia membrane were its physical and digital architectures. These visual projections and accompanying sound induced experiences of being within the amniotic sac or womb - an aspect of interior comfort explored in Chapter 4.3.

This immersive instance of a tangible interior membrane identifies innovative research-by-practice discourses and the relevance of this experiential research topic.

2.4.3. INTANGIBLE MEMBRANE: Comforting Belief

In section 2.2.2 ritualised comfort that societies and individuals use to construct identity can be associated with aspects of belief. This section briefly investigates the intangible concepts around beliefs that may impact on constructs of comfort. These precedents relate to intangible faith-oriented comfort desire-lines that surround a person's body, but are distinct from affect or other psychological constructs of comfort that are discussed in section 2.6.

Comfort membranes can be interpreted in terms of faith in a self, a family, a group, a society, a religion, a world, outer space and so on. Anthropologist Miller, encapsulates this by describing that 'people who strive to create relationships to both people and things' are motivated by 'material and social routines and patterns which give order, meaning and often moral adjudication to their lives'; adding that constructs, which become increasingly 'familiar and repetitive, may also be a comfort to them' (2008, p296). For example, traditional spatial gender divides are ritualised in the Christian, Hindu and Muslim religions. These (in)tangible comfort membranes are evidenced in cloth veils mostly worn by women over their clothes; or in screened lattice structures demarking (fe)male zones.

Some examples of mystical comfort are visually symbolised in the halo, which represents sacredness within Christian, Buddhist, Egyptian and Greek Art. Positive energy flowing through and surrounding a sacred being are metaphorically construed through intangible belief membranes that encircle a head or body.

Within a psychophysiological and spiritual context, the non-dualistic notion of the body and mind being conjoined, is developed in Eastern medicine and faith practices. For example, an individual's wellbeing or comfort is expressed in chi or

chakras, which are considered the alternate dimensional energy flows around and within a non-physical 'subtle' body.

In Chinese philosophy, it is believed that the free flow of chi in your body supports health through movement. From an intangible energy-use view, it is believed that the free flow of chi in a body supports health, but blockages are detrimental to wellbeing. Comforting actions of belief in this instance are evidenced in Qigong exercise. Figure 21 shows 'breathing and physical exercise' comfort rituals in 'dao yin, postures' (Mawangdui Tomb Han Dynasty 206BCE - 220CE). It illustrates how esoteric energy membranes are acted out through movement, providing a ritual of comforting belief.

FIGURE 21. ENERGY MEMBRANE "QIGONG" POSTURES

The concept of Chakras originates in Indian theology and refers to an energy wheel at intersections of the incorporeal body. From a devotee's perspective, these (in)tangible energy field membranes denote interrelationships between physical, physiological, psychological and spiritual comfort. An interpretation of these layered energy Membranes, emanating within and radiating around the human form, are illuminated by Højland in Figure 22 (Brofman, 1988).

FIGURE 22. ENERGY MEMBRANE "CHAKRAS": IMAGE HØJLAND

STRUCTURE

Yang
Male
Will
Acting

CAUSAL BODY
BUDDHIC (NIRVANIC) BODY
ETHERIC BODY
ASTRAL BODY
MENTAL BODY
EMOTIONAL BODY
PHYSICAL BODY

Vibrations	**Nerves**	System
Musical Notes	Glands	**Elements**
Violet	**Brain**	Nervous System
B Si	Pineal	**Inner Light**
Indigo	**Carotid Plexus**	Growth, Endocrine System
A La	Pituitary	**Inner Sound**
Blue	**Cervical Plexus**	Metabolism
G Sol	Thyroïd	**Ether**
Green	**Cardiac Plexus**	Respiration, Circulation, Immune System
F FA	Thymus	**Air**
Yellow	**Solar Plexus**	Skin, Muscles, Digestive System
E Mi	Pancreas	**Fire**
Orange	**Lombar Plexus**	Assimilation and Reproduction
D Re	Gonads	**Water**
Red	**Sacral Plexus**	Skeleton, Lymph, Elimination System
C Do	Adrenals	**Earth**

The Brofman Foundation for the Advancement of Healing   www.hea

EXPERIENCE

Yin
Female
Spirit
Feeling

(Deepest Inner Experience)
CAUSAL BODY
BUDDHIC (NIRVANIC) BODY
ETHERIC BODY
ASTRAL BODY
MENTAL BODY
EMOTIONAL BODY
PHYSICAL BODY
(Dutermost Level of Experience)

God
White Light
Father

Sense

Area of Consciousness

Soul   **Empathy**

Unity
Universal Consciousness
Source of Direction and Intuition

Spirit   **Extra Sensory Perception**

Spiritual Awareness
Individualized Consciousness

Hearing

Expressing, Receiving, Abundance
Flowing Manifestation
Listening to Intuition

Touch

Relating, Giving
Perceptions of Love
Acceptance

Having

Personality   **Vision**

Freedom/Power
Controle, Self-Definition
Intellect

Taste

Sensations
Feeling & Feelings
Food, Sex, Appetite

Smell

Safety, Security
Trust - Survival
Money, Home, Job

Mother Earth

aler.ch   The Body Mirror System   ©1988 Martin Brofman   Illustration and lay-out : Jørgen Højland

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These sui-generis circumstances of comforting belief imply that our corporeal bodies are surrounded by intangible Membranes articulated in constructs such as esoteric energy flows.

The tangible structural precedents portrayed explicit objects and Membranes that facilitate interior comfort in a variety of situations, reshaping the shearing-layers framework. The studiolo, rocking pram, transient hammock, portable suit-rooms and performative shadow membranes evidence the movement and fluidity of these physical constructs of comfort. The (in)tangible instances considered how sensory regulation is soothed by pressure actions that mimic an embrace, taking the form of interstitial Membranes or thermal meteorology.

In the next section, the comforting Interactions between humans and the objects and circumstances around them will be discussed.

2.5. INTERACTIONS: Potential and Effective

So far, some of the Outer, Inner and (In)tangible Membranes and comfort constructs between clothes and the building skin have been identified. The Interactions between the functional, ergonomic and cultural histories around the uses of furniture objects and living space circumstances are now considered. Figure 23 illustrates this zone.

FIGURE 23. INTERACTIONS: CONTEXTUAL REVIEW

The sociologist Gans, emphasises the difference between the 'potential', which encompasses object based 'material and architectural attributes'; and 'effective', that describes how these commute into circumstances as 'cultural or individual conceptions' (1968, p.5-6).

2.5.1. INTANGIBLE INTERACTION: Comforting Currents

Environmental psychologists Heijs and Stringer, explain that to 'in order to tackle the questions posed by contemporary social and economic changes, it was necessary to pay more attention to the interaction between people and their thermal environment' (1988, p.235). This section will outline and develop multi-disciplinary perspectives of thermal constructs of comfort.

Delineating the comforting aspects of the indistinct element of air generates ambiguity, because humans employ a variety of physical, physiological and

psychological constructs to augment their comfort. Furthermore, cultural and socio-economic factors introduce immeasurable specifications.

Shove's treatise on thermal comfort describes through 'the seemingly innocent goal of meeting peoples' needs, technical research (allied to commercial interest) has contributed to… the naturalization of ultimately unsustainable expectations and arrangements' (2003, p.21) within their interior spaces.

Consequently, specific physiological comfort-based temperature ranges have been quantified. Science and policy adviser Boardman highlights that 'emphasis has been placed on defining temperatures' by technical disciplines because other comfort 'parameters are more difficult to evaluate' (1991, p.105). This situation may be due in part to the intersectional difficulties of extrapolating individual elements of age, gender, class and juxtaposing with them with variable environmental and personal preferences.

In the context of the UK and domestic thermal comfort, Boardman identifies four temperature objectives. These comprise of 'the comfort of occupants… the health of the occupants… proper maintenance of the building and the prevention of condensation' (ibid, p.105-6). The thermal comfort of inhabitants is directly linked to indoor tasks and activities, also, optimum temperatures increase with age. Her research established that '56-75% of time is spent sitting, 15-31% lightly active and 6-19% moderately active' thus affecting the specification of 20.8°C as the 'mean comfort temperature' within a domestic environment. This finding is corroborated by Fishman and Pimbert's office-based research which concluded that to 'ensure that at least 90 per cent of the workers are comfortable, the range would have to be within 20-23°C'. The workplace is used as a site to explain optimum domestic temperatures because it was undertaken 'in a natural environment, rather than

during experiments, unrestricted by concerns about paying the fuel bills' (ibid, p.108-9). So, the intangible element of air becomes measurable, providing a notional thermal comfort standard.

These 'effective' ideals have been used by industry as a benchmark to develop new 'potential' objects that facilitate thermal comfort. Thus, energy use is controlled by consuming products with efficient credentials.

Yet, Sociologists Wilhite et.al. (1996), evidence that end users wish to consume thermal comfort circumstances. Energy use is a by-product of this desire, and the Interactions between users and thermal comfort products. An intermediative process ensues, where end users consume warmth or coolth by utilising temperature regulation devices, which in turn, consume energy. Wilhite et.al. caution that implicit comfort customs are 'impervious to rapid change' as 'services of cosiness' become culturally standardised. Their diagnosis for alleviating this situation, involves the creation of new devices or 'technologies which provide the same cultural service with less energy' (1996, p.803).

Shove corroborates this by outlining that worldwide 'expectations of the indoor environment' are merging into 'a concept of comfort that is immensely demanding to maintain and reproduce'. Hence, 'more environmentally forgiving specifications' are necessary. However, she queries the response of 'engineers and designers' who may be reticent to contravene 'established technical standards or challenge conditions of comfort that people have come to expect' (2003, p.21). This provides insight about the user-device and energy use arrangements; but, how can designers, prevent or invent comfort constructs that adhere to these Interactive technical and social distinctions of thermal comfort?

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For example, in international office contexts of thermal comfort men culturally wear more clothes then women, causing physiological discord when setting an optimum temperature within these communal spaces. Kopec concludes that it results in 'situations wherein temperature controlled by men creates a cold environment for women, and temperature control by women creates a hot, sweaty environment for men' (2012, p.253).

Instances of changes to thermal comfort routines come in the example of Japan's 'Cool Biz and Super Cool Biz' case studies, where office workers have been encouraged to dress down in the summer season so that mechanical ventilation systems consume less energy. Researchers Ndubisi, Aliagha and Cin, analyse its adoption in Malaysia, finding demographic differences in its concept, for example, 'Cool Biz attires were more acceptable among younger office workers (particularly 18 to 25 years) than the middle age office workers' (2013, p.444). These conclusions reaffirm how ritual comfort practices and expectations of comfort are evolving.

2.5.2.(IN)TANGIBLE INTERACTION: Latent Comfort

Although thermal comfort is intangible, its significance is explicit as it can directly influence human behaviour. These measurable technical and immeasurable social nuances of thermal comfort, can be enlarged to other comfort constructs, such as body position, clothes, lighting, etcetera. Comfort is associated with energy consumption and the circumstances surrounding our Interactions with objects.

As a sign of Interaction via human touch and time, the construct of patina will be used to explore the histories of material culture and comfort. In Diaconu's cultural anthropological research into environmental aesthetics, she describes how 'patina records the passage of an object through time… it stores history… and saves

the past from oblivion' (Tymieniecka, eds., 2006, p.133). Anthropologist McCracken explains how pre-modern familial lineage practices involved the assumption that if acquired new 'the duration of ownership of an object' signified that its hereditary owners 'had enjoyed a certain level of discretionary income' and 'certain social status' (2005, p.35-6). Accordingly, the patina or wear of an object signalled its high status as its age indicated provenance and wealth. Furthermore, the visual abrasions and oxidisation on the article evidenced the Interactions surrounding its former use – a visible accumulation of comforting genealogical, ritual and functional desire-lines.

However, McCracken documents that as consumption increased, comfort attachments to objects became more symbolic. For example, consumption systems and practices that championed newness, at the expense of older styles, were advanced; 'marketers… understood the dynamics of fashion and worked to increase its pitch'. Consequently, 'with novelty in the ascendant, patina fell into eclipse' (ibid, p.39), directly increasing energy consumption.

As the pace of consumption intensifies, unattainable desire or comfort aspirations are created. McCracken emphasises that our desires 'for luxuries, for goods beyond our conventional buying power, is not simply greed'. He believes it is a case of chasing 'displaced meaning' or latent comfort, where things that do not 'presently conform to ideal expectations' can be accessed. However, he warns against obtaining our desires because, 'for goods to serve the cause of hope, they must be exhaustible in supply' (ibid, p.116).

This view corresponds to psychologists' Brickman and Campbell's theory of 'hedonic adaptation' (1971, p.287–302), which postulates that people acclimatise to new positive and negative situations. Using the example of thermal comfort, altered expectations may create new norms.

Adaptations in objects usage are important in developing patterns of comfort, for example, technological smart devices have generated new forms of (in)tangible user and object comfort relationships. Intrinsic memories and data are stored in the device, and prestigious brand marks are extrinsically displayed. Teyssot portrays these 'nomadic devices' as extensions of 'the contours of our egotistical spheres, running experiments in which the body is the main node for technological mediation' (2013, p.275). Miller describes how individuals Interact with objects in the minutiae of daily life, as they reinforce 'their basic beliefs about the natural order of the world… everyday ritual is also an aesthetic, something which gives order, balance and harmony to the world people live in' (2008, p.287). Using smart devices as an exemplar, these emerging Interactions generate latent comfort negotiations.

McCracken advises that 'goods and the object-code are one of the ways… society continues in the face of quite overwhelming ethnographic odds'. The potential comfort of these devices transforms our Interactions. He believes the agency of objects 'serves as a means by which a society both encourages and endures change'; effective 'both as an instrument of change and an instrument of continuity' (1988, p.137). Relating back to the Outer section 2.2., Interactive comfort sequences of tradition and innovation allow for individual and societal cultural shifts.

2.5.3.TANGIBLE INTERACTION: Comfortable Things

Comfort is inherent in everyday activities such as washing. Hendry gives an example from Traveller Gypsies communities, which facilitates functional comfort. The washing of clothes is separated by gender; 'bowls for washing clothes are placed (outside) from bowls for washing up pots (which hold food are kept goes inside)' (2008, p.43). The functional use of separate washing bowls and spaces,

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provides an example of tangible ritual Interactions that generate comfort within families and communities.

Within Inner spaces, modernist principles focused on gender in the conception of the domestic engineer. Female productiveness within the home was re-appropriated into Taylorist principles of dreams of modernist efficiency. Interactive contexts were developed in 1918 by Pattison, a domestic engineer. She studied issues relating to a home's 'efficiency system' in relation to its inhabitants, space organisation, devices, food and society. These 'time and motion studies' reworked some classical scientific management principles, where the 'elimination of drudgery' (1918, p.103) could be achieved by the employment of her efficiency guidelines.

However, Ingraham probes how 'the woman became a statistical pleasure model' in these studies. She explains that 'under the guise of science' the 'woman as domestic engineer' suddenly became a 'useful cog in the great social and economic machinery'; and 'granted all the legitimacy of a good and proper member of society without any of its benefits (no wages, no property, and so on)' (Colomina and Bloomer, eds. 1992, p.263). These tangible efficiency frameworks, explicitly evidenced the domestic routines that generate comfort.

Recent iterations of these studies include ergonomics, a discipline formed to enhance the fighter pilot jet cockpit in World War II. Technology, human factors and interaction designers Dul and Weerdmeester, describe how ergonomics utilised expertise from multiple disciplines to apply 'theory, principles, data and methods to design, in order to optimize human well-being and overall system performance' (2008, p.1). The discipline branched into human factors or metrics, where humans are measured and typified in a range of postural tasks in order to develop efficient space recommendations and assist the design of comfortable things. An illustration

of body measurements is shown in Figure 24. Interestingly, in case the end user is not

statistically compliant, these are caveated with 'in accordance with normal

measurements and energy consumption' (Neufert, et. al., 2012, p18-9).

FIGURE 24. MAN: DIMENSIONS AND SPACE STANDARDS

MAN: DIMENSIONS AND SPACE REQUIREMENTS

Body measurements

In accordance with normal measurements and energy consumption
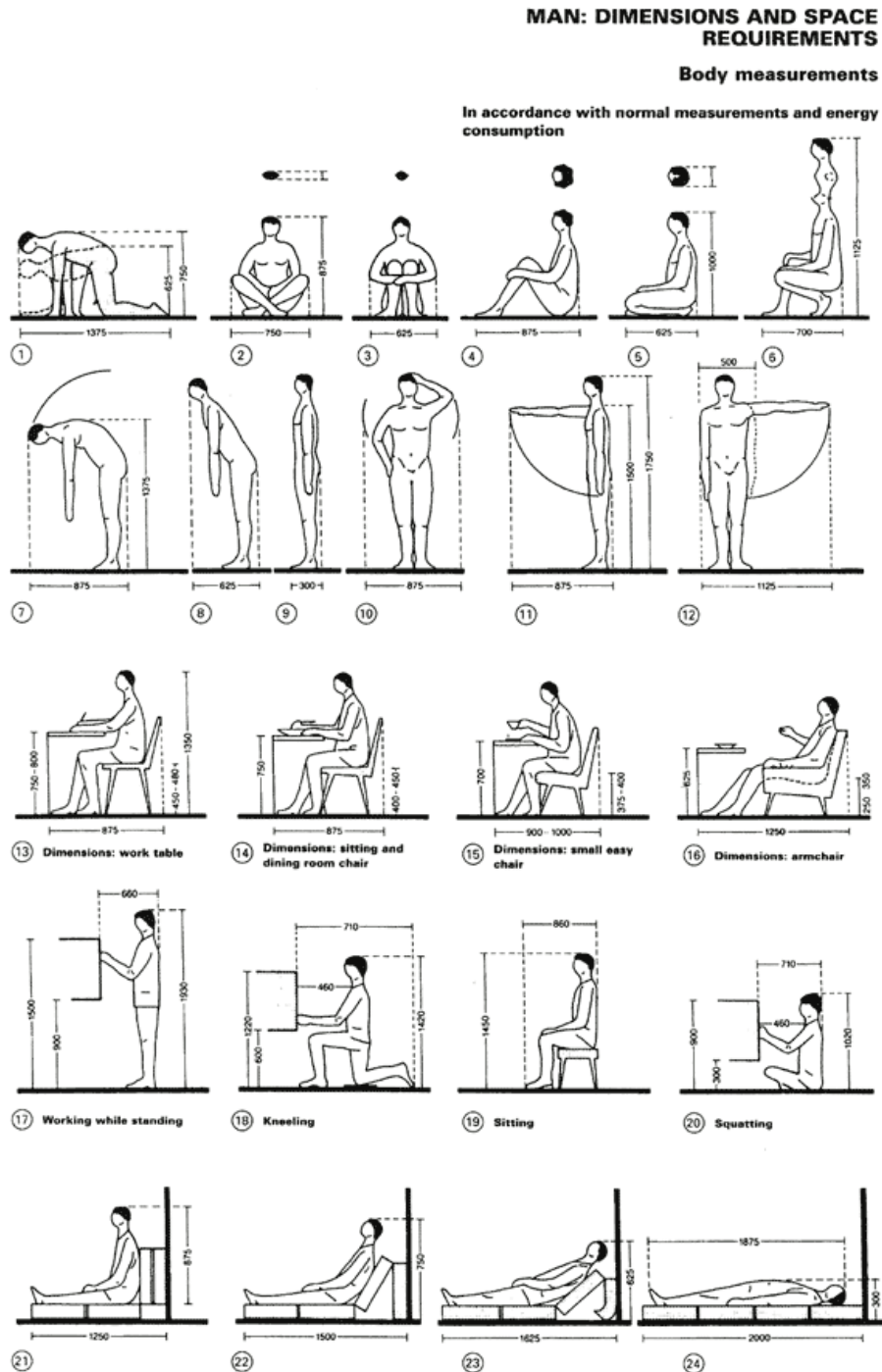
Developing comfort in furniture construction is documented by Giedion, who describes the evolving tradition of 19th century furniture. He states that 'multiformity and metamorphosis are part and parcel of their being'; explaining the care given to cater for physiological comfort needs in furniture design where 'everything is collapsible, folding, revolving, telescopic, recombinable' (1969, p.423). He describes seating systems as 'resilient and oscillating; by movement forwards, backwards, or sideways… or in any other spontaneous motion… in which body and mechanism collaborate' (ibid, p.404). These are evidenced in the burgeoning patent industry that ran in parallel with these innovations.

Further developments were created by inventor Carver, who designed a reclining, swinging 'improved couch or easy-chair, for accommodation, health, and comfort'. Autonomously adjustable, the apparatus can adapt to 'any degree of inclination which may be desired'. Additional comfort is achieved through movement, as the 'swinging motion may be given by an attendant, or by the person on the couch' via 'the frame in which it may be suspended when desired' (Patent US775).

This mobile apparatus is structured within a room as the four periphery supporting posts, used to hang the seat as a swing, create implied space around the device. The human user in Figure 25 is missing within this image but the potential object and effective circumstance of this 'improved couch' are demonstrated in Carver's Invalid Chair US775 Patent (1838).

FIGURE 25. VARIETY COUCH OR INVALID CHAIR, IMAGE: US775 CARVER

E. Carver,

Invalid Chair,

№775, *Patented June 12, 1838.*

No.1
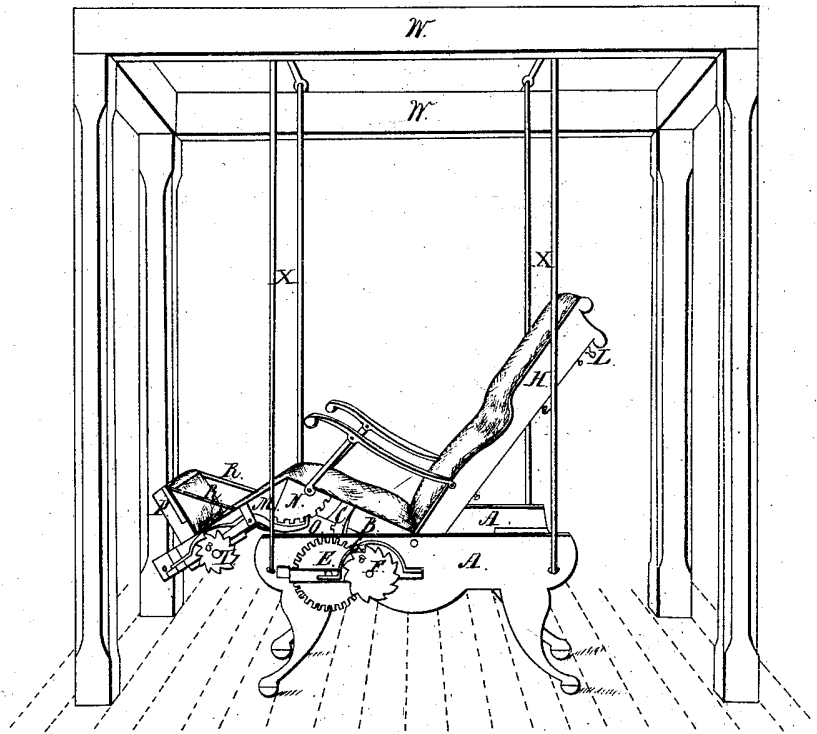
This section has considered the Interactive constructs of comfort. There is a tendency to prioritise the object or circumstance, rather than the human user in many of these (in)tangible interactions. Intangible thermal comfort currents, generate intermediary latent comfort needs, producing tangible, comforting things.

The next subchapter will focus on the Body and the sensations that enable each individual to develop their (in)tangible notions about the constructs of comfort.

2.6. BODY: Design Around the Human

Humans are at the centre of this investigation. Architectural scientists Smith and Smith promote design 'for how people experience space' and describe how bodily experience of interior inhabitation 'affects how we perceive buildings' because the 'boundaries of space are like a second skin' (2015, p.19). Figure 26 highlights the body form within a notional interior space.

FIGURE 26. BODY: CONTEXTUAL REVIEW
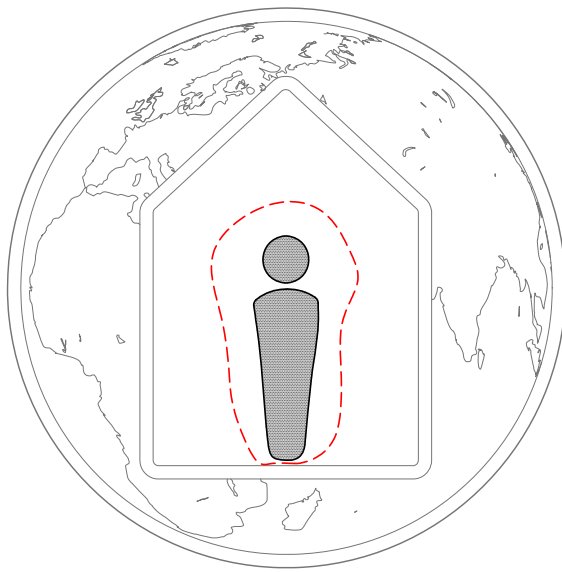
Lefebvre calls on designers to develop a 'pedagogy of the body' which reorients the natural rhythms of the Body within a bounded space. He explains his desire for 'a practice, addressed to lived experience, to lead it to the level of the perceived world' (Lefebvre, 2014, p.34).

2.6.1. INTANGIBLE BODY: Comforting Moves

The transition between comfort and discomfort generates movement in a Body; as Lefebvre states 'there is no pleasure without movement'. The energy expended in 'mobilisation towards a goal… contains its reason and its joy within itself' (2014, p.75). Desire for comfort can be described as the original motivation in looking for, and seeking an object or circumstance. Philosopher and scientist Aristotle thought that ideas and beliefs, on their own, lack energy unless they are accompanied by desire (Pearson, 2012). Desire sparks individual and community

acts of change and the ensuing movement is a prerequisite for invention. This explains fundamental aspects of change and in this context it relates to the implicit and explicit moves a person creates to augment their comfort.

Desires are evidenced in our intentional or voluntary actions, that Norman outlines are triggered by certain 'visceral, behavioral and reflective' emotional attitudes (2004, p.6). He describes that 'emotion is the conscious experience of affect'. Reflexively, 'affect' enables a person to 'make judgements', and cognition 'interprets' these decisions (ibid, p.11). In relation to comfort, Norman explains that we 'literally feel good or bad, relaxed or tense. Emotions are judgmental and prepare the body accordingly. Your conscious, cognitive self observes those changes' (ibid, p.13). These processes of emotion explain our conscious and unconscious reactions to comfort.

In relation to the desire-lines of comfort, Norman explains how cognitive science research investigates 'how people structure their environments to simplify their tasks... actions, and remember and organize their places after interruptions' (2011, p.234). Unspoken exchanges enable human behaviour to display shortcuts people use to create cognitive congenial environments for themselves and others.

Cognitive scientist Kirsh, explores the concept of 'cognitive congeniality' that examines the 'adaptive advantage' of 'creatures with some active control over the shape of their environment'. Still, 'there are limits on how many different tasks a creature can be designed to do well in' and these involve 'design trade-offs' (1996, p.416). This corresponds to the concepts of comfort, movement and desire-lines as individuals specialise and adapt to their needs through cognitive processing. Smith and Smith explain that recollections of 'prior experiences act as comparators to help understand new information' (2015, p.14). As memories of comfort experiences

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multiply, individuals become expert at selecting localised conditions that augment their relaxation and comfort.

In past experiences of (dis)comfort, movement, motivation and desire, elements of play will be framed, because it encompasses all these energies. Huizinga describes the process of play where 'all is movement, change, alternation, succession, association, separation… limitation'. This process concurs with the time-bound nature of play, where a 'space is marked out for it, whether materially or ideally, hedged off from everyday surroundings' (Huizinga, 1998, p.38). These playing rituals influence comfort, linking back to socio-cultural dimensions of comfort discussed in section 2.2. Huizinga gives a rationalisation of play that is similar to comforting ritual where, in each individual, it matures to represent a 'fixed form as a cultural phenomenon'. That is, the experience of play 'endures as a new-found creation of the mind, a treasure to be retained by the memory… it becomes tradition' (1998, p.28).

However, when play skills progress, Norman's advice on the 'moving target' of complexity is apt: 'the more expert we become at any subject, the more complexity we prefer' (2011, p.13). He suggests that 'an intermediate level of complexity' (ibid, p.60) circumvents the extremes of dullness or bewilderment.

Play and its complexity correlate with the idea of flow, which psychologist Csikszentmihalyi explains is unlike 'normal life'. The activities undertaken whilst in a flow state allows individuals to 'focus on goals that are clear and compatible, and provide immediate feedback'. Flow encourages learning because 'new skills and increasing challenges' can be adjusted to the ipsative comfort level of the individual (1997, p.29-30). These intangible states of lived experience, where being stretched, just within your comfort zone, attest to the idea of comfort and motion.

Other human-centered psycho-spatial comfort constructs include the concept of 'Proxemics'. This is the word given to Hall's anthropological articulation of intangible personal space bubbles that individuals regard as their territory. These invisible boundaries extend beyond the body in intimate, personal, social and public zones. Figure 27 shows a personal zone, made tangible.

FIGURE 27. PERSONAL SPACE COMFORT CONSTRUCT

These instinctive notions of security and shelter can be invaded, stimulating the adrenal hormone that generates a fight-or-flight response in the body. As well as being a direct visceral response to perceived threats, the size of these proxemic zones varies depending on learnt cultural and behavioural codes of comforting space distances.

Hall gives an example and describes that 'the skin itself is a very unsatisfactory boundary or measuring point for crowding' (1966, p.61) as people become agitated in larger gatherings because personal spaces collide. However, urban-dwellers adapt to encroachment into their body bubbles as a result of environmental conditioning.

Geographer Sack describes how individual territory governs exchanges between 'people, things and relationships' by 'attempting to enforce control over a specific geographic area' (1983, p.56). This evidence of body extensions into strategic areas around our Bodies supports intangible constructs of comfort.

2.6.2.(IN)TANGIBLE BODY: Sensual Comfort

Medical doctors Seguel et. al. describe indoor air pollutants being reduced by no 'smoking indoors; checking radon levels; reducing conditions that promote mold growth, dust mites, and animal dander; monitoring carbon monoxide levels; and using chemical products with care' (2016, p.9). Furthermore, interior pollutants can be higher than exterior concentrations, creating (in)tangible interior discomfort.

When operating within this interior zone, our skin, as a protective boundary becomes a permeable sense organ. Teyssot's describes skin as a tool for communication 'like the shell of an egg, or the cell's membrane'; it is our 'interface between pleasure and pain, the skin is at once both arm and armor' (2013, p.213). Expanding on this, other sensory fields, such as our olfactory, visual and gustatory and our internal organs are similarly involved.

Lefebvre's human based sensory fields highlight those above and include auditory, 'mechanical', including touch, pressure and penetration; 'thermal' heat, cooling and also ventilation; 'kinaesthetic' such as 'position, resistance, security,

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opposing forces, and auxiliary forces'; 'static' in the guise of weight, translation and rotation; and the 'affects' of these sensory inputs in, pleasure and pain. (2014, p.114-5). These (in)tangible physiological aspects, interweave with our psychological emotional and cognitive Body elements to generate input into comfort sensations.

These (in)tangible nuances of sensual comfort can be linked to pre and postnatal experiences. In psychology as they form the basis of future tolerances and understandings across many areas, including comfort. Although memories from early life are primarily implicit, some psychoanalytic streams access them for different purposes, and are discussed in chapter 4.3.

Applying these (in)tangible bodily elements to sensual comfort into a spatial context entails consideration of how personalised atmospheres are created. Art and literature critic Praz's concept of 'stimmung' (1983, p.53) involved a sense-based connection with an interior that goes beyond its utility as a room. For example, the history of each Inner space, the objects and their relationships to the bodies that inhabit them are all part of the experience of comfort.

Marketing management academic Fernandez suggests the marking of physical and psychological boundaries, similar to the marking of personal space around a body, are evident in the way 'portals of the home: the front door, the hearth, and the bed' (2008, p.774-5) are protected. When mapping these territories, landscapes, or desire-lines, pursuing the trails can facilitate knowledge.

Anthropologist Ingold believes wayfaring to be 'the most fundamental mode by which living beings, both human and non-human, inhabit the earth' (2007, p.81) and uses various metaphors to highlight this. Firstly, the 'knowledge systems, of habitation and occupation'; where the former entails a linear 'path of movement' as the individual 'knows as he goes'; and the 'latter builds up, from the array of

points… into an integrated assembly' (ibid, p.89-90). Secondly, he establishes that, our bodies survey and cognitively comprehend our spaces 'by joining up, into a complete picture, observations taken from a number of fixed points' (ibid, p.88). Finally, when 'retracing their steps in narrative' these contoured 'lines of movement' can be identified by sketching the history of the journey. The 'joins, splits and intersections of these lines indicate which paths to follow, and which can lead you astray' (ibid, p.84). These wayfaring maps can be used as a method to chart sensual comfort desire-lines in life events, and these theories are translated into practice in chapters 3 and 4.4.

2.6.3.TANGIBLE BODY: Recreating Comfort

The body can be considered during well-being or when symptomatic of disorder. Shifting patterns of (dis)comfort, movement and their desire-lines to relieve symptoms, can be used to consider how to relieve pain in the human body whilst at rest. Repetitive muscle conditioning will have an impact on the means by which an individual can elicit comfort. Whilst sedentary, a person may need to adjust their comfort by movement, to relieve pain.

Some perceptions of ergonomic comfort are culturally sensitive. In some societies a person finds physical comfort within their own or others' bodies, but in other cultures, physical comfort is achieved through devices, often that are moveable. Multi-functioning apparatuses are testament to the enduring quest to provide comfort and improve the intimate space surrounding our Body, for example the adjustable car seat is used in variants across the world.

How our physical, physiological and psychological spatial requirements are recognized, is significant. Changes develop through life and depend on multiple

factors some demographic, others more innate. Tangible physio-physical comfort articles such as hot-water-bottles, fans, scarfs, and duvets or comforters are classed as supportive membranes but other objects re-create a comforting atmosphere.

In considering the requirements of bodily functions, the circumstances of sleeping, going to the toilet, listening and eating are just some of the instances that can be juxtaposed with objects such as sheets and blankets, nappies, headphones, or food. These explicit physiological activities have wider efficiency implications as their inputs and outputs consume energy. For example, the essential physiological comfort needed to absorb human effluent at early or late life phases and during years of menstruation, has initiated the invention of various membranes whose disposal in landfill is problematic. In this instance, our intimate Body sanitary comfort constructs directly connect back to the Outer environment.

2.7. Summary of Contextual Review

In this chapter the constructs of comfort within the (in)tangible membranes between clothes and the building skin and beyond, were critically analysed for humans in many contexts.

The Outer socio-cultural contexts examined the (dis)comforts of work and community places. Building comfort examined the gendered constructs of this environment. Comforting ritual addressed the (in)tangible prescriptive acting out of external 'norms', which are subject to continuous scrutiny; and, aspirational comfort considered whose ideal of comfort takes precedence. This debate produced a kind of public comfort top trumps, in the de-territorialising of the Outer environment, affecting wider diversities including ethnicity, class, and gender.

Inner topographies of homely comfort viewed intangible constructs of who dominates interior space. (In)tangible contexts, where choices about comfort were being negotiated, with the question being who is the controller and controlled? The tangible crafting of comfort, through invisible and visible designs was also articulated. Scenes played out the subversive tactics used to control and maintain comfort within this Inner space.

Membrane precedents were given context through flexible and rigid tangible comfort structures. Comforting beliefs, showed how individuals construct their own comfort via intangible energy perceptions. These (in)tangible Membranes and structures fostered perspectives about how people invent ways to move between (dis)comfort.

The Interaction section considered how potential and effective elements of comfort have focussed on the object rather than the user. These aspects were considered through the intangible field of thermal comfort where intermediary currents progressed to latent (in)tangible comfort desires. Change was recognised as an important element in tangible responses to comfortable things.

Lastly, pedagogies of the Body and lived experiences were reviewed through intangible comforting moves. The (in)tangible aspects of psychological and physiological sensual comfort were contrasted with pathological conditions and the re-creation of comfort and tangible, daily experiences.

The next chapter, considers how interior comfort ideals can be traced and mapped, using research-by-practice methodologies and a design research framework to explore the constructs of comfort.

3. METHODOLOGY

3.1. Methodological Knowledge Structures

The methodological knowledge structures used throughout this research, focused on questioning how people construct comfort within their interior spaces. Whilst investigating the desire-lines of comfort and individualised energy use, this research has evolved from studying simulations and checklists, to designing new data collection methods that re-examine actual human behavioural approaches to personal comfort.

Creative practice and data collection methods were established using design research methodologies. These interwove practical and theoretical aspects, allowing for critical engagement with the research topic. Figure 28 summarises the configuration of this chapter.

FIGURE 28. FLOW DIAGRAM SHOWING CHAPTER STRUCTURE

3.1. Methodological Knowledge Structures
Researcher's Bias
PhD-by-Practice Research

3.2. War Scenario · Research-by-Practice Metaphor
Soldier, Correspondent and Historian Roles
Praxis x Critique + Reflexivity ≈ Research-by-Practice

3.3. Hybrid Research Methodologies
Design Research
Action Research and Grounded Theory

3.4. Measurement · Methods and Analysis
Primary and Secondary Data Collection Methods
Iterative Analysis of Individual and Group Patterns

3.5. Methodology Chapter Summary
Research Scope

My researchers bias is discussed next and the fundamentals of PhD-by-practice research. This leads onto a war scenario metaphor that outlines the praxis, critiquing and reflexive roles a researcher has to accomplish within their enquiries. The hybrid methodologies used to respond to the research question highlighted in Figure 3, and reiterated in Figure 29, are then reviewed and then applied to the methods and analysis used. Various research methods have been used to produce and analyse primary data that represents the interrelationships of comfort desire-lines, and individualised energy use. These facets of measurement are discussed in section 3.4.

FIGURE 29. METHODOLOGICAL RESEARCH TOPIC QUESTIONS
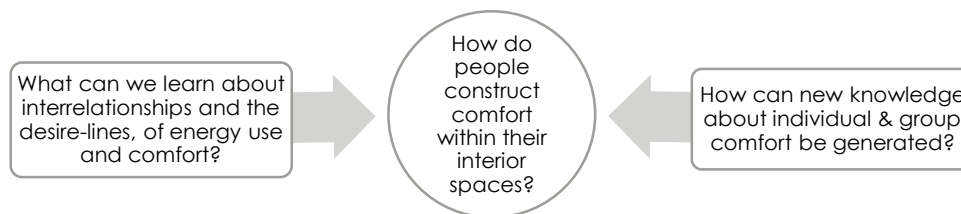
Furthermore, elements of applicability and repeatability influence these methodological questions. In his research into interdisciplinary methods, Repko recommends validating knowledge through 'triangulation of research methodology… (usually three) to investigate the same phenomenon' (2008, p.209). Bechhofer and Paterson describe how this compares to a land survey style of data gathering, where 'taking… three together will provide a more accurate observation' (2000, p.57). All these methodological nuances will now be discussed and the continuous appraisal, negotiation and refocusing of this interdisciplinary research topic are reflected on.

3.1.1. Researchers Bias

Anthropologists Okely and Callaway, suggest that researchers confront the 'problem of personal involvement in the research they carry out' (1992, p.15), by outlining their bias. Psychologist's Murray and Chamberlain's co-oberrate this by commenting that the open-ended interpretative process will 'never be complete and will always be partial and value-laden' due to the researcher being 'inevitably… influenced by their presuppositions and values'. They develop this point by stating that a researcher must reflectively 'offer a commentary on their position and socio-historical location in relation to the phenomena being researched' (1999, p.8) so that it can be put into context.

Accordingly, my categorical statistics include female gender, and dual British, Nigerian ethnicity. Other continuous indicators include my age range of 30-39 years and my design occupation that varies between educator, practitioner, researcher and learner roles. The experiences and observations needed for this inquiry were highlighted through my heuristic life journey, that is, knowledge perceived by the senses, with the person at the core - experimentally learning by doing. It was my professional practice within the interior, architectural and higher education industries that sparked my original research question and influenced its philosophical position. As sociologist Maynard, points out these experiences have outlined my understanding of 'what kinds of knowledge are possible' (1994, p.10) and they reflect the foundations of my knowledge.

This outline identifies my researcher bias so that the appropriateness and validity of my research and methods can be scrutinised. The next section considers the evaluation of PhD-by-practice research.

3.1.2.PhD-by-Practice

Definitions of practice oriented research are contested. For example, Frayling modifies Read's educational framework by stating that 'research *for... through'* and '*into* art and design' (1993, p.5). In the first instance the Researchers practice element overshadows the research aims per se; in the second this trend is reversed; and the third comprises the observing of practice research. Placing this PhD-by-practice research within this framework, it is both research *for* and *through* design.

Nevertheless, creative and aesthetic researchers Biggs and Büchler, found 'analogous terminology... indicating slightly different relationships between practice and research'. Stating that 'discipline and nation-specific preferences for the use of each term' meant that 'even these small changes in how one describes such links, one changes the nature of what is being discussed' (2008, p.2). Furthermore, in the UK's Arts and Humanities Research Council (AHRC) review of practice-led research; Till, Mottram and Rust, express that 'confident assertions of the nature of practice-led research' are frequently 'quite specialised, describing only a part of the spectrum of work that we have observed across' the fields of Art, Design and Architecture.

Their definition of research-by-practice is 'research in which the professional and/or creative practices of art, design or architecture play an instrumental part in an inquiry'. For assessment, they state that the specific activities of practice must be overtly outlined in the research 'method or methodology' so that 'an explicit understanding of how the practice contributes to the inquiry and research' is 'distinguished from other forms of practice' (2005, p.11).

In response to the AHRC report, this PhD-by-practice enquiry has fused research methods that encouraged open, supportive data gathering situations - conducive to studying the constructs of comfort. The epistemological frames

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underlying my methodologies were based on design, and action research. Data

collection methods included interviews, focus groups, models, questionnaire surveys

and immersive prop-based environments. Figure 30 outlines the specific techniques

used to gather unique data via research pilots and the three experimental interior

workshops events. These are discussed in section 3.4.

FIGURE 30. RESEARCH WORKSHOP METHOD AND SAMPLING TECHNIQUES

OBJECT | CIRCUMSTANCE PILOT - INTERVIEWS	• Precedent Review • Comfort Interviews • Checklist Survey Interviews
OBJECT | CIRCUMSTANCE 1 GYRO	• 2D/ 3D models • Prototyping • Immersive Experience
OBJECT | CIRCUMSTANCE 2 AMNIOTIC SAC	• Action Research - Co-researcher Interaction • Survey Responses • Creation of Physical Responses + Photographs
OBJECT | CIRCUMSTANCE 3 COSY	• Action Research - Co-researcher Interaction • Visual and Textural Survey + Exhibition • Experiential Immersive Environments

My ongoing Iterative analysis of these quasi-experimental research methods

fed into the creation of sampling arrangements that developed new insights into

comfort and energy efficiency. Schön supports this technique by articulating that

'each move is a local experiment which contributes to the global experiment of

reframing the problem'. Adding that while 'some moves are resisted... others

generate new phenomena' (1991, p.94).

The next section examines the competing and sometimes contradictory

nature of research-by-practice, which are juxtaposed within a war scenario

metaphor. This analogy provides a useful picture of the interrelated and layered

aspects of a research-by-practice paradigm.

3.2. War Scenario: Research-by-Practice Metaphor

A war scenario analogy is used because struggle and discomfort are conditions familiar to human experiences that people can relate to in differing intensities. Although war is destructive and could be regarded as the antithesis of creativity, Deleuze and Guattari's notions about asymmetric warfare (1986) counters this, as they posit that invention is always in response to an opponent.

As well as its function as a specter within the wider socio-cultural psyche, my choice of the war scenario is informed by past, current and impending wars. The industry of war pervades many aspects of daily life. Simulated war scenario franchises, such as 'Star Wars' or 'World of Warcraft', allow for mental navigation and wider public familiarisation. Huizinga gives the analogy of war to play where he states 'ever since words existed for fighting and playing, men have been wont to call war a game... we can call it the most intense, the most energetic form of play and at the same time the most palpable and primitive' (1998, p.110). The time-bound nature of war encourages rapid investment in the creation of new products and technologies impacts on human and wider energy resources. It generates many job roles for example a soldier, warlord, scientist, arms dealer, correspondent, banker, designer, politician, historian, etcetera. Other more emotive protagonists can be expressed as oppressor, victim, perpetrator, retaliator and so on. Figures 31 - 33 explain some of the praxis, critiquing and reflexive roles a researcher-by-practice has to negotiate throughout their research journey in the guise of soldier, correspondent and historian.

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3.2.1. Soldier, Correspondent and Historian Roles

Figure 31 relates the researcher's role to a soldier's functions. In this example, the larger-scale context of war and its detailed facets need to be completed by a series of hierarchal job responsibilities - from the marshal to the private.

FIGURE 31. PRACTICE & THEORY: SOLDIERS WAR SCENARIO DISCOURSES

Infighting happens, which is unproductive but it has to be included in contingencies

The new knowledge created has positive and negative effects that affect wider audiences, The mistakes made are real and have been actioned, but how are they learnt from?

The politics of the changing environment have to be reacted to in all levels in the hierarchy e.g. mission creep; and justification to oneself and the wider public

PRACTICE & THEORY
The **marshal** has to communicate with the powers-that-be whilst the **private** has to complete the grassroot tasks, the **captain** transfers information up and down this pyramid

Going though the experiential iterations of skirmishes improves reflexes in practice, thinking, and communication – a kinaesthetic learning style

Fighting 'fronts' need to be predetermined within reasonable limits so that the fighting force is not spread too thin

A flexibility in approach is required as rigidly sticking to a plan will backfire, as will just reacting to events

Knowledge of former fighting techniques and current technologies are mandatory as new strategies are needed because reusing former tactics will not suffice

Figure 32 discusses the descriptive and analytical roles a researcher has to fulfill. These critiquing positions can be seen in war correspondent and editor roles. The reporter feeds information back to their editor, in turn, the publishing supervisor presents this information to a specific audience, and disseminates it in a palatable format.

FIGURE 32. ANALYSIS & CRITIQUE: CORRESPONDENTS WAR SCENARIO DISCOURSES

Criticality is important in the various theatres of war as it is crucial in exposing indoctrination but conversely, it can also be used to validate certain epistemologies

It is difficult to gauge when you have undertaken enough fieldwork, data gathering, analysis and critique

Keeping a balanced dialogue is imperative as you may not be armed with all of the facts but you still have to interpret the data to hand

ANALYSIS & CRITIQUE
The war **correspondent** feeds information back to their editor; and in turn, the **editor** disseminates this information to a specific public in digestible format

You do not know if you can have any influence over the outcome and the measure of this is unquantifiable

You have to pace yourself - although strategic plans have been drawn out - you do not know when the situation will end

Your persuasion techniques are reliant on understanding you and your audience's fluctuating focal positions, for example oversaturation, impact and serendipitous timing

Figure 33 illustrates reflexive elements the researcher has to employ. In assuming the role of the historian or curator, the researcher gives a reflective synopsis and interpretation of the information.

However, there is a divergence from these established protagonists because you are part of history making. Therefore, the researcher is able to directly affect this experiential paradigm, by learning from mistakes through reflection and reacting in alternative, critical ways.

FIGURE 33. REFLECTION & REACTION: HISTORIANS WAR SCENARIO DISCOURSES

Bias and perspective can be ascertained more clearly with time, as data is sifted and small elements used to inform interpretations;

What mistakes were made, have they been learnt from, and will these transform future war scenarios?

REFLECTION & REACTION
The role of the **historian** or **curator**, gives a synopsis and interpretation of the information - you are also part of the history, affecting the knowledge produced

Different stakeholders can be identified more clearly and dispassionately

The script can be written with a specific audience in mind which affects the presentation content and mode

The "theatre of war" directly develops the idea of playing to an audience

3.2.2.Praxis x Critique + Reflexivity ≈ Research-by-Practice

Although this 'war scenario' analogy can be used as a methodological metaphor for research in general, its parallel to research-by-practice is the fact that the researcher is part of the action. As such, predispositions are interwoven into the data implicitly and explicitly thus directly influencing the outcome. The need for the researcher to seamlessly transform backwards and forwards across all the different job roles, sections and subsections in a non-linear mode allows an understanding of the mental fluidity necessary to navigate through the research journey. Delegation is a prerequisite where it is feasibly possible, but many of the roles require the attention of the primary researcher.

As a researcher-by-practice, the use of the war metaphor has allowed me to articulate the switches between the different investigative approaches. The complex situations generated by this research are juxtaposed with Schön's insights into reflexive exchanges of the practitioner.

In "practice and theory" the practitioner selectively manages 'large amounts of information… spin out long lines of invention and inference, and… hold several ways of looking at things at once without disrupting the flow of inquiry' (1991, p.130).

When undertaking "analysis and critique" the practitioner navigates through the iterative research process where actions, exchanges and their consequences 'talk back'. This process morphs into new understandings where comprehension of 'unanticipated problems and potentials' created by interactions is appraised. This evaluation looks at: 'the desirability of their consequences... conformity to or violation of implications set up by earlier moves… appreciation of the new problems of potentials they have created' (ibid, p.101).

Whereas on "reflection and reaction" iterations of the research process are negotiated and the changing circumstances that are the result of interchanges add further depth and complexity. A designer responds to the fluidly of the research activities by cultivating the trajectories of choices surrounding past conditions and future moves. The practitioner learns to instinctively progress 'from embracing freedom of choice to acceptance of implications, from involvement in the local units to a distanced consideration of the resulting whole' (ibid, p.102).

This research-by-practice model interposes a different emphasis on the knowledge produced as it generates insight into my researcher experiences. The next section describes the methodologies utilised in this research, which include design, action and grounded theory.

3.3. Hybrid Research Methodologies

The audience for this research covers both academic and lay communities, therefore design and action research methodologies were chosen to invite the general public as co-researchers into the studies.

When considering co-researcher involvement, my initial interest was in representing the UK's wider population. However, this sampling theory became problematic and Bechhofer and Paterson query whether 'random or quota sampling has become an end in its own right' by not actually 'dealing with real epistemological issues' (2000, p.39). They cite that UK sampling evidence in the social sciences has shown that 'people who agree to be interviewed are more likely to be female, middle-class, have a lot of education, to be young, to be living in rural areas, and not to be living in the south of England' (ibid, p.38). In my demographic

findings a female gender and 20-59 age range skew was evident, these results are discussed the Analysis chapter 5.

Therefore, the co-researcher sample used in this research consisted of contributors who Moustakas points out, had the heuristic 'ability to articulate the experience, cooperation, interest, willingness to make the commitment, enthusiasm' (1990, p.38-9) in the iterative data gathering pilots and workshops. When inviting co-researchers to give their time and energy to the workshops at different venues, ethical considerations and chances to feedback, and forward, were clearly stated. Psychologist Walker expounds fundamental ethical principles used in gathering data, which include 'getting informed consent from people who take part in research', 'avoiding distress and stigma', 'confidentiality' and 'anonymity' (2010, p.56, 61). The use of design and action research methodologies fostered these principles, becoming part of the open contract with co-researchers and informed all the research event procedures and practices.

3.3.1. Design Research

Design precedents and ambitions can be investigated to decipher the research question about interrelationships between the desire-lines of comfort and energy use. Chapter 2 references how the industrial, engineering and architectural design fields have historically focused on answering societal problems by focusing on the object rather than the user. The result was the design, production and consumption of innovative products that superseded obsolete merchandise.

Recently, the focus has changed from final products to looking at processes by devising toolkits and lifecycle analyses that generate best-practice guidelines. For example, the use of industrial waste as a resource was problematised in the ZeroWIN

project dissemination event (2014). At this conference, researchers described how the waste industry was reluctant to proceed with innovative proposals to lower economic and environmental costs implicit in current waste disposal practices. These topics were discussed in academia for over 30 years, yet the trickle down of research to the business realm was slow. Norman's point that 'innovative' knowledge is difficult to absorb if 'one ignores the internal meanings that people assign to cultural innovations' (2011, p.196) has to be considered. In this case the desire-lines of the waste industries were not accounted for.

Exploring the constructs of comfort through the medium of design research meant interactions needed to be made explicit, such as the movement of humans within their interior spaces. Human geographer McCormick, gives insights into embodiment and movement, by deducing that spaces situate and moving bodies act (McCormick, 2008). Accordingly, as part of this research process interior sites were selected so that people could re-enact their comfort desires. To embody (in)tangible comfort membranes, physical experiments were conducted to chart these comfort trajectories. However, unlike furniture objects that can be investigated via life-sized prototypes, interiors contain an assortment of circumstantial elements to be studied by immersion within their situational condition. Therefore, my data collection methods had to consider and incorporate research methods that enabled co-researchers to replay relational comfort interactions with objects and circumstances.

The process of design research is elucidated by Schön. His example involves a designer who goes through various steps to develop unanticipated project trajectories due to the intricacies of the many decisions that are made in the process. He says 'a designer makes things… the final product' or 'more often… a

representation… of an artefact to be constructed by others'; the complexities of these procedures involve 'more variables… than can be represented in a finite model' thus producing 'consequences other than those intended'. Through reflection and reflexivity, the designer adapts and responds to this evolving process with the 'unintended changes' (1991, p.78-9) creating innovative alternatives to the design that could not be predetermined.

Inns, an academic and designer, describes this interdisciplinary design thinking approach as 'setting up a vision together with a possible realisation of this vision', rather than just searching for and 'generating solutions to a given problem'. Furthermore, he links the knowledge gathering process of design with complexity - developing a knowledge base that is a 'critical state between order and disorder' (2010, p.88-90). This complex creativeness can be untidy but, there is a tendency for creativity to be considered as a purely positive experience. Psychologist and social scientist Claxton, suggests that as well as its constructive elements, creativity can also have a 'potentially wasteful, destructive or 'unbridled' quality' (2006, p.57-61).

My heuristic experience of this creative and complex research journey is discussed in section 3.2 as a war scenario analogy - it expresses my interpretation of this design research-by-practice process. Thompson and Thompson promote critically reflective practice where being 'open' predominates. They advocate explicit, developmental 'knowledge… open to challenge and scrutiny'; to encourage creativity they suggest a flexibility to existing and new ideas through 'open-mindedness'; lastly, 'openness to learning' (2008, p.25) allows for strengths and weaknesses to be constructively absorbed in the research journey.

In this design research, a range of methods discussed in section 3.4, were created and used to understand co-researcher behaviours and responses towards

physical, physiological and psychological constructs of comfort. These tools involved an experimental combination of design and action research.

3.3.2.Action Research and Grounded Theory

Social researcher Jupp defines action research as 'collaboration between researchers and co-researchers' that is 'educational and empowering' (2006, p.2) with practical action used as a learning tool. Psychologists Murray and Chamberlain explain that data gathered in this way portrays 'people's lived experience of an activity or circumstance' (1999, p.207). They expand this by highlighting the potential for action research to expose 'questions outside current frameworks of thinking' (ibid, p. 202-3). Implementation of action research in this study involved the design of immersive workshops to elicit responses. Firstly, co-researchers could experience a gyroscope ride to elicit information about the GYRO invention. Secondly, co-researchers created their own 2D and 3D interpretations of comfort within the context of the AMNIOTIC SAC. Thirdly, co-researchers experienced immersive environments in the COSY workshop, responding in pictorial and textual formats.

These action research tools generated new data collection methods. The design of the immersive workshops expanded into a type of contrived ethnographic play, evident in the AMNIOTIC SAC and COSY workshops, creating novel experiential research into interiors. The subject topic hook-line was "everyone is an expert in their own comfort" and the investigations endeavoured to explicitly represent individual desire-lines of comfort. These diverse methodological cross-fertilisations enabled me to test a range of techniques, stimulating and improving both my research and professional practice.

However, this experimental approach became complicated and the term "messy research" describes these complexities. Educational psychologist Mellor reasons that 'messy method' is 'a universal method' as 'if we are honest, we all work this way' (2001, p.476). He explains that the unfavorable connotations of the term should be transmuted so that the approach is seen as 'difficult, requiring a high level of skill' because it enables extensive investigations into 'the problems that confront us' (ibid, p.480). My messy research approach came with positives, such as unanticipated outcomes, but also with negatives, including bottlenecks in workload, scheduling and timetabling. These issues were alleviated by discussion with fellow researchers within my institution. Further afield, my contribution at the PhD-by-Practice, Goldsmith's Conference in London (2014) that problematised this type of messy research within the wider design research community, enabled me to situate myself in the ambiguities it generates.

As part of a cyclical learning framework, each action research event iteratively fed into grounded-theory processes. Jupp classifies grounded theory as an 'inductive process in which theory is built and modified from data collected' (2006, p.131). Burgess and Bryman outline three stages to this method where initially data is subdivided with 'labels, names or codes'; where these amass, 'abstract definitions to specify the properties associated with these core codes' are developed. Finally, 'associational' and 'casual… links' between these themes are used to cultivate ''grounded' theoretical patterns to account for aspects of the data under scrutiny' (1994, p.196-7). In this research, after logging theoretical themes, my various practical research methods restarted. The results generated anticipated but also unexpected outcomes and microanalysis of these sparked new ideas, themes and journey routes. This grounded theory method also links back to design research as it

resembles a service design paradigm. Norman explains this style of ongoing analysis is 'about procedures - which means they have to be analysed in action' (2011, p.178). Therefore, all these elements fuse to create a hybrid of design, action and grounded-theory research methodologies.

3.4. Measurement: Methods and Analysis

The methods and analysis employed in this research were iterative, and although linear forecasts of the proposed research trajectory were timetabled from the outset, some opportunities and obstacles were unpredictable and could not have been forecast. Retrospectively, even complex linear programming, such as Gantt charts, could not adequately forecast instinctual elements of the research activities. In essence, the research journey timetabling created basic structure, but diversions and failures became necessary learning realities. In praxis my research process embraced instincts about certain research paths; this was allied with determining specific timescales so that ineffective hunches did not adversely affect research outcomes. These discernments contribute to a flexible research approach that balances intuitive and scheduled elements facilitating optimal decision-making.

The methods of data collection and iterative analysis in this research journey were approached with the appreciation that appropriate measurements - in this case comfort desire-lines - could be elusive. This was not unexpected since social and educational researchers Bechhofer and Paterson, comment how 'only once the study has been undertaken do you know what the interesting variables are' (2000, p.25). Supporting this reality, sociologists Burgess and Bryman, highlight misconceptions that 'the analyst works in a mechanical way, making obvious conceptualizations and connections'. They emphasise that 'each step requires

leaps of intuition and imagination' (1994, p.186). This is because the 'story' of the research journey is not told 'spontaneously', but that 'in the interrogation, what to ask becomes completely clear only after the story is revealed' (ibid, p.209). These aspects of measurement have influenced the specific methods and tools of analysis employed in this research.

Both qualitative and quantitative measurements were used in this research data collection and analysis. Numerical data creates a seemingly simple way to collect, and assess progress. Norman pithily describes the acceptance within management and scientific realms as 'if you can't measure it, you can't improve it'; because in these circles 'measurement has been a powerful tool for improving efficiency' (2011, p.171). Bioclimatic charts, simulations, graphs and scatter plots that map and measure 'comfort zones' have been used in technical interpretations of sensory comfort. The logic behind these more quantitative approaches includes the seeming reproducibility of results. Underlying these comfort constructs are Shove's (2003) Socio-technical critiques of optimal thermal zone ranges. As discussed in chapter 2, the connection of warmth and coolth comfort parameters are allied with interior thermal comfort industries.

From a built environment perspective, architect Moe posits that simulation techniques can 'neglect so many energetic system factors, parameters, and qualities that they cannot alone be understood to constitute the sole understanding of energy in relation to design' (2013, p.52-3). More recent case study research into the comfort of users and their interactions with energy efficient buildings, is evidenced by researchers Grandclément, Karvonen and Guy. They conclude that 'energy performance is achieved rather than prescribed in buildings' via 'intermediation processes' that align the sometimes competing comfort 'desires of

occupants and the designed strategies for energy performance' (2015, p.220). This case outlines how realistic measurements of comfort incorporate human efficiency desire-lines.

Comfort is a sensory measure, with each individual's response being unique - the challenge is in interpretation of data. Humanistic psychologist Moustakas describes measurement in this situation as about coalescing 'attitudes, beliefs, and feelings of the person' rather than 'definition and classification' (1990, p.93). Therefore, the use of both qualitative and quantitative techniques develop research around comfort. Quantitatively, standardised demographic questions permit datasets to be cross-referenced with secure computer compilation of the results and analysis. The different qualitative methodologies used in this research include semi-structured questionnaires relating to the various circumstances that allow users to experience immersive environments.

From design research perspectives, these questionnaires connect back to visual discourses about method and measurement. For example, social anthropologist Leach comments on the relationship of natural and man-made lines where 'wild Nature is a jumble of random curves; it contains no straight lines and few regular geometrical shapes of any kind. But the tamed, man-made world of Culture is full of straight lines, rectangles, triangles, circles and so on' (1976, p.51). The interfaces used in design research are set within specific frames that require acknowledgement - the book or journal, the picture mount or magazine, and the laptop or smart device. These frames mathematize space, artist and scholar Reynolds, lectured that "the logic of the grid is ubiquitous so we don't see how we're using it". She describes how this enforced perspective pervades many forms of

communication but counters the human bodies "overlapping poly rhythms" (Metabody Forum, London, 2016; PhD dissertation 2012).

Consequently, the 2D and 3D design research methods realigned these orthogonal and jumbled visual mark-making paradigms. The visual icons presented in the research questionnaires enabled measurement of a kind - as co-researchers qualitatively drew or wrote their feedback over graphical baselines. These responses established alternative ways to map human desire–lines in relation to comfort and their significance is analysed in chapter 6.

3.4.1. Primary and Secondary Data Collection Methods

The classification of my data gathering and collection methods are now discussed. My primary research started with a model-making process, and a secondary data collection of research precedents. Trial pilot interviews were then superseded by my main data collection exercises, which established a series of experimental, immersive data gathering workshops. They were devised to investigate the evolving research question through design surveys that represented the perceptions of active co-researchers. The application and process of these methods are discussed in Chapter 4.

A theoretical visual and textural library of precedents constituted my secondary research. These were grouped in relation to the research questions and methods. This themed library material has a nomenclature unique to this research and it contributed to chapter 2.

Early practical 2D and 3D physical explorations of GYRO, were used as a means to develop the research topic as a problem-solving exercise. Sketches,

models and maquettes were designed to explore my early research questions and these are illustrated in chapter 4.2.

To cultivate my researcher skills, interviews about comfort were carried out in various locations, within informal settings. These initial comfort interviews were open-ended as my research questions were still being formed. At this early stage in my research, this style of pilot interview seemed appropriate. The early interview efforts iteratively informed the subsequent design of my paper based surveys and questionnaires with visual, textual and verbal ways of logging responses. The checklist survey interview was an oral questionnaire of 62 questions. It was carried out within informal settings and it took 5 - 50 minutes with varying degrees of completion. Chapter 4.1 looks at how these pilot data collection methods iteratively informed the design and implementation of the main data gathering exercises. The open versus pre-coded question format evolved in my research journey. The clarity of question and simplicity of wording needed care. In addition, Bechhofer and Paterson identify that social studies research finds 'long questions produce better responses'; the main factor underlying this being the time to reflect which allows 'people's recall' to consider different views before the question is answered. Lengthier queries also encourage the perception 'that the questions are serious' and reassure people to give 'more truthful answers' (2000, p.79). They caution that when recording answers interviewers can 'hear one thing but mark the wrong response on the schedule' (ibid, p.70). Thus my survey questionnaires were designed to allow co-researchers to directly log their own responses offering a simple but extensive question format.

Aspects of research design were pre-evaluated in small focus groups held before each workshop that were used as feed-forward to the larger scale events.

They were lightly structured discussions about future workshop topics, similar to a brainstorming or consultation exercise. Research method themes included survey question clarity, the timetabling of activities to stimulate co-researcher interest, but crucially, how these elements furthered and amplified the underlying research topic investigations. Focus Group attendees included professionals and students from research, exhibition design, architecture, interiors, product, fundraising in the arts, and business. As a research tool the focus groups and series of workshops served 'the dual purpose of keeping... 'hosts' informed; and getting feedback from them' (2000, p.33) which is an approach Gillham recommends.

Immersive workshops materialised as the most appropriate data gathering method in this research. In the interior and architectural disciplines, smaller physical and simulated scale models are usually employed to represent larger spatial configurations, but spatial research can be difficult for non-professionals to articulate. In practice 1:1 scaled, life-sized spatial experiences were designed for non-professionals to fully understand the context of the research questions. This aided multi-faceted responses that embodied real-world experiences and reactions.

In this area of interactive experience, conceptions of play can come to the fore. To augment these immersive environments, the data gathering research workshops were actually designed with a game-like methodology to assist interactions. Converse to the notion of charting the everyday experience of comfort, play can be described as being about the non-conventional. Huizinga insists that 'one of the most important characteristics of play was its spatial separation from ordinary life'. It has a start and finish point within which 'a closed space is marked out for it, whither materially or ideally, hedged off from everyday surroundings' (1998, p.38). Paradoxically, the voluntary nature of play has to be considered when

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developing this type of workshop format. The play scene has to be set, but the play activity space has to be left open for the co-researchers to disclose, in various ways, 'meaning to the action' (ibid, p.19). This is where the crux of play lies - it is 'a helping-out of the action' (ibid, p.34). The key lies in trying not to overly control the play process, as data responses from co-researchers would become forced or unnatural.

This corresponds to sociologist and media theorist Gauntlett's research where 'people were asked to make something as part of the process'. He describes how through the 'physical process of making something… an individual is given the opportunity to reflect, and to make their thoughts, feelings or experiences manifest and tangible' (2011, p.4). This immersive interactivity is defined by communication studies academic Griffiths as, 'the sensation of entering a space… that eschews conventional modes of spectatorship in favor of a more bodily participation in the experience'. Interactivity on the other hand, 'extends an invitation to the spectator to insert their bodies or minds into the activity and affect an outcome via the interactive experience' (2008, p.17). This style of immersive interactivity was included in the research streams.

Other immersive precedents include the Metatopia membrane. My experience of immersion at the International Metabody Forum, 2016, is discussed in chapter 2.4. Its creator De Val described how this experiential, performative space uses 'multisensorial laboratories of perception and movement integrated in a mobile experimental interactive/ intra-active architectural structure' (2013). He lectured that "space emerges from the person, in an ecology of movement". This feeds into feminist physicist Barad's theory of intra-action where 'independent objects with inherent boundaries and properties' are intertwined as '*phenomena'*. Intra-action 'represents a profound conceptual shift' as 'the boundaries and properties of the

"components" of phenomena become determinate and that particular embodied concepts become meaningful' (2003, p.815). This intra-action correlates to the concept of comfort desire-lines. The immersive workshops enable these relationships or 'components of phenomena' to be discovered.

In her practice, scenographer McKinney explains how previous scenic presentations focused on 'the visual transmission of information or symbolic ideas'. This concept has evolved to 'multi-sensorial' scenographic modes, that 'engages audiences bodily as well as visually and intellectually' (2012, p.1). She describes 'the distinctiveness of the environment and the particular nature of the objects within in it' enabled her immersive scenography to stimulate 'participants to make a meaningful contribution and influence the event... through the use of a narrative structure' (ibid, p.7-8). These sense-based qualities and immersive methods invited co-researchers to participate in her research.

The research method of immersing people in simulated circumstances can facilitate the mapping of individual comfort desire-lines. Explicit trails map behaviour in relation to actual situations, as complex perceptions of comfort and movement are experienced and charted. The workshops embodied knowledge through a selection of objects and circumstances. Thus co-researchers' perceptions, consciousness and elements of understanding became materialised by practice.

One final aspect of immersion methods is my decision to actively involve myself in the research process. This aspect has complemented my PhD-by-practice research, but also links back to Okely and Callaway's description of how 'anthropologists, immersed for extended periods… learn not only through the verbal, the transcript, but through all the senses, through movement, through their bodies and while being in a total practice' (1992, p.29). My own heuristic constructs of

comfort emerged and evolved through these diverse data collection methods. The appreciation of what to prioritise in analysis of the data became apparent and will now be discussed.

3.4.2.Iterative Analysis of Group and Individual Patterns

In critical analysis of this research, recurrent themes were identified as they emerged. Between each workshop the data was analysed cyclically so that the new knowledge generated in the iterative research process could be assessed and taken into the next phase of investigation. For example, initial trials of smaller pilots before the larger research workshops allowed for experimentation with different types of method. This rationale resulted in innovative outcomes and the development of productive qualitative comfort representation techniques. The workshop methods utilised at least three different types of data gathering techniques for triangulation and allowed for multiple perspectives of knowledge validation and confirmation. This process is narrated in chapter 4, where each procedure informed subsequent events; and evaluated in chapter 5.

From a Design research perspective, as a method of investigation, the GYRO research stream discussed in chapter 4.2 was an innovative example of a conceptualised product. It interpreted the subject topic from a design practitioner's problem-solving position developing into an instrument that facilitated the research process, rather than its outcome. As a result, it sparked a problematising research approach, which asked questions about comfort within the original interior bubble space of the AMNIOTIC SAC examined in chapter 4.3; and additionally, the rest of the COSY scenarios, which are reviewed in chapter 4.4.

My criteria for data collection and analysis involved using quantitative information to gauge group associations of comfort; whilst also qualitatively evaluating individual effects. Moustakas describes how qualitative aspects of inquiry such as 'descriptions, illustrations, metaphors, poetry, discourse, and other creative renderings' (1990, p.38-9) allow for experiential feedback. His heuristic themes were used to categorise and chart co-researcher's responses. These included: 'qualities or dimensions of the experience'; 'events, situations, and people... connected with the experience'; 'feelings and thoughts... generated by the experience'; 'bodily states' occurring 'in the experience'; and 'time and space factors' affecting the 'meaning of the experience' (ibid, p.48). Where pertinent, Lefebvre's human based sensory fields, discussed in Chapter 2.6 are also incorporated into the analysis. These instances comprise of 'visual... auditory... olfactory... gustatory... mechanical... thermal... kinaesthetic... static' sensations and their 'affects' (2014, p.114-5). Analysis into comfort encompasses sensitivities involving portrayals of 'weight, translation, rotation' and 'position, resistance and security' (ibid, p.114-5) and these aspects are appraised in chapter 5.

Taking into account the pluralistic nature of the research findings a multi-layered framework is used as a way to scrutinize the data gathered so that the analysis can be absorbed at different speeds and concentrations. The issue of power relations between interpretation, visibility and representativeness influence the research outcomes. When undertaking qualitative analysis, the acceptance of ambiguity is a requirement. Burgess and Bryman posit that the characteristic predicament of 'many qualitative analysts faced with a new task' involves 'anxiety, bewilderment and uncertainty' (1994, p.209). When these evaluation and threshold points occurred in my research, they were dealt with by discussing the specifics with

peers, or reflecting on, and providing time for alternative approaches to become apparent.

3.5. Methodology Chapter summary

This chapter highlights the epistemological structures applied in this research-by-practice to traverse the 'messy' nature of research by concurrently utilising and flipping between practical, theoretical, analysis, critiquing, reflexive and reactive modes. It navigates through the hybrid methodologies adopted to address the research questions by overtly outlining the specific activities of practice advised in Till, Mottram and Rust's Arts and Humanities Research Council review (2005, p.11). The methods and analysis techniques constructively enabled working within bounds whilst also being responsive to research opportunities.

My methodological framework iteratively (re)scrutinized or (re)interpreted the research question. This recurrent-searching or (re)searching interacted with all aspects of my topic and methods and ever decreasing or increasing circles metaphorically explains this iterative agenda. The ever-decreasing circle represents the traditional notion of refining and narrowing your topic within a set academic discipline, which allows for the creation of new ideas in one respect. However, a different predicament comes when one is researching within an interdisciplinary context as ever-increasing circles and dynamic spin-offs is envisioned. The creative outputs of the research methodologies used in this research came with positive and negative attributes. The latter includes the amassing of large quantities of data and the consequent concerns surrounding its appropriate interpretation.

As a result, although they held promise, parts of the information gathered in this research journey were by-passed, due to time and focal constraints. Bechhofer

and Paterson endorse this by stating 'judgments have to be made when creating a research design about the trade-offs between different desirable outcomes' (2000, p.64). The material needs to be extrapolated in a way that communicates to a wider circle of influence. The aim is not to only create 'new insights' but to also apply the social science "so what" question to the process. Therefore, one of the tasks of this research was to create, manipulate, interpret and disseminate the more unwieldy aspects of this ever-increasing knowledge cycle into a digestible format. For example, the COSY Designbook discussed in chapter 4.4.3, condensed lifecycle scenarios of comfort constructs into an A6 booklet. This design article served as a means to question co-researchers about their interactions with objects; it also enabled them to explicitly consider and express their implicit desire-lines in relation to comfort in a variety of circumstances.

The next chapter narrates the research procedures undertaken in this investigation. The war scenario metaphor describes the job roles that included critically planning as different perspectives were assessed; persuasive presentation techniques so that various audiences could be reached; and balancing interpretations. Additionally, the repositioning of definable outcomes allows for advancement of the research such as pacing myself, working within given timescales and allowing scope for future transformations.

4. RESEARCH PROCEDURES

4.1. DESCRIPTION OF RESEARCH PROCEDURES

Figure 34 shows a flow diagram outlining my research procedures. To use a metaphor, each separate strand contributed to weaving the cord. Some wore out, others had knots, yet the resulting suppleness culminated in praxis. These changing research conditions will now be discussed.

FIGURE 34. FLOW DIAGRAM SHOWING ITERATIVE RESEARCH PROCEDURES

4.1. Primary and Secondary Data Collection Pilots
Comfort and Checklist Survey Interviews;
Precedent Library

4.2. GYRO Investgations
An explicit membrane

4.3. AMNIOTIC SAC Investigations
The Original Concept Of Inhabiting

4.4. COSY Investigations
Lifecycles of Comfort & Movement

4.5. Research Procedures Chapter Summary
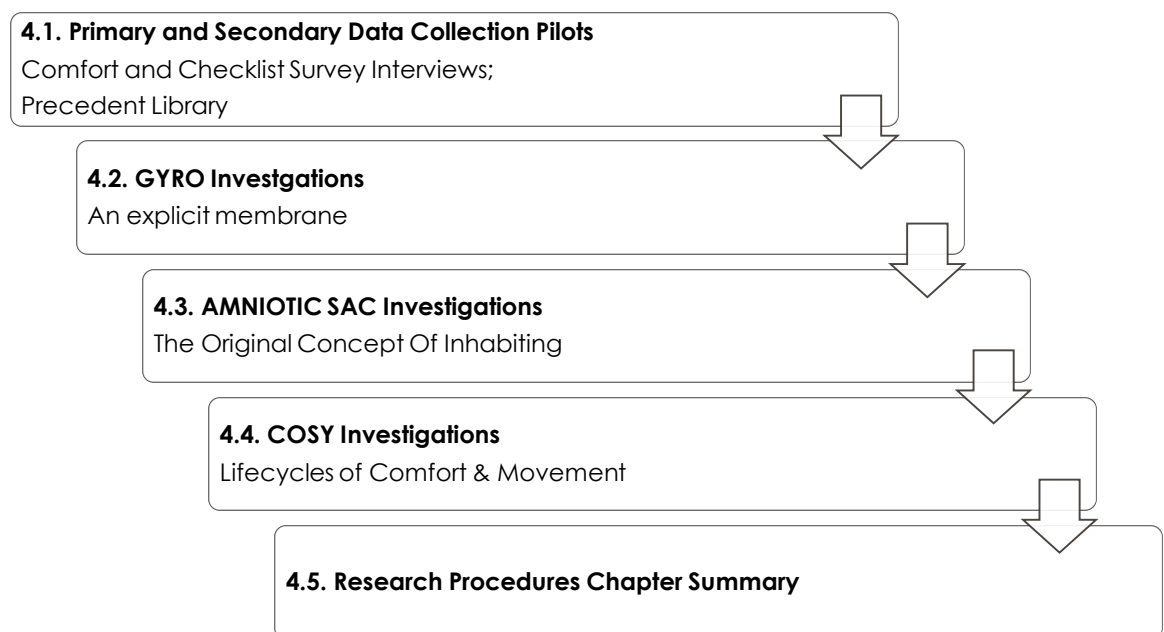
4.1.1. Initial Ideas – Secondary and Primary Data Precedents

Early research strands included problematising the interdisciplinary subject topic. Initially, UK planning regulations for analysing new products or services within an interior context were investigated. For example, assessing micro combined-heat-and-power units such as the Baxi Ecogen boiler; or devising an interior U-value calculator for internal building elements that bolt onto the procedural aspects of building control guidelines (Scottish Technical Handbooks, 2015). Then other practice

and data gathering ideas related to comfort, such as mobile phone applications or

a development of the game Cluedo (Pratt and Pratt, 1944), or similar. These

examples have accessible pictorial frameworks to reveal users comfort preferences

but did not allow for the collation of primary data regarding their understandings

and perceptions. In particular, the boiler object or U-value circumstance

concentrated on technical exercises, side-lining the human element, only

tangentially questioning people's comfort behaviours. The mobile phone application

and board-game ideas were superseded by the immersive workshop events, but in

the future they could be used for further research development.

Whilst collecting primary data, a secondary research library was compiled

which mixed historical, current and future articles and textual documents using

Evernote software. Figure 35 maps these constructs of comfort.

FIGURE 35. DIAGRAM SHOWING PRECEDENT LIBRARY CATEGORIES
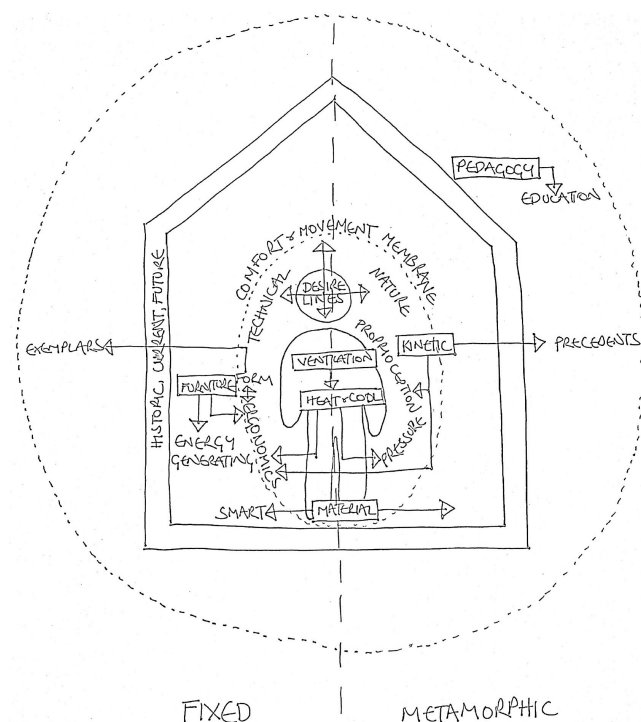
The categories were collated into: acoustic, behaviour, biography, cultural, energy generating, ergonomic, form, furniture, health & wellbeing, historical, kinetic, lighting, literature, living space, material, measuring device, nature, pedagogical, research, software, space, technical, thermal comfort, ventilation, visual and work precedents.

These collections represented differing aspects of physical, physiological and psychological comfort membranes. As the library developed it furthered my experimental research streams. For example, as illustrated in Figure 36 it influenced the 'life story' of circumstances based on recognisable sites of comfort.

FIGURE 36. DIAGRAM SHOWING PRECEDENT LIBRARY THEMES
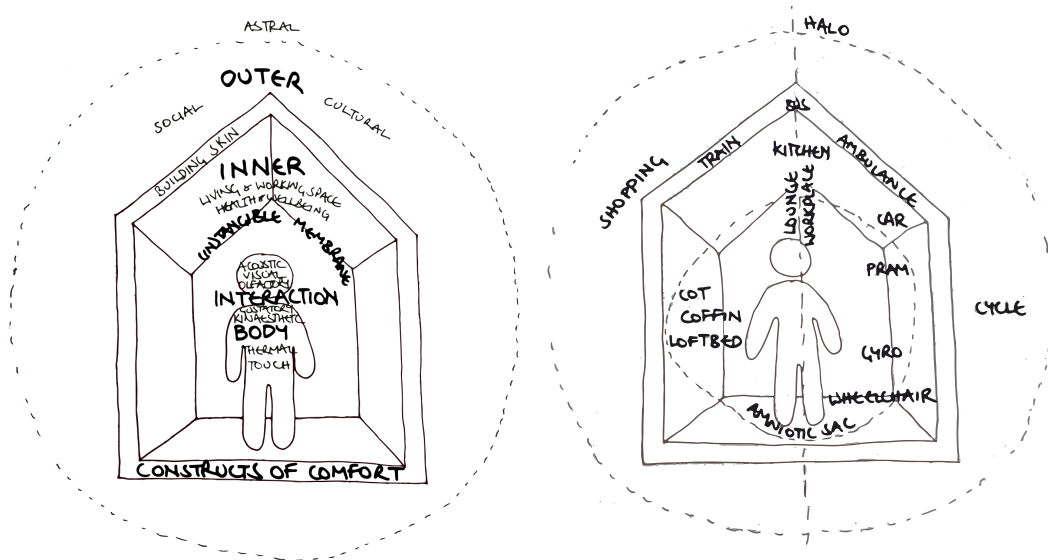
4.1.2. Trials of Data Collection Methods

In addition to compiling a range of object precedents and case studies, small-scale pilot studies began. These tested experimental ideas and research methods before the main data collection. Pilots took the form of comfort interviews and a checklist survey on the sustainability of comfort membrane precedents.

4.1.2.A.   Comfort Interviews Pilot

A series of short interviews asked an open question: "what is your idea of comfort?" The settings for these interviews were public spaces for eating and drinking and took 5-15 minutes. This created an informality so that data could be gathered around the subjective issue of individual comfort. It was a type of heuristic

consideration where the co-researcher's view of the topic was explored and responses are shown in Appendix 1.

The data collected was categorised into physical, physiological and psychological themes and analysis revealed that many of the concepts of comfort discussed were intangible. From a design research method viewpoint, articulation of abstract comfort desires in this verbal-to-textual form was unsuitable for this type of study. Interviewees could not express their heuristic comfort ideals easily in words because scenarios of comfort are diverse and changeable.

On reflection, the rigor and potential for generalising or creating new knowledge by this method was limited. Although these informal interviews were low-risk, they were anecdotal and unfocused. Hence more specific methods were required. This led to asking more focused questions about the topic, selecting specific sites and gathering data in an alternative, non-written formats. Therefore, the research insights gained in this pilot was productive because they assisted in the design of my future workshops.

4.1.2.B. Checklist Survey Interviews Pilot

The next pilot study aimed to collect information about the uses of specific (in)tangible comfort membranes. A checklist survey was devised from the library precedents and an assortment of membranes and structural precedents where chosen to represent explicit comfort objects and circumstances. Categories for the checklist were selected by extrapolating questions from specifications within the building, furniture and product design industries. It was partially based on the British Research Establishment Limited, Eco-Homes assessment criteria - a format previously employed in my professional practice within the built environment. The questions

shown in Appendix 2, were formulated to gain insight into 'energy, transport, pollution, materials, water, land-use & ecology, health & wellbeing, management' (BREEAM, 2006), product design principles, sensory modes and desire.

The survey cross-referenced the comfort precedents with the checklist categories. Interviewees were then selected for their heuristic interactions with these comfort precedents, providing real-world qualitative end-user information. Their comfort associations are highlighted in Figure 37.

A consultant obstetrician gave insights into the amniotic sac and placenta category. Direct feedback was that my survey format was long, time-consuming and many of the 60 survey questions were irrelevant in this natal context. This negative response matches with guidance on research design principles. Bechhofer and Paterson for example, state that 'interviewing is by no means unproblematic'; they add 'although most people seem to enjoy well-conducted interviews on topics which interest them, response rates in surveys are falling' (2000, p.59). They suggest that this can be partially explained by perceived bureaucratic associations, the invasion of privacy and the time-consuming nature of survey activities. In this checklist survey the style designed for assessors undertaking evaluations in a solo context became impractical for data gathering.

Norman's advice on complexity was incorporated into the next circumstance – a tent. He asserts that 'a good conceptual model sets up expectations and aids in understanding of the actions that are taking place', stressing that effective feedback should be used to assure, providing 'evidence of care' to lessen uncertainty - a 'prime cause of emotional irritation' (2011, p.186). Thus the next consultation was approached by setting up expectations for the research activities that would take place - a lesson learnt from the obstetrician.

FIGURE 37. CHECKLIST SURVEY OF INTERIOR COMFORT PRECEDENTS

AMNIOTIC SAC & PLACENTA

- a biological membrane (discussed in more detail in chapter 4.3)
- the original comfort scenario with life-long associations
- precedent categorisation: acoustic, behaviour, energy generating, ergonomic, form, health, wellbeing, kinetic, lighting, living space, material, nature, thermal comfort, ventilation and visual

'POP-UP' TENT

- a ubiquitous membrane suitable to interior & exterior use
- it represents comfort as shelter
- precedent categorisation: behaviour, cultural, form, furniture, health, wellbeing, historical, living space, material, technical, thermal comfort, ventilation and visual

'LIT-CLOS' BED

- a present-day luxury french cabinet structure
- a refuge for relaxation and work comfort within interior space
- precedent categorisation: acoustic, behaviour, cultural, form, furniture, historical, lighting, living space, material, technical, thermal comfort, ventilation, visual and work

'ORKNEY' CHAIR

- a seat structure to aid thermal and visual comfort
- a vernacular form that responds to the human shape
- precedent categorisation: acoustic, behaviour, cultural, ergonomic, form, furniture, health, wellbeing, historical, living space, material, nature, technical, thermal comfort, ventilation, visual and work

'REGENCY' BED

- a curtained four poster structure with a sprung base
- a historic interior comfort application
- precedent categorisation: acoustic, cultural, ergonomic, furniture, health, wellbeing, historical, living space, material, technical, thermal comfort, ventilation and visual

'ECOTYPIC' BED

- a biomimetic four poster structure
- an example of a futuristic interior comfort application
- precedent categorisation: cultural, energy generating, ergonomic, form, furniture, health, wellbeing, lighting, living space, material, nature, technical, thermal comfort, ventilation and visual

'POD' BED

- a lit, cocoon-like relaxation structure
- a bespoke product that facilitates comfort
- precedent categorisation: acoustic, form, furniture, health, wellbeing, lighting, living space, material, technical, thermal comfort and visual

'HAG' CHAIR

- a flexible seat structure that adapts to many different postural modes
- a product that allows comfort through movement
- precedent categorisation: behaviour, cultural, ergonomic, furniture, health, wellbeing, kinetic, material, nature, technical and work

The checklist was emailed to the interviewee beforehand and a guestimate of the time for completion provided. Moustakas states that for the interviewee 'to share his or her experience in unqualified, free, and unrestrained disclosures… an atmosphere of openness and trust' must be provided. In speaking directly with the interviewee 'the nature, meanings, and essences' of their perspective by 'looking at their own experiences in perceptions, thoughts, feelings, and sense' (1990, p.26) was communicated. These prompts allowed for implicit elements surrounding this human-object-circumstance relationship to be clarified.

Rather than being a sales representative for a specific brand of tent, the second interviewee was an experienced user of a wide range of tents with direct heuristic knowledge of their use in different climates, conditions and functions. These ranged from acquaintance with hi-tech tents in low temperature mountaineering scenarios to mini-breaks and family use of common tents; to yurt inhabitation. The lengthy tent checklist survey was completed and a variety of comfort and efficiency responses logged.

At this time, the intention was to commence a larger compilation of objects after these initial items had been assessed by heuristic users for my primary research data gathering exercises. However, extending the checklist survey interviews with focal and time constraints became untenable. Methodological constraints included the length of time it took to complete the checklist and analysis of its complexity, plus the methods were not directly addressing the research question.

This checklist survey approached the research question from an object-based approach. However, Shove's comment about this research method format includes the appreciation of its limitations where; 'goods and objects are analysed in isolation… without noticing the pre- and co-requisite systems and technologies on

which they depend, or the reconfiguration of ideas, actions and habits associated with their use and appropriation' (2003, p.11-2). The tangible objects selected as interior comfort precedents and the subjective nature of the survey structure did not allow for a broader range of viewpoints, whilst also making interpretation and analysis problematic. Critically, the circumstances and desire-lines of comfort were not being addressed.

Further to this, some of the artefacts chosen in Figure 37 such as Xin's Ecotypic bed, were simulated or historic, making it problematic to find expert users who had practical experience of them. It was considered that simulators could be used but the main drawback was that interviewee feedback would require conjecture and was probably unrealistic.

Consequently, it was determined that this trial qualitative checklist format of data collection had proved inadequate to answer my research questions. Nonetheless, it developed my practical research skills, and nurtured ideas and designs for subsequent research streams, such as the AMNIOTIC SAC workshop discussed in section 4.3.

4.1.3. Applicable Research Approach

This preliminary work established that the chosen structure did not assess how constructs of comfort relate to (in)tangible membranes. The qualitative comfort interviews were too 'open' and the 'tighter' checklist styles were too prescriptive.

Therefore, following my pilot investigations, proposals for research workshops that problematised my subject topic meant engaging a service design perspective, presented in section 3.1.1, where research procedures are evaluated in action. Accordingly, a sequence of iterative workshop events was staged as part of my

design research procedures. Their aim was to tangibly chart the responses of co-researchers to both qualitative and quantitative comfort questions. The workshops resolved the problems highlighted in my pilots, by asking for feedback from a wider group of co-researchers using objects, and sites, to simulate circumstances of comfort. These consisted of familiar objects, as well as a hypothetical new product of comfort.

Plans for the workshops went through multiple timetabling and conceptual iterations resulting from the realities of event management. Early plans involved procuring monetary and spatial capital to manufacture and install 1:1 scale objects and circumstances. Exposition spaces were investigated and deadlines set with practical revisions so that this PhD-by-practice research could be achieved.

4.1.3.A. Patchworking and Data Gathering Exercises

Physical exposition spaces were acquired for the workshop events, but money to finance the events was harder to secure. Therefore, my data collection strategy altered towards using human capital. Attracting help with various tasks was out of my psychological comfort zone. The event spaces were only available at busy periods within the calendar, such as Edinburgh's Fringe Festival and Black Friday to Cyber Monday. In addition, my roles of researcher, practitioner and tutor sometimes created unintended dichotomies. For example, directly inviting my students to the workshops caused ethical dilemmas, so was not pursued.

In their insights into qualitatively analysing data, Burgess and Bryman highlight that 'most social research projects exhibit "breakdown" at some point'. They suggest this is due to the theoretical origins of the proposals being inappropriate for the actual assignment. They add that investigators perceived their reactions to these

conditions as insufficient, but Lowe describes their 'ad hoc coping mechanisms 'or' "patchworking" activities as representing 'the most creative part of the research project' (1994, p.211-2).

My patchworking activities to enable the workshop events were reflexive and the war scenario analogy, outlined in Chapter 3.3, describes my researcher roles in practice, theory, analysis, critique, reflection and reaction.

The juggling of many occupational roles was a prerequisite in my events-based research procedures. In actuality, the point when case studies of past surveys and theoretical guidance were supplanted by my own practical experimental survey designs came very close to the event dates. Theory and precedent only took me so far – the unknown practice elements of the research journey had to be navigated blindly. Still, in hindsight the ingenuity of this patchworking approach advances the idea of praxis.

The following subsections chart the series of procedural workshops that flowed from abstract to concrete principles. The GYRO, AMNIOTIC SAC and COSY research streams, introduced in chapter 1.4, enables the research audience to situate themselves within spaces they have 'concrete' comfort experiences of, whilst also challenging them with new 'abstract' concepts. Each section is announced by a "research recipe card" which gives a synopsis of the "ingredients" and "procedures" employed in each research stream and workshop.

After each workshop, data was analysed so that the new knowledge generated in the iterative research process could be learnt from and taken into the next research stream. This iterative analysis is collectively evaluated in chapter 5.

Research Recipe Card:– abstract idea

Ingredients:
Equipment:-
- Sketches (hand & ortho)
- Maquettes
- Models of varying scales

Helpers:-
- Technicians
- Engineers
- Spaceball Event Hire
- Health and Safety Officers
- Janitors

Procedures:
Pre:-
- Prepare ground by communicating ideas about implied space by researching existing practice and theoretical artefacts (literature and objects)
- Use 2D hand & CAD (computer aided design) sketches and 3D maquettes and simulations to explain more detailed conceptual ideas

During:-
- Get more tangible reaction to your abstract concept with 3D models of differing scales.
- If possible create, or hire, a 1:1 model that can allow for experiential feedback

Post:-
- Develop how 2D and 3D data gained will be understood and/or interpreted for relevant insights into topic

Tips:-
- Keep things in research-by-practice mode - this is not a product development or prototyping exercise - it is PhD-by-practice research

4.2.1. An Explicit Membrane as a Tangible 'Hook' into the Research

This GYRO research stream was a response to an invention of a metamorphic spatial furniture idea, which facilitates the pursuit of comfort whilst reducing energy.

The proposed product enables sleep lying within a horizontal mesh; aids relaxation in a rocking cradle or audio bubble; and facilitates work in a pod. These modes are illustrated in Figure 38.

FIGURE 38. OVERVIEW OF GYRO MODES AND IMPLIED GYROSCOPIC SPHERE
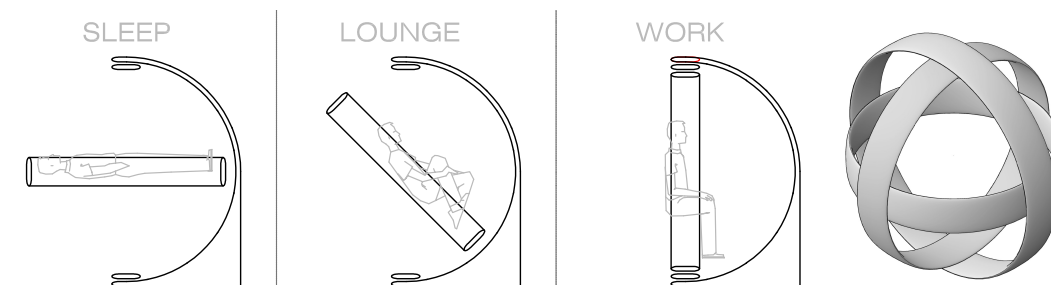
Essentially, the GYRO concept stems from gyroscopic principles. Spatially, when all the circles are aligned, the device mimics a two dimensional planar entity; then whilst in motion, the object becomes a three dimensional sphere. These changing circumstances generate instances of implied space in the GYRO as the rotating circles transform into a structural bubble. A stretchy membrane, fixed to the outer and middle circles would enable the person within to fully enclose themselves in the space. This outer skin would reduce energy use as individuals only heat or cool this bubble space rather than the wider room it may inhabit. Furthermore, it facilitates acoustic or visual privacy, like a futuristic and functionally adaptable four-poster bed. The users inhabiting the object or structure would be encouraged to invent and develop a range of comfort circumstances based on the required tasks.

My Practitioner experience within the design and architectural industries involved generating and constructing practical, artefact and product based

solutions to briefs. From an industrial and product design perspective this explicit, but abstract idea was a 'hook' that permitted a physical exploration of a tangible membrane between clothes and the building skin.

The flexible furniture GYRO concept developed from problem-solving into a research exercise that problematised the subject topic. It became a vehicle to test the research questions, via maquettes and prototypes. These models created evidence that was difficult to measure or articulate verbally, but were pertinent in advancing this innovative spatial comfort concept to potential future users.

4.2.2. What is already known on this Spherical GYRO Topic

My GYRO idea began from a representation of Da Vinci's Vitruvian man (1490), which illustrates an idealised proportional male human form, with his limbs in two positions, outstretched in a circle and square. Smith and Smith suggest this icon embraced Vitruvius' notion of balance in architecture and implies a cosmology of the body where 'humans were viewed as the centre of the universe' (2015, p.27).

Nevertheless, if embodied in actuality, this icon visualises a discomforting body position. Physically the force of gravity would impact on the body and physiologically the effort required to keep this position would cause discomfort. The introduction of movement would relieve this rigidity and this design research insight led to investigations about rotating circles. The potential for movement of the circular structure and the implied spherical, bubble space became the next research investigation.

Olafur and Weibel highlight aspects of spheres that rotate, stating that they have 'a spherical symmetry but also cylindrical symmetry; the axis of rotation fixes a direction in space' (2001, p.146). These latent ideas are demonstrated in gyroscopes

and gimbals, which are devices that consist of concentric circles mounted within each other so they can spin about dual axes.

My concept of the GYRO device developed from these origins. Within its interior space, the human occupant would manipulate the interconnected circles to generate a dynamic equilibrium, creating comfort in different functional contexts. This movement links to neural orientation or proprioception, which Sloterdijk theorises as the 'complex mechanics of the senses working together to keep the person upright and balanced regardless of the spinning, rotating, or wobbling of the world' (2011, p.607). He describes how it links to the ancient Greek word 'Perichoresis', that is translated as 'dancing around something' or 'being whirled around in a circle' (2011, p.603). These expressions describe the dynamism of the gyroscope and prompt insight into some of the psychological constructs of comfort that instigated ideas about the next AMNIOTIC SAC research stream discussed in section 4.3.

Spatially, spheres and bubbles have an efficiency of form. Steiner delineates architectural and scientific 'interest in the sphere as a synthesis of function and form' because the skin of a bubble provides 'the maximum volume with the minimum surface area' (2009, p.154). The gyroscope has an implied correspondence with the spherical form, and these qualities counter the functionally inefficient, orthogonal box shape that dominates interior spaces.

Teyssot designates spheres and bubbles as 'membranes between' the 'interior and exterior' producing bounded forms of 'inter-betweenness' (2013, p.243). Other analogies to the container principle are nests. In reference to spherical spaces, Bachelard describes the internal shape of a nest. He depicts the action of the bird 'constantly turning round and round and pressing back the walls on every side' which allows it to invent its own comfort as it 'succeeds in forming this circle''

(1994, p.100-1). This nest formation links to the idea of movement within the core, connecting to comfort and wellbeing within a spherical container boundary.

4.2.3. GYRO Design Research Methodology

Planned techniques and procedures for this research stream included following the interior architecture process. Firstly, a conceptualised overview, which involves compiling a range of theoretical and historical precedents for contextualisation was undertaken. Secondly, the feasibility of the visual, aesthetic and functional aspects of the project were ascertained. Thirdly, the technical aspects of the 'build' were considered so that statutory regulations could be incorporated into the GYRO.

After these initial stages industrial design procedures would be integrated into the process. Analysing the functionality and experience of it in use would be advantageous, therefore, if a 1:1 scale GYRO prototype could be constructed further product development could commence. Design iterations, based on user interaction would permit the refining of the object and the circumstances it created.

The lifecycle of the product would be designed as part of a closed loop sequence. This would build in the planned aftercare, maintenance and finally the reuse of all or parts of the GYRO object. These hypothetical service based elements would be key to its development into the marketplace.

4.2.3.A. GYRO Conceptualised Overview and Feasibility

The conceptualised overview and feasibility of the GYRO idea was investigated by compiling spherical and kinetic artefacts. These included historical, current and futuristic objects and circumstances. Figure 39 selects three instances of

spherical, gyroscopic or rocking movement, which are juxtaposed with the human form, to acknowledge scale. These give motile, material, and structural exemplars.

FIGURE 39. SPHERICAL PRECEDENTS

PTOLEMY WITH AN ARMILLARY SPHERE MODEL Ghent and Berruguete (1476)	CRADLE CHAIR Clarkson et.al (2011)	GYRO THE CUBE Linden, Virtox (2009)
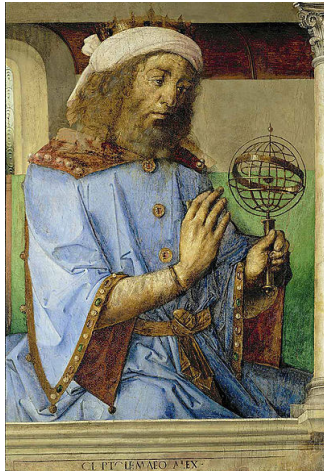
A historic armillary or celestial sphere used for orientation in Eastern and Western astronomy – a finely balanced metal measuring device	A contemporary rocking hemispherical nest designed using principles that support Autism and Childhood Rhythmic Movement Disorder- utilising traditional manufacturing methods such as upholstery and timber framing	A toy designed to rotate interlocked structural elements - 3D printed using sintering/ additive manufacturing

Curved forms in bio-organisms include the shells of turtles, snails, nuts, eggs and even the human skull, which Vogel points out has 'light and thin bone' that 'needs only minimal internal bracing'. However, structurally domes can be problematic as 'localized loads can be troublesome, and resistance to local penetration may demand enough material to offset most of their cheap resistance to uniform transmural pressure differences' (2003, p.440-1). This understanding would relate to the hinged pressure points in a gyroscope product, which would need to function under habitual use.

When considering the multiple potential functions of the GYRO, various levels of metamorphosis can be considered. The GYRO concept enables sleep lying flat,

lounging in a reclining position and work in a seated position. The solo or dual users'
bodies cooperate with the device to create different circumstances to augment
these primarily sedentary activities. When a furniture object is distilled to incorporate
a variety of circumstances changing notions of intimate, personal and public spaces
can define these transformations. For example, current technologies have facilitated
laptop-based work in a range of new circumstances; the intimate bed space, the
personal sofa and the public train seat can function as a cradle, a chair, or a desk.

The bed can be defined as an item of furniture that facilitates rest and/or
sleep in an intimate space. Related tangible membranes surrounding this
circumstance include covers such as the duvet and curtains. These devices enable
the bed to transition between a sleep, lounging and workspace. Giedion describes
'beds that swing vertically or horizontally away, beds folding upward or upon
themselves - the most variegated methods have been tried for saving daytime
space in dwellings (1969, p.432). From a mid 20th Century life stage perspective,
Cieraad points out how in the Netherlands, 'the furnishing of children's and
teenagers' bedrooms… had preferably to look like small-size sitting rooms or studies
(2005, p.174-5). This was to cater for active use in the daytime and sedentary use in
the evening. These modes correspond to the changing use of spaces across eras
and lifespans. In relation to physiological temperature control and comfort, Wright
pithily points out that 'it is clearly easier and quicker to heat the bed than the whole
room' adding that a 'very effective bed-warmer' is a 'human companion' (2004,
p.217-8). This resonates with the idea of efficient thermal comfort within the
immediate bounds of the human body.

A sofa is classed as a furnished seat for more than just one person, within the
realms of personal space. The (in)tangible membranes surrounding this circumstance

include items such as comforters or pillows. As Cieraad explains, 'in the domestic affairs of today's post-modern generation… living rooms and bedrooms have even become interchangeable' she adds that in advertisements users of the furniture are shown 'in more or less erotic poses, while lounging on their mega couches and beds' (2005, p.175). Sofa synonyms include names such as settee, couch, or daybed with the latter directly evidencing rest and sleep functions. The sofa's historical topography is interrelated with the cultural mores surrounding the use of the wider livingroom space it customarily inhabits.

The desk and chair are typically associated with work and are also associated with public space. In relation to comfort and movement, the (in)tangible membranes surrounding this circumstance include individualized heating and cooling systems or screens for personalisation and privacy. Within office-based working environments, legal requirements base guidelines on safe physical, physiological and psychological working practices. However, home-working is increasing with few constructs to cater for these changing circumstances. Therefore, comfort cannot be generalised, but, within communal spaces, defensible personal space is key, as outlined in chapter sections 2.2 and 2.3.

Other relevant functional precedents are audio, visual and communicative products and some are illustrated in Figure 40. Acoustically they show the potential of how speakers, mounted in the outer structure could enable an isolated sound experience, a circumstance advantageous to urban living. The GYRO canopy awning would be a flexible material that incorporating a sound amplifier and thermal and visual membranes. Current state-of-the-art optic and handheld technologies could facilitate workstation interaction and leisure pursuits such as

cinematic and gaming experiences within the GYRO's spherical interior. Future

adaptations may include visual projection onto the internal membrane surface.

FIGURE 40. FUNCTIONAL AUDIO, VISUAL AND COMMUNICATION PRECEDENTS

SOUND DOMES
Brown Innovations Inc.

CRADLE BED
Okooko Co.

OCULUS RIFT OPTICS HEADSET
Oculus Virtual Reality (2016)

Hemispherical sound domes isolate and focus audio acuity within a specific locality – comparable to earphones

A modern daybed with retractable, rotating sun canopy - facilitates visual privacy under awning

Virtual reality display and communication device - technological interfaces allow for immersive experiences

4.2.3.B.   The GYRO Models

The GYRO concept was difficult to articulate in 2D, thus 3D spatial

representations were generated. As a research method Smith and Smith contend

that models 'take the place of words and may present a design more effectively

than pictures'. They suggest 'a picture is worth a thousand words but it could be

argued that a model can be worth at least a thousand pictures' (2015, p.95). Such

conceptual models or mock-ups can disseminate concepts to people without the

need for an education in orthogonal, technical drawing.

The next stage of the research process involved the creation of physical

maquettes by manipulating materials such as paper, card, wire, wood, scalpel and

a 3D printer to communicate aspects of the spherical GYRO space. However, many

model-making materials fell short. Polypropylene was too supple; paper and card

were too insubstantial; wood did not bend in the dual directions required for the spherical form and wire did not hold its form. Using found materials with an inbuilt circular structure seemed appropriate and Figure 41 illustrates these models.

FIGURE 41. GYROSCOPE MAQUETTES
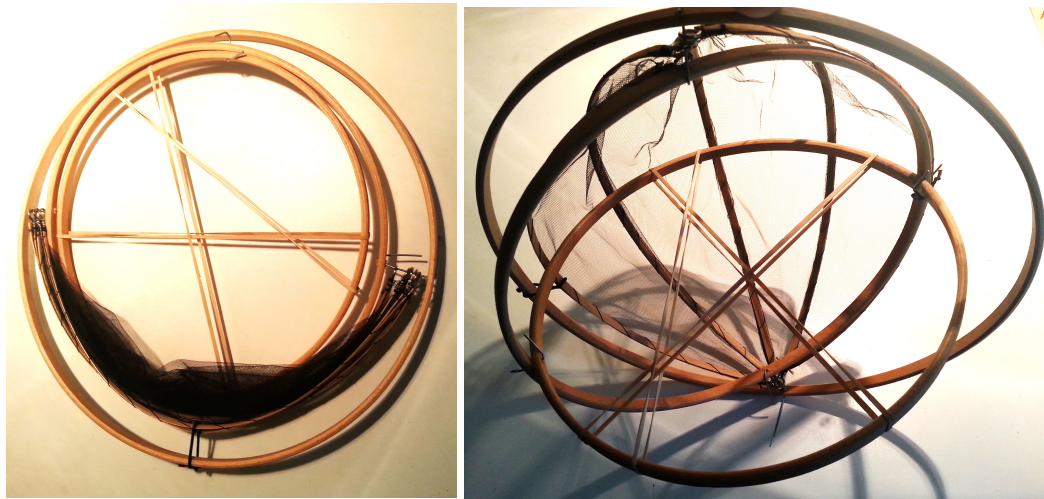
My goal was to construct a 1:1 prototype and replicate a realistic construction technique. Smith and Smith affirm this by stating 'models are used to view shadows, massing of forms, complicated intersections, and a variety of other issues concerning the design of future buildings or products... Working three-dimensionally allows for the discovery of conflicts before the construction phase' (2015, p.94). In physical architectural model making, problems ensue when creating kinetic forms. The circular mechanism hinge and balance arrangements created problems in how to show the shifting conditions created in the different GYRO modes. Thus the physical representation of my GYRO idea was manifested in a physical 3D form that took cognisance of its potential future production. At this juncture, simulating the concept on a computer did not fit this material approach.

Consequently, the next model shown in Figure 41 was based on various war-based construction technologies such as 1st World War bi-plane structural concepts,

where the underlying frame supports the outer skin of the object; and 2nd World War

moulded plywood framing for injured leg splints. The circular members could be

reinforced via glulam processes, that is, laminated timber to enhance structural

capacity and create unusual shapes. This approach employed existing furniture skills

to craft a relatively light framed object, with the main material derived from a

sustainable wood source. Ways of creating movement in this model included the

use of elastic bands as hinge mechanisms. It also articulated how sheet materials

could be used to create the object – something that would have a large impact on

the future financial viability of the concept. A pragmatic consideration included the

need for the largest full circle element to be able to diagonally fit through a

standard door portal for delivery and assembly in existing interior spaces. Figure 42,

shows the model being printed and part of its assembled form.

FIGURE 42. 3D PRINTED GYRO MODEL CRAFTING STAGES
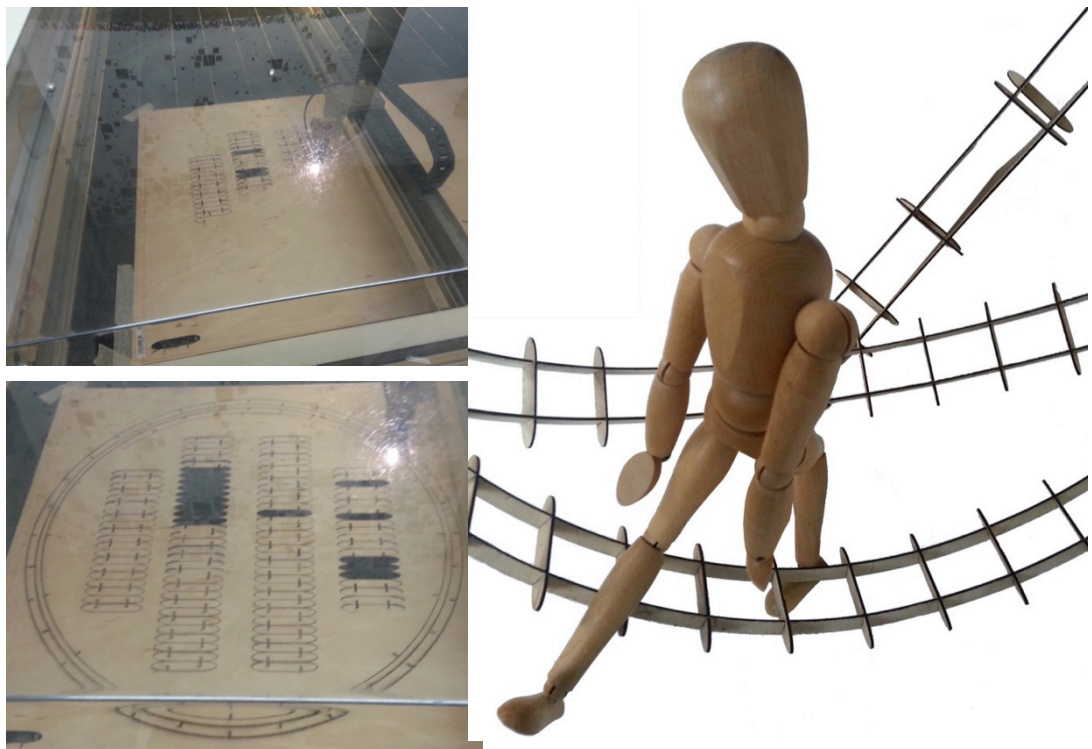
Although these technical constructions could be considered later in the prototyping process, their inclusion was vital in identifying procedures that would impact its future production. Affordable laser-cutting infrastructures, augmented by traditional furniture making, would increase its production potential.

The next stage in this model-making process involved the drafting of schematic drawings and a 1:20 scale 3D printed model. Figure 43 shows an overview of the GYRO functional modes and its kinetic maneuverability.

FIGURE 43. OVERVIEW OF GYRO MODES AND MODEL
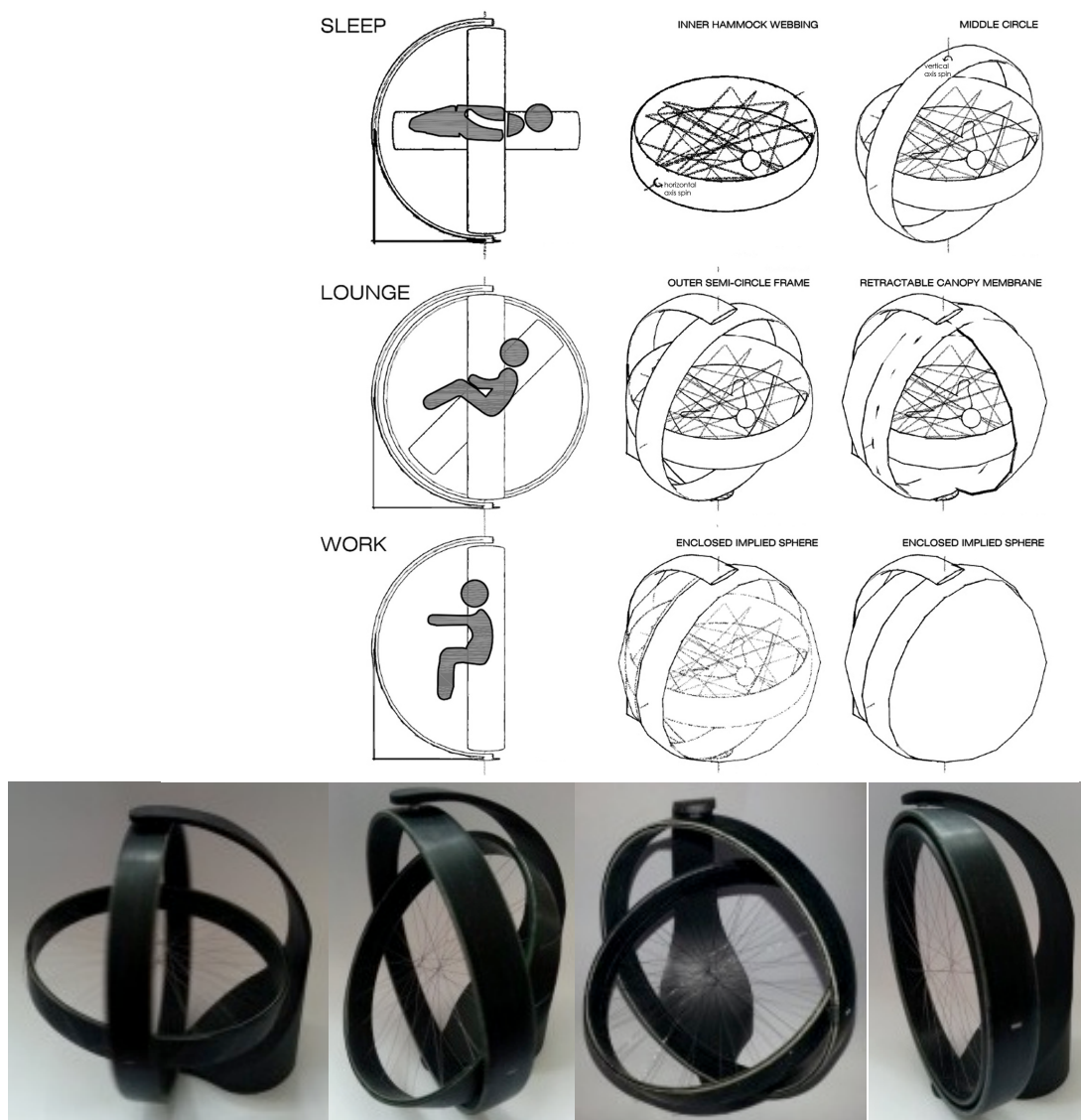
As well as being a counterweight, stand and housing for inbuilt or retrofitted machineries, the outer semi-circle would incorporate a curtain like membrane, creating a fully enclosed sphere when rotated against the middle circle. The innermost ring would have a hammock style membrane stretched and woven across its diameter. This would allow the user to create different types of postural comfort in the various modes the GYRO adopts. A potential material for the knitted surface includes thermal components so that physiological comfort is maintained - similar to an electric blanket for warmth or cooling. This hammock type membrane would negate the need for upholstery cleaning in the case of sofas and chairs, or mattress replacement. Different materials and finishes would be used to develop a range of GYRO's that could cater for different tastes and status aspirations. The basic frame and moveable elements would allow for upgrading throughout the product lifecycle to factor in technological advances and specialist requirements from users. The GYRO would support energy efficiency through its use.

4.2.4. Problems Encountered and Subsequent Changes in Procedure

As a method, the use of scale models demonstrated ideas which were difficult to articulate verbally or in a 2D format. They allowed for the applied advancement of spatial interpretations, permitting consultation and conjectured responses about the GYRO concept. Lay and Academic individuals were approached to give feedback and their speculations were recorded, their responses are analysed in chapter 5.2.1. This could be seen where instances, such as nuances regarding body posture, as opposed to the position of the apparatus, could be discussed; or details about how the inner hammock structure would

support the occupant. However, methodologically these smaller scale models had limitations because they could not embody the experience within the GYRO space.

Due to logistical constraints a viable 1:1 GYRO prototype could not be produced as part of this PhD research. Therefore, to gain an embodied experience of GYRO inhabitation, an events Spaceball gyroscope was used to gain immersive insights. It was not the exact representation of the GYRO's sleep, relax and work circumstance, but was the closest, accessible expression of the proposed concept.

Thus, in addition to the COSY workshop and exhibition that is described in section 4.4, a human gyroscope was hired to get heuristic responses to this unfamiliar device. The merging of research streams into a three-day event facilitated the mobilisation of volunteer helpers, the maximisation of exhibition space, and the fusion of financial and marketing capital. Figure 44 illustrates the pre-event test and event situation of the Spaceball gyroscope.

FIGURE 44. PRE EVENT TEST AND INSTALLATION OF SPACEBALL GYROSCOPE

4.2.5.Iterative Lessons and New Opportunities

This conceptual GYRO research stream developed as an abstract innovative artefact. It showed how theories, concepts and ideas could be applied to problem-solve the research topic of the construct of comfort within interior space.

Metaphysically, Sloterdijk theorises human existence as a pattern of 'coming-from-within', recounting how the first environmental containing spaces we emerge from, such as 'eggs… membranes, gelatinous capsules or shells', are all symbolic of the 'boundary principle'. He adds that these tangible casings 'seal off the inner from the outer' and allow for 'highly selective communications between the egg and its environment - such as exchange of moisture and ventilation' (2011, p.327). In this research context, the GYRO represented the biological membranes within proximity to the inner creature. This aspect of physical intimacy is akin to Leonardo's Vitruvian Man, where the person is able to touch the surfaces that surround them, allowing them to invent their own comfort.

These understandings from the GYRO research stream, evolved to consider an individual's first comforting place within the AMNIOTIC SAC membranes. Questions of how and why people invent comfort were iteratively problematised and the roots of individual comfort efficiencies were considered in the next AMNIOTIC SAC research stream.

Research Recipe Card: - abstract & concrete idea

Ingredients:
Equipment:-
- A4 surveys
- Plasticine (pink, green & purple)
- Box of straws & rubber tubes
- Atom set
- Paper
- Coloured pencils
- Chinese lantern
- Sticks
- Knex set
- White balloons

Helpers:-
- Photographer x1
- Workshop assistants x3

Refreshments:-
- Cake and fizz

Spatial Aids:-
- hanging red & white paragliders parachute
- hanging white paper Chinese lantern
- Music – heartbeat sounds and various tracks

Procedures:
Pre:-
- Obtain workshop venue with chairs & tables
- Prepare paper surveys that ask pertinent questions and can be written or drawn on
- Gather a mixture of structured and unstructured materials that will allow different types of interpretations to the research question

During:-
- Invite Co-researchers on specific day and provide some refreshments
- Ask them simple questions then watch them play in 2D & 3D
- Thank all for their participation

Post:-
- Collate information gathered
- Communicate basic findings with Co-researcher/ collaborators
- Analyse and use findings to develop further insights
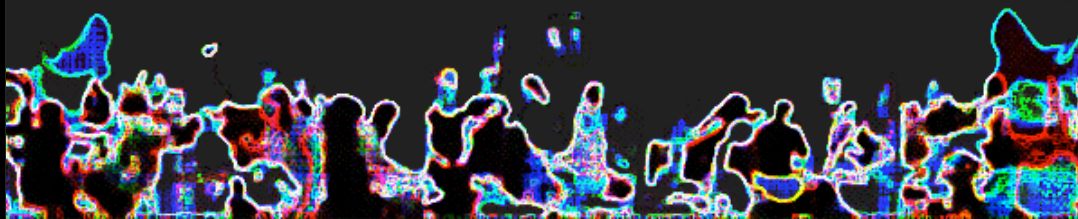
Tips:-
- Start small and informal to allow your research design event iterations help you investigate your topic
- Remember the motto from the movie, Wayne's World 2 – 'invite them, and they will come' (Surjik, 1993)

4.3.1.The Proposition For Investigating The Original Concept Of Inhabiting

As a protective bubble circumstance the AMNIOTIC SAC research stream built on my GYRO investigations. The iterative research journey led to investigating aspects of fetal membranes between a baby's skin and the uterus to problematise how we construct comfort within interior space. All humans have had direct embodied experience of this quintessential interior. The AMNIOTIC SAC circumstance stimulates debates around unconscious human behaviour and its impacts on sensory comfort and energy use.

The AMNIOTIC SAC can be considered the original zone of (dis)comfort, influencing an individual's fundamental understanding around perceptions of inhabitation. It becomes a tangible metaphor for understanding relationships with (in)tangible membranes. These placental membranes act as a perceptible boundary and enable nutrients, heat and other forms of comfort to move between mother and baby.

In exploring desire-lines of comfort and movement, the notion is that each individual has a unique trajectory of physical, psychological and physiological requirements that originated in the environmental circumstance of the AMNIOTIC SAC. This topic is emphasised by Lynch (2016), an Undertaker and Poet, in a radio broadcast. He links the uterine space to the formation of our desires and pithily, describes the womb interior as our 'first home' where the 'the temps are set, the rent is easy, the food is good, and we aren't bothered by telephone or tax man'.

The AMNIOTIC SAC research stream focuses on prenatal comfort. It has to be acknowledged that there are ongoing ethical debates around pro "choice" and "life" regarding this developmental stage. Nevertheless, these issues can dominate

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discussions and are out of the scope of this research. Therefore, the (in)tangible membranes of the AMNIOTIC SAC and their linkages as to how people construct comfort, is the focus of this research stream.

4.3.2. What is Known about this AMNIOTIC SAC Space

The protective boundaries of the AMNIOTIC SAC are defined as a tough, thin; transparent sets of membranes that help support the developing embryo and foetus until birth. The three membranes that comprise the placenta are the outer layer of the chorion, the umbilical cord, and the amnion membranes. Anatomists Gray, Lewis and Warren describe the 'amnion is a membranous sac which surrounds and protects the embryo'. Its emergence shows it 'in contact with the body of the embryo' but as the fetus develops amniotic fluid 'increases in quantity and causes the amnion to expand and ultimately to adhere to the inner surface of the chorion' (1924, p.56).

Physiologically these membranes are cast-off after birth, being redundant for the next stage of the human lifecycle. However, the memories of comfort at this stage in life have lasting affects as corroborated by biologist Palmer who describes fetal senses as 'the means by which organisms gather information from outside their bodies' (1987, p.411). The intelligence gained about comfort in this prenatal space inform future identifications.

Figure 45 gives physical depictions of the AMNIOTIC SAC membranes. The left image shows Thomson's (1918) illustration from Gray's anatomical textbook, where they are portrayed in a balloon type bubble. The right image shows a baby born in its caul - a term used to describe visible amniotic membranes. Pappas, a Birth Services Practitioner, describes how the image gives a 'rare… sneak peak [sic] into

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the lives of our littles when they are on the inside' showing 'how protected baby is inside that sac, and how cuddled up within themselves they are. safe. secure.' (June 26, 2012).

FIGURE 45. FETUS ENCLOSED IN THE AMNIOTIC SAC MEMBRANES
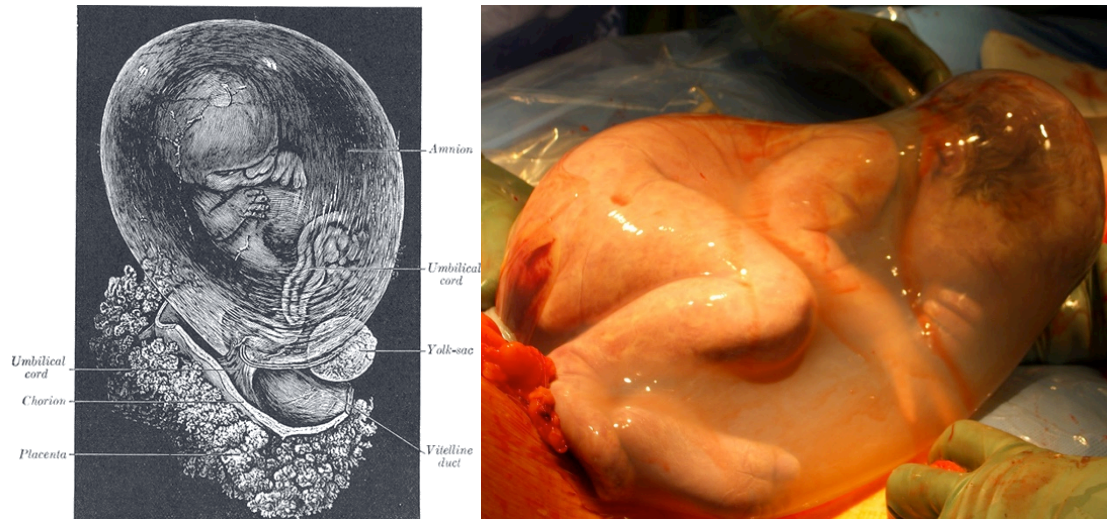
Psychologically, the AMNIOTIC SAC is ambiguously mythologised in diverse cultures. For example, Power and Schulkin express how the birth caul can be viewed as an intangible mystical defence that ostensibly appears to promote 'charm' or fortune in the possessor (2012, p.1859). Spiritual ideas associate birth with a caul, 'veil', or 'shirt', with a protective barrier. Metaphysically Sloterdijk describes how the AMNIOTIC SAC can be considered a 'lost twin' or 'guardian angel' (2011, p.327) in relation to its role as the foetus' support system. For example, psychohistorian Demause describes ancient Egyptian customs where 'the pharaoh's placenta was thought to be his "double," his ka, his "helper," his "twin" who would help him in battle'. Adding that there was an overarching belief in the dyad of the soul where 'the placental ka or double of every Egyptian was believed to accompany him everywhere, and it was the goal of each of the 500 million Egyptians who were mummified "to rejoin their kas," their placentas, in afterlife' (1981, p.289). These

beliefs highlight the intangible comfort value given to the AMNIOTIC SAC membranes.

Metaphysically Teyssot portrays the prenatal experience of fetal 'cohabitation in which the incipient child experiences the sensory presence of liquids, soft bodies and cave boundaries', whilst 'embedded in a dark, spheric spatial factor' (2013, p.293-4). Orwell's literary allegory of 'the whale's belly' being a 'womb big enough for an adult' represents this interior cosmos as a 'dark, cushioned space that exactly fits you, with yards of blubber between yourself and reality', he adds that 'short of being dead, it is the final, unsurpassable stage of irresponsibility' (1940, p.107). Furthermore, Sloterdijk gives a sensual response to this fetal state where he imagines 'even a genuine born brother would for a long time be not so much a sight as a sensed presence, a sound center, something touched, a pulse, an aura, a source of pressure actions – and only lastly something visible too' (2011, p.446). These theoretical viewpoints give philosophical articulations to this space. If we were to link these conceptions with desire-lines of comfort, one could surmise that darkness, softness and pressure are primary constituents of this prenatal experience?

Fetal psychology is a speciality that deals with an individual's memories around prenatal, birth and postnatal events. As a caveat, appreciation of this area requires a cognitive framework that allows for the blurring of lines between illusion and recollection. To demonstrate this psychiatrist Grof's 1950's data gathering techniques, included the use of Lysergic acid diethylamide (LSD) for psychotherapeutic regression. His studies concluded that research subjects commonly re-experienced pre and post birth memories (1976).

Recollections of prenatal comfort are outlined by Demause, who expresses that imaginations of this gestational stage incorporate positive ideals where,

'fantasies of Paradise, unity with God or Nature, sacredness, "oceanic" ecstasy, etc.' (1981, p.250) are exposed. However, stereotypes of unification with the mother are contra-indicated physically and psychologically. Medical practitioner Liley describes how the foetus 'does not live in a padded, unchanging cocoon in a state of total sensory deprivation, but in a plastic, reactive structure which buffers and filters, perhaps distorts, but does not eliminate the outside world' (1972, p.3). Demause outlines that 'comforting fantasies of "regression to the womb"', are digested more readily than 'when the patient produces frightening material with overt fetal content' (1981, p.248). He queries psychological assumptions that oversimplify 'life in the womb… as comfortable', 'birth as traumatic, and re-birthing as the overcoming of separation anxiety'. Demause gives sensory descriptions of fetal movements within the 'roomy' amniotic sac, including how the fetus; 'floats peacefully, now kicks vigorously, turns somersaults, hiccoughs, sighs, urinates, swallows and breathes amniotic fluid and urine, sucks its thumb, fingers and toes, grabs its umbilicus' (ibid, p.254). These sense-capes of the womb indicate an energetic changeable environment that has pleasurable and uncomfortable aspects. At later stages of development in utero, space becomes more restricted with the placenta working less efficiently as time elapses and the 'once-peaceful womb slowly grows more crowded, less nurturant and more polluted' (ibid, p.258). These insights of womb and AMNIOTIC SAC inhabitation may inform future behaviours surrounding perceptions of comfort.

4.3.3. Themes to be Identified and Research Methods & Techniques

The practical and theoretical elements of the GYRO research stream directly sparked the investigations of the AMNIOTIC SAC as the human origin of comfort and

movement. This was because of a link made with the orientating physiological concept of movement and proprioception, associated with the foetus' experience of eddies and currents in the womb.

Opinions surrounding comfort and security throughout life that correspond with a person's prenatal amniotic sac experience were explored. However, anecdotal discourses were skewed toward childbirth rather than the gestation period. Instances of this included advice on how to cook the placental afterbirth rather than explorations into immersion within the amniotic sac membranes. Moreover, when trying to translate theoretical perspectives into practice the outcomes were gender imbalanced because perceptions of the circumstances surrounding birth were predominately linked with the feminine. Yet, everybody has been through a subjective AMNIOTIC SAC experience, with memories closely linked with the unconscious and the intimate.

Recollections of these interior projections of comfort might be illustrated by the use of metaphors. Smith and Smith advise that repositioning 'the unusual connection between things' by juxtaposing 'things that are clear… with things that are ambiguous', aids discovery. They suggest that putting yourself into 'the mind of others, in different scenarios, or in the place of inanimate objects helps find ideas' (2015, p.41). Therefore, the research aim was to explore metaphors of the AMNIOTIC SAC in 2D and 3D practice.

Consequently, to develop narratives around this research stream and to build on the GYRO idea of whirling around in a sphere discussed in section 4.2.2, a design charette workshop procedure was planned to gather insights into people's perceptions of comfort desires within their AMNIOTIC SAC. This technique of data gathering can be defined as a collaborative session where co-researchers generate

ideas. Kopec describes it as a procedure that environmental psychologists use as a productive method to 'find out what people want from their environments'. The informality of the event structure promoted discourse that was 'more relaxed and casual creating an environment in which occupants are willing to communicate more freely' (2012, p.19). This style of event was formulated to provide primary qualitative data with self-selected volunteers. It was hypothesised that this would develop research praxis, fusing theoretical comfort concepts with practical reactions to experiences of the AMNIOTIC SAC membranes. The charette workshop structure facilitated creative responses by recreating situational play circumstances. Huizinga posits that play, 'with its tension, its mirth, and its fun' (1998, p.21) constitutes 'more than a mere physiological phenomenon or a physical reflex... there is something 'at play' which transcends the immediate needs of life and imparts meaning to the action' (ibid, p.19). Nonetheless, play cannot be forced and this experimental research method applied a flexible framework to cater for any subtleties. This method corresponds to experiential, heuristic and action research.

The visual, verbal and textual data gathered during the charette was used to identify themes of comfort in the AMNIOTIC SAC membranes. This information was evaluated via typologies such as envelopes, wrappings or containers.

4.3.4. Pre-event Focus Group, Consultations & Workshop Procedures

The preparation for the event involved the use of a focus group with 2 females and 1 male contributors. A pre-event discourse and brainstorming session included specific feedforward about how to communicate about the AMNIOTIC SAC charette. Furthermore, it aimed to make the topic more accessible to co-researchers of all ages, genders and ethnicities.

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Key points raised in the focus group included the primary importance of making sure that people know what is expected of them when they arrive. This advice was incorporated into a handout and paper survey given to the workshop co-researchers.

Secondly, the need to provide chairs and tables set out with various materials was proposed, because it would promote intimate conversation spaces, thus encouraging participation.

Thirdly, it was suggested that linking the research with a party would constructively align the research to the subject topic and an email was devised:

'I'm having a party… I'm doing research into interior spaces and feelings of comfort we experience throughout our lives. The party would look at the first interior space we inhabit, our amniotic sac or womb. There's forms to fill out if you want to input or if you're feeling inspired please do come with your creative party hat on' (Oji, 2014)

This email invitation superseded a formal invite, which summarised some theoretical insights. Although practical experience of the AMNIOTIC SAC circumstance was a given, as a summons to potential co-researchers on an already ambiguous topic, the focus group contributors felt this invite might thwart the communication process. Their critique was its appeal to an academic, rather than the target lay workshop audience. Therefore, the focus group discourses were very instructive as detached, but constructive perspectives into the subject topic and research procedures contributed to the success of the workshop.

The logistics of the workshop were also discussed with the Proprietor of the 'Basic Mountain' venue hired for the event. The outcome was to incentivise co-

researchers to engage with, and participate in, the AMNIOTIC SAC event.

Resolutions focusing on creating objects and circumstances that people could

experience and achieve as part of the workshop and are shown in Figure 46.

FIGURE 46. 'EXPERIENCE' & 'ACHIEVE' ELEMENTS OF AMNIOTIC SAC WORKSHOP

EXPERIENCE: IMMERSIVE INSTALLATION
- Install a large sensory 'amniotic sac thing' (i.e. parachute silk, hot air balloon, light & warm womb room)
- If time, or in future workshops install 3-to-5 collaborative projects (i.e. old tents, fabrics)

ACHIEVE: PARTICIPANT CREATIONS
- Ask co-Researchers to create ideas and drawings (i.e. paper, cardboard, plasticine)
- Ask question such as "show me what you are thinking?"

4.3.5. Process Followed & Ethical Issues

The AMNIOTIC SAC event was small scale, with a self-selecting group of co-researchers. It encompassed iterative, heuristic and action research data collection methods to provide qualitative 2D and 3D artefacts and quantitative demographic statistics.

Invitees followed an action research approach in the AMNIOTIC SAC workshop. They communicated their ideas via spatial aids selected to encourage and record responses.

A range of physical materials enabled interactive play. These included paper and coloured pencils to facilitate drawing and writing, instantaneous model making equipment such as cardboard, plasticine, straws with rubber connectors, sticks and

balloons, were combined with proprietary Knex and atom sets. This array of provisions inspired thoughts and designs.

A paper survey was designed and distributed to record textual and demographic data. It asked questions surrounding a person's sensory experience of comfort, security and shelter. Co-researchers were observed as they conversed, played and created objects based around the concept of their first interior membrane in the AMNIOTIC SAC workshop. A photographer circulated and visually documented some of the interactive exchanges.

Research Recipe Card:– concrete idea

Ingredients:
Equipment:-
- A6 Designbook surveys
- Props x 16
- Van HIre

Helpers:-
- Photographer, Camera x1
- Workshop assistants x5

Spatial Aids:-
- Props – TV, Computing
- Storage space

Procedures:
Pre:-
- Obtain workshop venue that can contain 1:1 objects & circumstances
- Gather a mixture of props that will allow different types of experiential interpretations
- Prepare Designbook surveys in A6 paper booklet format
- Undertake focus group that develop through survey questions so that pertinent questions can be set down on paper written

During:-
- Set up object & circumstances props
- Invite Co-researchers on specific days
- Ask them simple questions about their experience
- Thank them for their input

Post:-
- Collate information gathered
- Reuse/ recycle/ repurpose props
- Communicate basic findings with Co-researcher/ collaborators
- Analyse and use findings to develop further insights

Tips:-
- Storage for items
- Help from volunteers
- Planners - Timescales
- Event organization
- Happy face

4.4.1.The Premise and Setting for the COSY Lifecycle Investigations

The COSY workshop and exhibition expanded the AMNIOTIC SAC research by investigating constructs of comfort over a lifetime. An assortment of 1:1 immersive objects and circumstances related to the human experience were installed in an exhibition hall to explore how people use their interior spaces. From foetus to post-burial, this notional human lifecycle research strand elicited real world responses and co-researchers comfort desire-lines were charted.

The workshop was titled COSY, as this onomatopoeic word fosters links to physical, physiological and psychological concepts of comfort. The workshop evolved the action research method employed in the AMNIOTIC SAC research event, refining it into a larger data collection exercise. It expanded comfort theories into praxis to problematise the representation of (in)tangible efficiency membranes.

The comfort trajectories of individuals change over time, and insights into domestic cultural topographies include Teyssot's present-day description of a home being 'anyplace one actually lives, resides, dwells, or travels, including one's bed, sofa, office or vehicle'. Thus, home is designated as a selection of personal objects, which individuals use to subjectively construct comforting circumstances. The designated COSY categories link to these types of concrete situations, objects and circumstances provide familiar sites for communication.

4.4.2. COSY Lifecycle Themes Identified

The experimental COSY research method appropriated anthropological initiation rite characteristics. Hendry delineates how cultures 'mark various stages of development which are regarded as important', such as anniversaries and birthdays, and these occurrences 'reflect the local system of classification of life into

stages' (2008, p.72-3). Van Gennep generalised a 'rites of passage' framework

which entail changes in state. These include, initial 'rites of separation... preliminal

rites'; intermediate 'transitional stage... liminal, or threshold rites'; and finally

'ceremonies of incorporation... postliminal rites' (1977, p.21). COSY reinterpreted life

stages of comfort using this rites-of-passage structure. Figure 47 illustrates how the pre

and post-liminal elements intersperse with the transitional, liminal categories,

creating a lifecycle. Each of the 16 COSY situations denote changing life stages,

without being prescriptive, leaving the workshop co-researchers to negotiate their

own heuristic understandings of comfort in each scenario.

FIGURE 47. COSY RESEARCH STREAM NOTIONAL LIFECYCLE CONTEXT
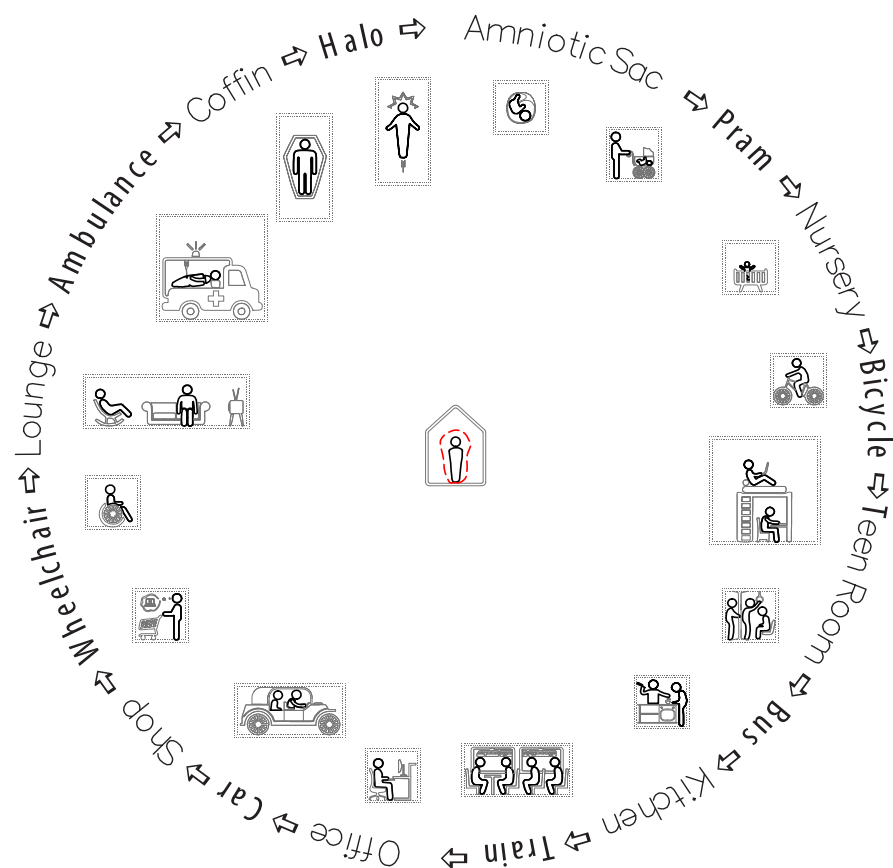
The AMNIOTIC SAC workshop led to the COSY research because the rationale for selecting the lifecycle circumstances started with rites of birth and death, articulated in the Amniotic Sac and Coffin categories. In a radio broadcast Lynch (2016) lyrically describes how 'the surest human rhymes of all' are 'womb and tomb'.

Yet, in relation to comfort and efficiency, when isolating specific life stages, many different products, situations and scenarios could be selected. To proceed, grounded-theory categories were used to narrow choices to suit the venue space and time constraints. 16 objects and circumstances developed as sites for the COSY lifecycle workshop. They included fixed situations comprising: the Amniotic Sac; a Nursery Cot; a Teenagers Loftbed; a Kitchen; an Office; a Shop; a Lounge and a Coffin. The liminal modes of transport between these sites include a: Pram, Bicycle, Bus, Train, Car, Wheelchair, Ambulance and Halo. Depending on religious or faith constructs, the Halo scenario connects back to the Amniotic Sac circumstance creating a circular representation of the COSY lifestory. These categories are considered interior micro spaces that exist between clothes, furniture and the building skin.

4.4.3. COSY Research Procedures; Methods & Techniques

The logistics, organisation and management of the COSY event were complex. Initial proposals involved gathering interview data by conversing with each co-researcher as they progressed around the 16 COSY scenarios. However, this approach relied on vocal and textual paradigms, as well as being time and labour intensive. Earlier research pilot reviews, described in sections 4.1.2.1 & 2 enabled reconsideration of this method.

An interactive approach, where co-researchers directly fed back at each stage by writing or drawing on the exhibits, became more suitable because responses in hard copy would lessen explanatory bias. Case studies of sketched illustrations from child centred health research influenced this procedure. Sociological and health researchers Pridmore and Bendelow, find a 'draw-and-write' method allows 'children to participate including' those 'with special needs' or who 'are unable to do so in the language of instruction' (1995, p.486). These insights helped to expand the audience of the immersive experience, provoking considerations of how to structure visual information. For example, simple illustrations were created so participants who find reading difficult, could still contribute.

Early designs for the immersive exhibition included the use of cardboard cut-outs that would represent the 16 COSY sites on a 1:1 scale. The cardboard would permit rapid installation and dismantling of the exhibition workshop, whilst also enabling co-researcher responses through graffiting the displays. Figure 48 shows some of the card design maquettes for these exhibition display proposals. They were designed to utilise one sheet of cardboard, and folded so that the structure could support itself. The cut out sections would assist in creating a 3D experience.

FIGURE 48. COSY MAQUETTES FOR CARDBOARD DISPLAYS

AMNIOTIC SAC   COT   LOFT BED   COFFIN
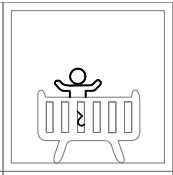
In the run up to the event a range of exhibition design and sponsorship sources were concurrently investigated. Examples of this involved applying to various funding bodies and asking numerous companies to donate products, such as cardboard sheets. Some of these forays were productive, but others involved a lot of frustration.

One example was the coffin object. Undertakers and their suppliers were contacted without success as coffins are "made to order" and transport coffins have "unwanted residue inside". Fancy dress prop companies were approached, but their transport costs were prohibitive. Purchasing a coffin from the Internet was another option, as "death is the one sure thing in life". However, pragmatically the storage or re-selling on of such an item would pose problems. My coffin procurement mission finally ended when a self-built facsimile was constructed in the wood workshop.

In reality, found objects were used in the majority of the 16 COSY event scenarios, and the logistics around these loaned, hired and bought spatial aids, are charted in Figure 49. A service design strategy was implemented when designing, administering and installing the immersive COSY workshop event. Norman gives guidance that 'memory of the whole experience is more important than the experiences of the separate parts'. His principles include managing 'the ending, provide mementos to take home, start strong, and bury unavoidable unpleasant aspects on the middle' (2011, p.207). These guides were followed when the three-day self-participatory workshop event was publicly advertised after securing an appropriate exhibition venue at the University Of Edinburgh within the Sculpture Court.

FIGURE 49. COSY WORKSHOP JOURNEY: IMAGES A.SHAW & O.OJI

SYMBOL | ICON	COMFORT CRITERIA *PROP - LOGISTICS JOURNEY*	PROP | PHOTO
	AMNIOTIC SAC Chosen as an explicit representation of a comfort membrane *Paragliders parachute – Loaned; Poles At High Level - Janitors*	
	PRAM A low-tech customisable product that allows for reactions to changeable environments *Pram – Loaned*	
	COT At this stage children create membranes and structures in the form of wendy houses, boxes, tents & dens made from blankets - differing from what adults provide for comfort *Travel cot – Own*	
	BICYCLE Chosen to gain insights about familiarisation with an uncanny device; globally it revolutionised personal travel, allowing more freedom and mobility to users of all genders and socio-economic status *Fold Up Bicycle – Loaned (secured at closing each day of show)*	

SYMBOL | ICON	COMFORT CRITERIA *PROP - LOGISTICS JOURNEY*	PROP | PHOTO
	LOFTBED in teen-room An age specific object developing the concept of multi-function furniture; creating set circumstances between the realms of rest, work and play *Chairs x 1 – Janitors;* *Bunk Bed With Study Desk - Bought and resold*	
	BUS or tram Public spaces that create a microcosm of personal & social space with competing environmental, social and economic exchanges *Straps & Hoops - Bought and repurposed;* *High Level Pole & Chairs x 3 - Janitors*	
	KITCHEN and dining Considered the 'flagship' or 'heart' of the home in some societies; it is associated with varying degrees of energy use and monetary cost and is the subject of many efficiency studies *Reception Counter – Janitors* *Tap & Chopping Board - Own*	
	TRAIN or plane Facilitates physical, physiological and psychological comfort needs to be met, for example: sitting, standing, eating, drinking, going to the toilet, using mobile devices and Wi-Fi *Chairs x 6 - Janitors*	
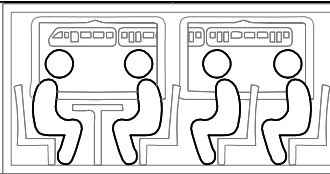
WORKPLACE
Currently undergoing major change through binaries such as analogue or digital; active or sedentary; home or office locations

Chair x 2 & Tables x 2 - Janitors
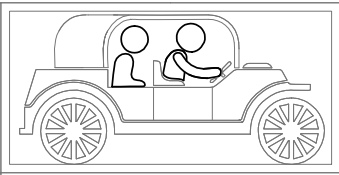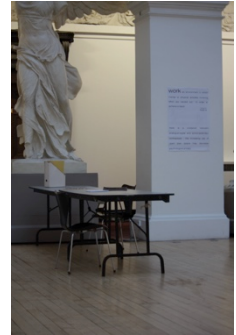
CAR
An explicit example of an exterior customisable personal space for one or more people; associated with large amounts of energy in their construction, consumption and disposal

Steering wheel cover - bought and reused;
Chairs x 5 - Janitors
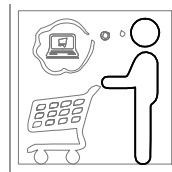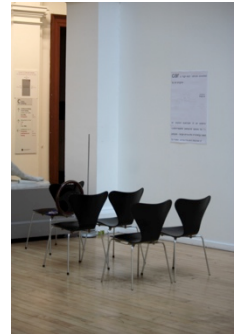
SHOPPING or retail
Links with consumer comfort where, for example, Co-researchers were asked to highlight their entertainment or achievement shopping styles

Basket – borrowed from Sainsbury's (confirmed with store Manager);
Mini trolley - Own

WHEELCHAIR
Where it is judged 'reasonably practicable' standards have instigated disabled access to various spaces – has this allowed for greater freedom of movement within the built environment?

Manual wheelchair - Hired from Charity for duration of event
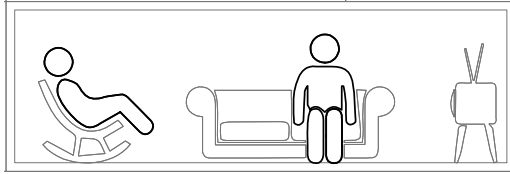
SYMBOL | ICON	COMFORT CRITERIA PROP - LOGISTICS JOURNEY	PROP | PHOTO
	LOUNGE A multi-use, shared, social area with changing activities, customs and rituals associated with this space; new technologies affect, visual, acoustic, and temperature regulation *TV with Real-Fire Playing In Loop – Hired from Q digital & Own;* *Sofa – Loaned for duration of event from ECAfe (confirmed with cafe manager);* *Pouffe & Tray - Own*	
	<u>AMBULANCE</u> or hearse Highly visible intimate spaces, aligned with the healthcare needs of their occupants; this object allows for in/direct health scenarios to inform the research. *Gurney Stretcher – Loaned from Anatomy Department for part of event*	
	<u>COFFIN</u> A tangible representation of a structural membrane; historical customs and cultural rituals influence factors such as its status or materiality, making it applicable to more than just the departed *Chipboard Coffin Without Lid – Own, (constructed using chipboard and reused timber) in storage*	
	<u>HALO</u> A symbolic circumstance, in eastern and western art traditions; it could be expressed as the cultural and visual manifestation of energy in relation to the human form, allowing for allegoric comfort *Laminated Doily Hung at 1.7m – Own*	
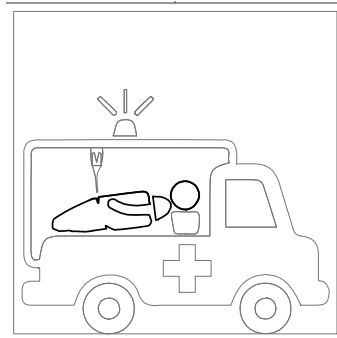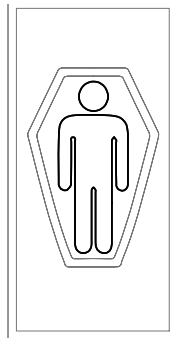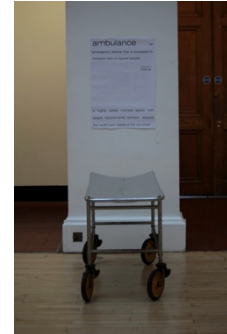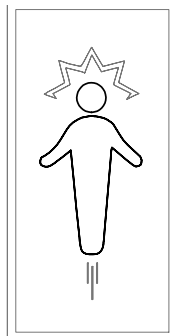
Due to research constraints the COSY and 1:1 GYRO Spaceball experience were merged to maximise resources. The exhibition space allowed for this convergence and its spatial proportions were used to full effect. The Spaceball human gyroscope ride was hired to investigate processes highlighted in Chapter 4.2; but also to create an attraction for the whole event, helping boost co-researcher numbers. Figure 50 illustrates the COSY|GYRO spectrum, which was conceived as a visual device to link the two streams of research. It communicated ideas about changing body positions that correspond to the 16 COSY scenarios and the GYRO concept. Its graphical symbolism alludes to the 'human evolution' illustration. Furthermore, the measuring scale focuses on the head of the person, signifying the mental, as well as physical aspects surrounding comfort and movement.

FIGURE 50. COSY|GYRO SPECTRUM
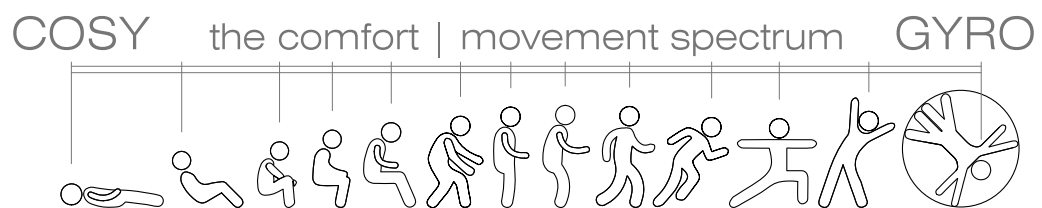
Building-up to the event, theoretical considerations had to be balanced with the practice elements. Research praxis aspects of this pre event process involved managing many different strands; including but not limited to event organisation, marketing, exhibition design, and survey design. These responsibilities ran simultaneously but smaller tasks were delegated where feasible.

The spatial strategy of the COSY workshop and exhibition combined immersive props placed at each arch within the exhibition space. Visual interpretation in an A1 poster format, explained the comfort rationale at each column. These 3D prop objects, and the 2D poster elements linked with the survey

design, which invited co-researchers to draw or write their ideas around comfort in the Designbook at each of the 16 COSY life story scenarios. Figure 51 illustrates how data protection and demographic information was published in a postcard style.

FIGURE 51. COSY WORKSHOP DESIGNBOOK COVER
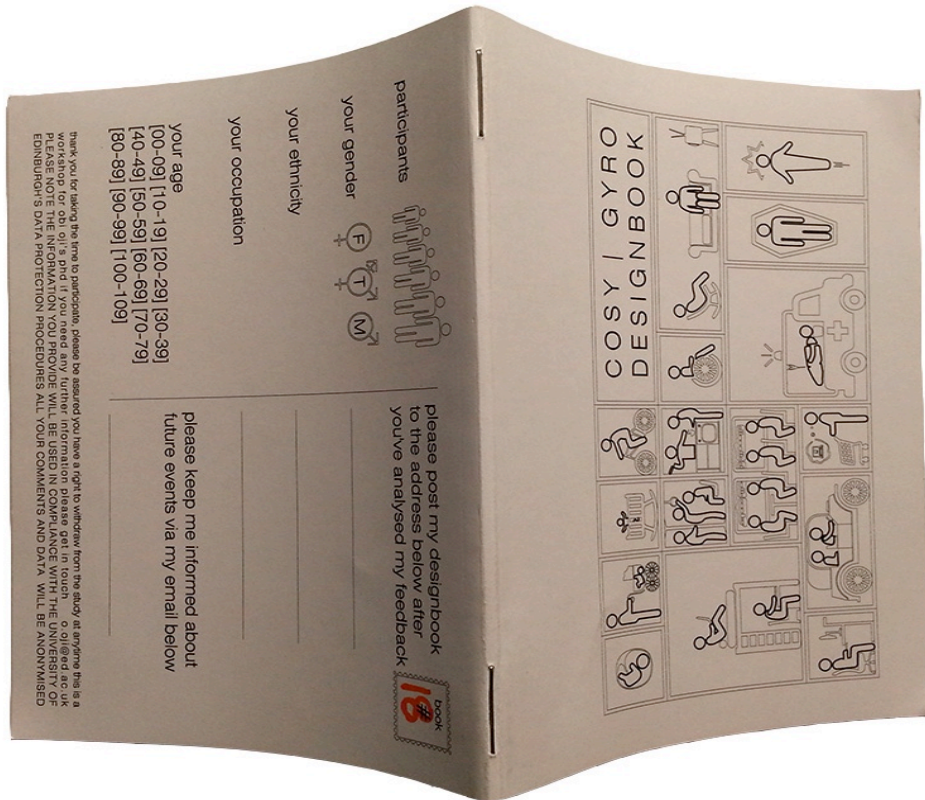
The iterations of this survey booklet design, was one of the praxis elements of the research and is shown in the practice chronicle that accompanies this thesis. In the design of the COSY Designbook, visual researchers Pink and Pauwels' queries such as: 'which kinds of insights are expressed in my visuals that are largely inexpressible in words'; 'what about the interplay of different expressive systems'; 'do the images work together with the words'; and 'does the layout add any meaning' (2012, p.262) were considered in its formation. These questions were also asked in the pre event focus group that responded to earlier drafts of the Designbook. Contributors suggested that questions around comfort and (in)tangible membranes

be rephrased to allow for wider public engagement because words, such as membrane were overtly medical.

Subsequent revisions of the Designbook used plainer English to prompt comment, such as the instruction page which stated, "please scribble down your responses in images or text... be assured there aren't any right or wrong replies YOU ARE THE EXPERT". This textual clarity also fed into the icons illustrating each life-stage, making clear that the human form was the priority without using words.

For input at different intensities co-researchers were guided into prioritising the right hand pages for each of the 16 COSY life stages. This page asked the principal question of "what would improve your comfort in this situation?" If they had time constraints co-researchers were advised to omit the left hand page, which elicited supplementary feedback by asking more varied questions around human-environment interactions. These were formulated as an assortment of questions concerning ergonomics, environmental conditions, operation, organisation, functionality, posture, robustness, marketability and perceived quality. These sensory questions facilitated the articulation of contributors' (in)tangible desire-lines.

Therefore, co-researchers in the COSY workshop and exhibition could engage at four different levels. The first was the experiential Props; the second was the Interpretation rationale; the third was the Designbook's right-hand page; and the fourth was the Designbook's left-hand prompt page.

4.4.4. Proceedings of COSY Workshop and Exhibition

As planned, the COSY event objects were delivered and set up by a team of Helpers. On opening, co-researchers interacted with the workshop and exhibition at different levels. Figure 52 shows the workshop in progress within the Sculpture Court.

FIGURE 52. COSY WORKSHOP

The main influx of visitors came on the second day of the workshop, in conjunction with the scheduled human gyroscope ride. Photographs were taken to document the process and co-researchers completed the Designbooks whilst immersing themselves in the physical objects and circumstances alongside the exhibition interpretation. Many co-researchers were interested in the kinetic items, such as the bicycle and wheelchair. As planned, people played with the objects while working out how they would respond to the questions posed.

On the closing afternoon the event was dismantled with helpers. The COSY spatial aids were disposed of by implementing closed-loop principles where possible. They were returned if borrowed, reused or repurposed, and recycled in charity shops or resold.

4.5. Research Procedures Chapter Summary and Developing Themes

This chapter chronicles the research procedures and progresses the subject topic, which asks "how do people construct comfort in their interior spaces?"

Each procedure iteratively informed subsequent events. The visceral sense-based discourses of the GYRO and its proprioceptive movement sparked investigation of the AMNIOTIC SAC membrane. Rather than developing this GYRO element as an object per se, a problematising approach instigated new perspectives and research activities. These were observed in the COSY lifecycle

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workshop that problematised human movement and its relationship to the arrangement of objects and circumstances that enhance comfort. Individual and group desire-lines were marked out and these are analysed next.

Procedurally, as each workshop concluded they were evaluated iteratively to feed into the next stage of the research journey. Consolidation of each of the GYRO, AMNIOTIC SAC and COSY research streams made the masses of data gathered more economical. This process aided the analysis, but also logged disconnects in what people were saying and doing. Critically, in this type of experimental data collection hindsight revealed where deviations occurred.

In the next chapter, the inputs and outputs of my visual and textual forms of communication and data gathering tools are analysed to map the (in)tangible membranes and their relationship to constructs of comfort and movement.

5. ANALYSIS

5.1. Analysis Foreword

In this PhD-by-practice research, subject topic, methodological and procedural themes have been presented to address the question of "how do people construct comfort within their interior spaces?" Figure 53 shows the structure of this chapter, which critically analyses these research procedures and their interconnections. The synthesis of these elements are developed in the following Insights Chapter 6.

FIGURE 53. FLOW DIAGRAM SHOWING ANALYSIS CHAPTER STRUCTURE

5.1. Analysis Foreward
Interpretation Structure
Scope

5.2. Individual Research Stream Analysis
Subject topic and research method analysis of the
GYRO, AMNIOTIC SAC and COSY investigations

5.3. Interrelationships Between The Three Research Streams
Subject Topic Cross-Fertilisations
Research Method Fusions and Justifications

5.4. Demographic Analysis
Patterns evidenced in the Data
Individual and Group Desire-lines

5.5. Summary of Analysis
Main Findings
What will it contribute back to the Design Field?

5.1.1. Interpretation Structure and Scope

When compiling the mass of practice and theoretical data collected into a coherent whole, interpretive decisions have to be implemented. Film, dance and theatre academic Saldaña outlines a qualitative analysis continuum, where at one extreme, all fieldwork detail is contemplated because 'it is from the patterned minutiae of daily life that we might generate significant social insight' (2013, p.15).

The contrasting strategy selects only a portion of the data for analysis whilst the rest is abridged or discounted. In this research context, where a surfeit of data was accumulated, an interpretative demographic lens was applied. Some less important potential results could not be fully matured - a necessary compromise due to limitations of time, money and human resources.

When analysing demographic, individual and group contexts, responses to comfort may be relevant only at certain points in time. Psychologist Walker, explains this by recognising that 'we don't just find variety between people, we also see variation within people' (2010, p.9). Whilst Murray and Chamberlain state that, 'there are as many ways of interpreting experience as there are individuals to interpret it' (1999, p.207). In action research they go further by implying that 'the researcher's voice is only one of many in the construction of knowledge... an iterative spiral of practical and critical reflection' (ibid, p.215); advocating that new research knowledge should establish perspectives that 'shift from measurement to understanding, from causation to meaning, and from statistical analysis to interpretation' (ibid, p.7), requiring holistic and contextual evaluation.

However, from a researcher's perspective, the interpretation of experience is subjective, so it is fundamental to develop a critical viewpoint. Rendell expands this by stating that 'critical theories aim neither to prove a hypothesis nor prescribe a particular methodology or solution to a problem'. They aim to modify inequities of 'market capitalism... patriarchal and colonial (or post-colonial) interests' by not just dwelling on 'existing conditions, but also to imagine something different' (2006, p3). These wider societal imbalances have implicitly motivated and influenced my research stream choices. For example, the GYRO imagined a different future via a product that could enable rest, play and work in an efficient bubble. The AMNIOTIC

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SAC queried how our original space impacts our future notions of comfort from a non-gendered viewpoint; and COSY expanded on this by modifying the focus to consider our comfort trajectories across a lifetime.

When reflecting and redefining the concepts in this study, the data collected identified experiential understandings of the invention of comfort through (in)tangible membranes between clothes and the building skin. The subject topic was iteratively problematised via heuristic research methods. These experimental techniques evolved so that data gathering exercises could represent individualised and collective efficiency routines - evidencing the constructs of comfort desire-lines.

Representations of co-researchers' comfort membranes were mapped in images and words. Patterns such as the repeatability of these relationships are delineated in the AMNIOTIC SAC and COSY analysis sections. General analysis themes in the data include representations of the (in)tangible membranes between a person's clothes and the building skin. These typologies demonstrate the dynamic human explicit and implicit notions of comfort and movement.

Importantly, surveys and articles completed in the immersive environments allowed individual and trend results to be identified. As Moustakas clarifies, 'two or three exemplary portraits are developed, profiles that are unique to the individuals yet characterize the group as a whole' (1990, p.50). These distinctions then allow for individual longitudinal responses to feed into wider research insights. The next sections analyse the data from a range of perspectives.

5.2. GYRO, AMNIOTIC SAC & COSY Subject Topic and Research Methods

The results and discussion of the three workshops will be considered in this section. Figure 54 visually sites the research streams within an everyday format.

The GYRO is placed within an interior and can be seen as a direct membrane between clothes and the building skin; the AMNIOTIC SAC is enclosed within the womb; and the multiple COSY research scenarios are repositioned within an urban environmental context.

FIGURE 54. SEPARATE ANALYSIS OF THE 3 RESEARCH STREAMS
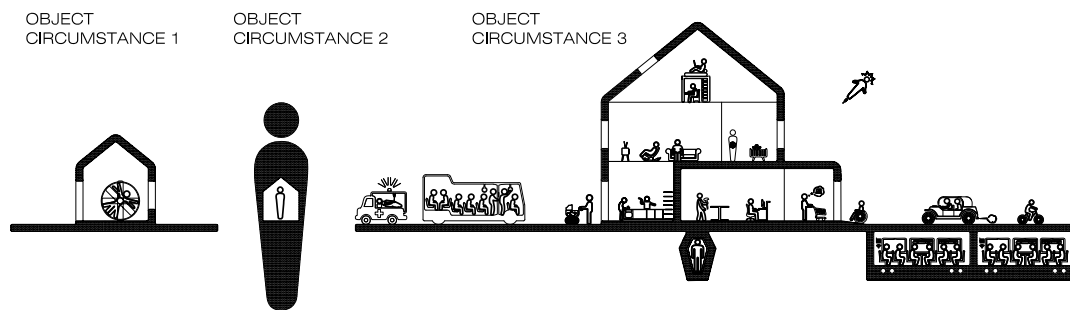
Similar to chapter 4 the three research stream analyses in sections 5.2.1, 5.2.2 and 5.2.3 are prefaced by a "research recipe card" which summarises the "methods" and "results" employed in each research stream.

Research Results

Card:– conceptual

product
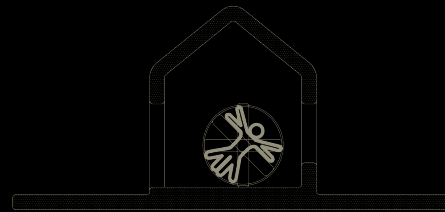
Maquettes and Models:- Feedback from 17 co-researchers

Immersive Spaceball Ride:- Feedback from 34 co-researchers

In the GYRO research stream my design drawings and models were used to gain feedback about this sleep|relax|work invention. In addition to these a human 'Spaceball' gyroscope was hired to elicit additional responses. The results report the maquette prototypes, and then the immersive ride.

5.2.1.A.   **GYRO Maquettes Results**

The GYRO stream initially involved the design and construction of 1:5 and 1:20 scale models to communicate its functional modes. Descriptive analogies for the GYRO are scarce as comparative products are not widely available, so unstated responses to the concept such as "hmm" were common. Furthermore, the scale models omitted the experiential nature of the concept.

There were 17 recorded reactions to these maquettes from lay-people and interdisciplinary peers at the Metabody conference and these individuals gave feedback. GYRO model Respondent 7 asked, "what type of creature would represent this concept?" My initial response was to give a snail or tortoise as a response, but these are fixed instances. On reflection, the dynamism of the GYRO corresponds more with a creature with a movable exoskeleton such as a beetle or woodlouse. This theriomorphic metaphor could also correspond to creatures that shed their skin as the outer membrane of the device has a retractable skin.

Another specific question by GYRO model Respondent 8, included queries about the type of cords and weaving used in the inner hammock elements of the device. This is where the occupant would be suspended and GYRO model Respondent 10 suggested investigating "animals that go into a cocoon, such as the Ghanaian weaver bird" as a biomimetic precedent. My portrayal for this intimate membrane was a soft, strong, smart material with haptic qualities that simulate skin.

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However, these discourses enabled me to gain wider perspectives of the GYRO concept, generating opportunities to explore in subsequent research. Appendix 3 charts the Respondent feedback and my analysis of these smaller models. Heuristic themes studied responses such as qualities of experience and were evaluated using positive and negative attributes. 65% of the respondents recorded a positive dimension and 17.5% each, for negative and ambiguous responses.

The maquette feedback fed into perceptions of personal and intimate spatial relationships with the GYRO space. These were conveyed via psychological 'Feelings & Thoughts' and physiological 'Bodily States' constructs. Figure 55 defines the types of membranes the GYRO models provoke.

FIGURE 55. GYRO MAQUETTE FEEDBACK ANALYSIS (SEE APPENDIX 3 FOR DETAIL)

POSITIVE MEMBRANE QUALITIES
Function, Weight, Delight, Equilibrium, Pulse, Resistance, Cosy, Enclosure

•**Physiological Feedback**
Accessible, Utility, Adjustment, Ergonomic, Pressure, Pleasure, Floating, Balance, Thermal, Regulation
•**Psychological Feedback**
Practical, Water, Decelerate, Intimate, Soft, Restrictive, Held

NEGATIVE MEMBRANE QUALITIES
Strange, Instability, Distress

•**Physiological Feedback**
Unstable, Dizzy, Discomfort, Pain
•**Psychological Feedback**
Uncanny

Thus, when delineating the concept of personal membranes, the elements of a future GYRO product or service would include the positive qualities highlighted, such as functionality, weightlessness, delight, equilibrium, pulsing, resistance, cosiness and enclosure. The adverse instances of strangeness, instability and distress would also be used constructively to guide future design development.

5.2.1.B.   Gyroscope 'Spaceball' Immersion Results

Appendix 4 highlights co-researcher responses to the experiential 1:1 'Spaceball' ride, which records Responders 21-55 reactions to the 1:1 gyroscope and my discourse analysis. Proportionally, 63% of responses were physiological, with 37% linking to psychological reactions. Figure 56 shows the feedback.

FIGURE 56. 'SPACEBALL' RIDE FEEDBACK ANALYSIS (SEE APPENDIX 4 FOR DETAIL)

POSITIVE MEMBRANE QUALITIES
Function, Weight, Delight, Equilibrium, Pulse, Ocular, Quicken, Motion, Delight, Enclosure, Wellbeing, Cosy, Expectation, Release

- **Physiological Feedback**
  Ergonomic, Pressure, Pleasure, Floating, Balance, Gravity, Thermal, Visual, Acceleration, Rush, Stimulate
- **Psychological Feedback**
  Swaying, Elation, Pleasure, Held, Comfort, Soft, Desire, Anticipation, Relief

NEGATIVE MEMBRANE QUALITIES
Strange, Distress, Dependent, Instability, Repulsion

- **Physiological Feedback**
  Unstable, Dizzy, Nausea
- **Psychological Feedback**
  Uncanny, Discomfort, Pain, Unhappy, Anxiety, Helpless

When evaluating the "before" and "after" feedback on this gyroscopic ride, the sequence of the pre-to-post "qualities of experience" column assessed positive (+) or negative (-) attributes. Appendix 4 shows that 66% of the respondents had an improved experience and 11% had an adverse reaction. 3% remained totally positive, 9% negative, and 11% were ambiguous. Diagnostically, people with extremely negative associations about this ride may not have come forward; but, the responses also show that people are willing to try out new circumstances even if they have negative "pre" associations.

As with the GYRO models, both the positive and negative reactions or experiences provide insights into respondent's comfort desires in relation to this object and circumstance. Utilising this feedback, a future GYRO product would incorporate additional positive membranes that incorporate visual, motive, release, expectation and wellbeing qualities of experience.

Ambiguities such as expectation and anxiety, would need to be carefully managed. Some of the negative responses such as repulsion or distress, were a direct response to the fast moving, fairground ride type of motion generated by the hired gyroscope. In the context of this thesis, my conceptual GYRO product would move slowly to avoid any dizziness and nausea.

5.2.1.C.   What this GYRO Concept Adds to Existing Knowledge

In both the GYRO maquettes and gyroscopic 'Spaceball' ride, human centred personal and intimate space membranes were experienced by people with initially negative comfort ideas but these changed on further immersion. Physiological and psychological states of being, such as equilibrium, pulsing, cosiness, and enclosure are integral to the inner hammock and outer cocoon GYRO membranes. Gradations of 'Resistance' when the GYRO moves, or 'Pressure' within the hammock membrane could be calibrated to the individual. For example, in potential use in a healthcare environment, a patient may need slower mechanised locomotion and less compression to alleviate pressure sores or sensitive body parts.

Within the constraints of existing door portal sizes, each GYRO could incorporate the limb measurements of its user in its assembled proportions. This aspect extends current product choices in mattresses or sofa's that include varieties of density and width, within standardised dimensions. What is normal for one person

can be too large or small for another - this intimate tailoring customises the GYRO. These choices would be designed into its manufacturing and production processes.

The wider social implications of the GYRO space connect to the "events & situations", and "time & space" categories. Figure 57 places these qualities into the United Nations sustainable framework of 'economic development, social development and environmental protection' (2005, World Summit Outcome, p.12).

FIGURE 57. SOCIAL FEEDBACK FROM GYRO MAQUETTES & SPACEBALL RIDE

ENVIRONMENT
•**Manufacture**
Object, Potential, Production
•**Materials**
Biomimetic, Technical
•**Spatial**
Origin, Interior, Site, Outer, Perspective

SOCIAL
•**Timescale**
Childhood, Older, Phased
•**Efficiency**
Utility, Adjustment
•**Associations**
Solitary, Relationship,
Control, Protection, Water

ECONOMIC
•**Industry-Sector**
Healthcare, Active
•**Marketing**
Label, Legal, Trademark
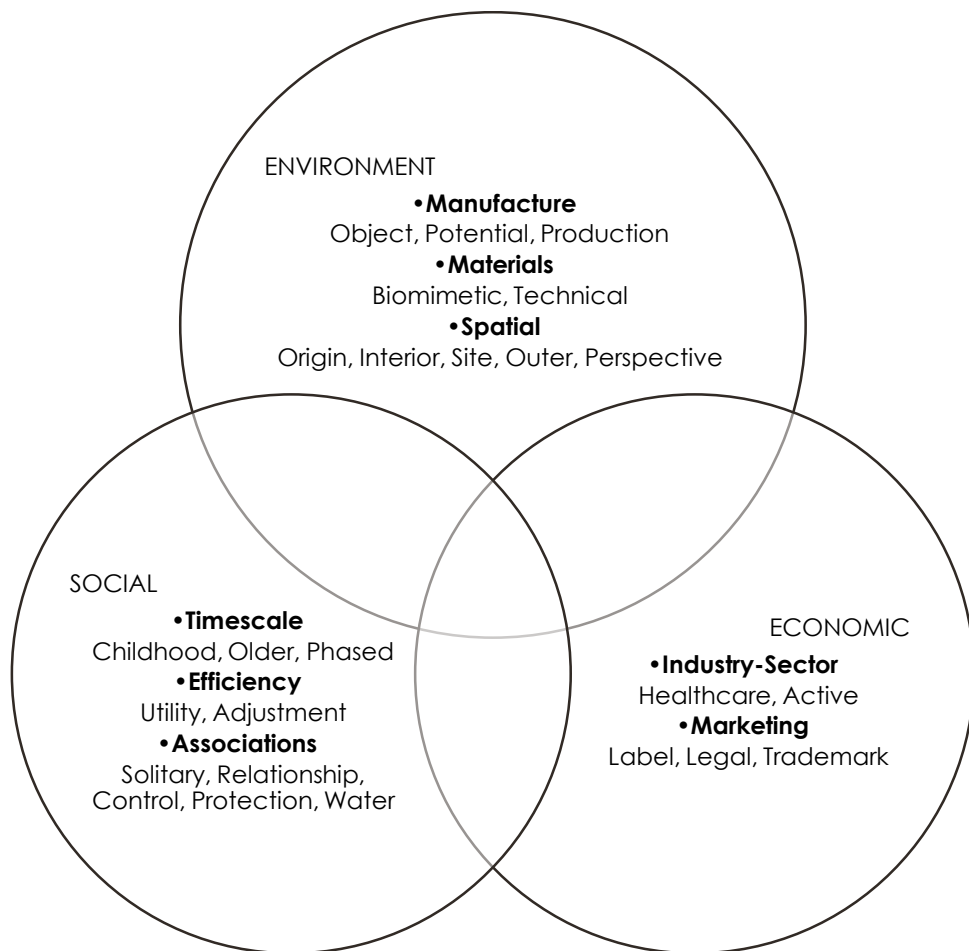
Future sustainable explorations of the GYRO may focus on space saving trends by substituting a single space for a bed, sofa and desk. The GYRO's middle ring is designed to fit diagonally through an existing door portal - the larger outer ring as a half circle facilitates this. When not used, the structure could be flattened

against a wall, creating more space. This smaller imprint could streamline bedsit or studio apartments in Inner living scenarios. Other living space applications include advancing its wider use in Outer gardens, and Astral space exploration situations.

The service and maintenance of the GYRO could extend to re-adaption groups. Users could modify their devices in-line with technological advances; or strip down and overhaul their GYRO's fostering a cradle-to-cradle product lifecycle and a personal bond with the object.

Such qualities of the GYRO correlate directly with the efficient use of social, environmental and economic energies in interior space. These explorations show how the proposed GYRO concept generates future discourses into interior comfort through embodied and theoretical constructs. It develops a functional interior design product circumstance with energy efficiency in its conception, as illustrated by my models and service design ideas. The GYRO research stream proceeded from conceptual design to simulation; resulting in feedback, leading to constructive criticism and analysis. The progress of this innovative GYRO idea, into the repertoire of metamorphic furniture adds to existing knowledge by advancing a new construct of (in)tangible comfort membranes between clothes and the building skin.

5.2.1.D. GYRO Limitations - You Have To Get In It, To Get It.

The GYRO concept cannot easily be equated with other furniture whilst the integrated membranes add further complexities to the idea. The lack of familiar experiential precedents presents a challenge although many GYRO participants were able to move from negative feelings before the experience, to positive ones afterwards. However, the immersive nature of the concept needs further exploration.

Both the smaller scale models and 'Spaceball' ride provided considerable research insight. Specific responses to the GYRO concept were 65-6% positive; possibly more familiarisation could potentially increase this. However, the rapid movement and upside-down position of the gyroscope ride distorted the negative feedback as strong physiological responses were recorded such as 'Pain', 'Dizziness' and 'Nausea'. The other comments about it being 'Unstable' and 'Uncanny' can be rationalised because the GYRO concept is still unusual. Inhabitants would have to become accustomed to the spherical physicality of the device, which may prompt new body positions and mental states. A slower moving 1:1 or 1:2 scaled sleep|relax|work prototype could be constructed to gain these potential interactive reactions to the GYRO concept.

The GYRO research procedures enabled me to concede that it was not the solution to my research question. It was conceived as a direct manifestation of my research topic, being an innovative object and circumstance that could foster human and product efficiency savings. However, it correlates with Murray and Chamberlain's example of early psychological research where data was 'used to promote the smoother working of society without critiquing its underlying ideology' (1999, p.4). Critically, the GYRO concept partially sidestepped the research issues by responding to symptoms rather than causes relating to the constructs of comfort in the interior and energy use.

So, rather than getting caught up in a fix-it, problem solving, product prototyping, research and development exercise; the GYRO concept emerged as a channel for my research practice. It influenced this study in unanticipated ways as investigations about human comfort and movement within this spherical membrane directly sparked the AMNIOTIC SAC research stream.

5.2.1.E.   GYRO Research Method Discussions

The outcomes of this research stream were evidenced in maquettes and models to communicate this conceptual GYRO product idea. Furthermore, the 1:1 scale scenario was limited to a gyroscopic ride. Nevertheless, a human scaled prototype of the GYRO product concept would have enabled more direct, experiential feedback about this physical construct of comfort.

My design Practitioner background stimulated me to pursue potential opportunities. The prototyping process, highlighted in Figure 58, would have included industrial standards of visual to pre-production prototyping (http://www.design 2market.co.uk/prototyping.html 20/04/2016,18:56).

FIGURE 58. INDUSTRIAL PRODUCT PROTOTYPING PROCESS
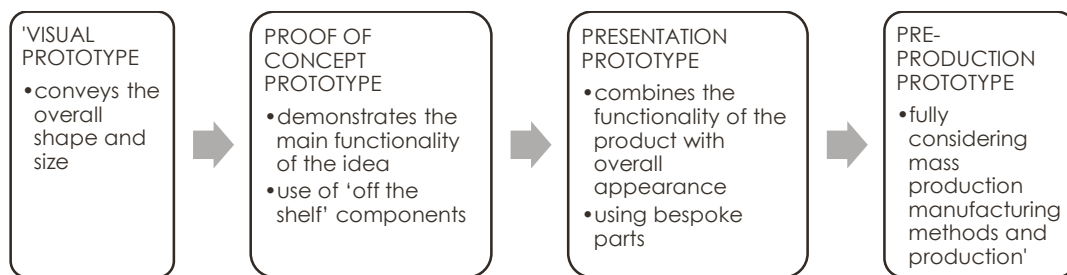
However, pragmatically it can take years to develop a product and this PhD framework was unsuitable to pursue this style of prototyping process. For instance, in reality the kinetic precedent of the Falkirk Wheel took 5 years for an interdisciplinary team to design and engineer it. Therefore, Michael and Seale's advice on analysing research by altering our perspective from 'product' to 'process' (2011, p.609-10) was observed.

This GYRO research stream advanced to the second prototype stage. Elements of the last stage such as mass manufacture have been considered from the outset in the fusion of new technologies with more traditional furniture making

methods. These ideas are featured in the design and construction of the 1:5 GYRO

model where laser cut plywood and metal would form the GYRO structure illustrated

in Figure 59 and discussed in Chapter 4.2.4.

FIGURE 59. GYRO PRODUCT PROTOTYPE
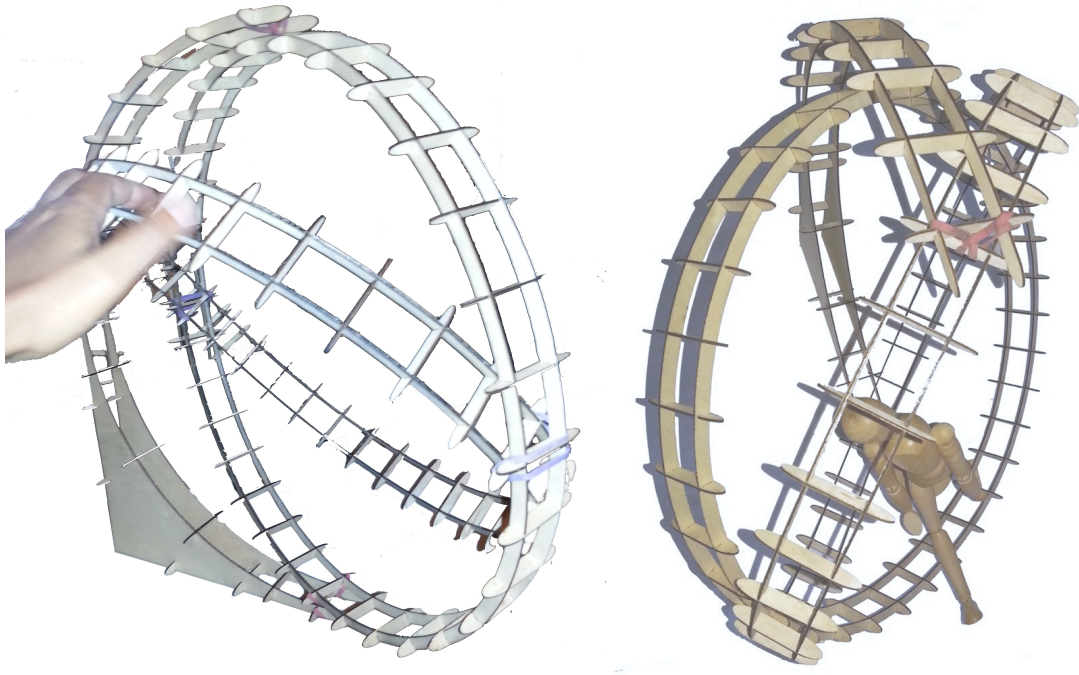
Strategically, a research opportunity had the potential to alter the

development of my GYRO research stream, because it gained early approval for

inclusion in the 2016 Edinburgh Science Festival. In discussions with my Supervisors,

issues surrounding this potential opportunity were articulated; they believed it could

easily become unmanageable and would add to my already sizeable data stock.

My practitioner bias was to seize this chance to actualise the GYRO concept at a 1:1

scale, so it could be experienced and allow for invaluable feedback. If framed as

an investigational research concept, potential co-researcher and press would

understand that this prototype would be a sketch - not a slick finished product.

To effect this work various interdisciplinary, industry based professionals were contacted including: mechanical and structural engineers, fabrication and assembly manufacturers and the event organiser. However, the feasibility of progressing the GYRO prototype within the timescale of 3 months became unrealistic. For example, if the general public were interacting with this unknown product, structural certificates and other technicalities would be required. These logistics alone presented sufficient difficulties, aside from physical constraints, so this opportunity did not materialise at this time. Nevertheless, when considering the 'So What' question of the research outcomes, these explorations may become a future direction.

Research Results Card:- Origins of Comfort

Interactive Charette Workshop:- Feedback from 26 co-researchers

5.2.2.A.   **AMNIOTIC SAC Charette Workshop Results**

The AMNIOTIC SAC research stream progressed as an immersive, action research method of data collection. Co-researchers were "invited to explore metaphorically ideas of the first interior space that we all experienced, your amniotic sac membrane and placenta". They were given a selection of materials to make, draw or write about their conceptions and were asked "could you create another?"

There were 26 self-selecting respondents to the event, 19 females and 7 males, with one responding via email after receiving an electronic survey on request. Co-researchers took an active role; conversing, interacting with the immersive installation, filling the surveys with sketches or writing, and creating objects and maquettes that physically articulated their reactions to the questions posed. In some of the 2D and 3D feedback, representation of the human form was documented, providing an awareness of scale and situation. Charting these nuances was considered important because they would have been inexpressible in words.

5.2.2.B.   **The Main Findings of the AMNIOTIC SAC research stream**

The AMNIOTIC SAC survey responses are documented in Appendix 5 and Figure 60 illustrates the 3D creations. Co-Researcher responses contained unique data that were categorised into physiological and psychological variants to gain heuristic insights into the AMNIOTIC SAC. This feedback included the use of covers and cushions for thermal and static comfort; but interestingly, co-researchers did not comment on gustatory or toilet comforts.

FIGURE 60. 3D RESPONSES TO AMNIOTIC SAC CHARETTE

Some specifically noted sensory comfort in relation to 'childlike' freedoms portrayed as 'weightlessness', being carefree or having 'financial' security; whilst others noted that comfort was a 'state of mind'. In this study, psychological responses were considered most important, but least explicit, in relation to comfort and efficiency.

Themes of comfort were identified in the objects with the descriptions of 'containers' or being 'enveloped' and 'wrapped'. They also took the form of protective cocoon, nest or tent like structures, while in contrast others appeared to focus on angular and sharp expressions, reaching for wider space. Some explanations for this dichotomy could be found in the textual responses where AMNIOTIC SAC Respondent 25 expressed that "I would not now find being in a tight confined space, very turned in on myself and dependent on another being for everything comforting". This can be juxtaposed with the same individual giving a more positive statement regarding the space as "a place of safety and growth... limited... purposeful time".

These dualities coincide with Lefebvre's observation that the 'individual is most generally found at the intersection of two roads: he can either return inward, towards a cocoon, the original space (the womb, home), or cut the umbilical cord and set out for open space with all its attendant risks' (2014, p.107). These themes of (dis)comfort reflect the ambiguities of dependence and autonomy.

Contradictory positive and negative reactions to the AMNIOTIC SAC research event could also be linked to respondents focusing on conceptions of birth and postnatal discomfort, rather than recollections of prenatal comfort within this space. For example, AMNIOTIC SAC Respondent 15 related a recurring stressful dream that they considered to be a memory of the early stages of birth "I couldn't

control my body and I'd be swished around as if on a fairground ride" adding that this "seems at odds with the expected feelings of safety and comfort".

Maslin gives an experiential psychological account that characterises early emotional development, with its emphasis of the separation event of birth; this relates back to psychoanalytic literature discussed in Chapter 4.3. She describes that in utero, the Embryo is dependent on the mother 'for all the elements that it needs for physical growth'. After birth 'the baby will experience and re-experience the physical shock of separation from the mother's body'. As the cyclic actions of feeding, changing and sleeping are no longer involuntary the baby learns to communicate with its caregiver to satisfy its needs. This reaction repeats until the child appreciates its needs are adequately met so that emotively, 'separateness is no longer a shock' in its new condition as 'a separate entity' (2013, p.17-8). Prenatal dependence on the mother for comfort is supplanted postnatally by learning to autonomously communicate comfort needs.

Physiological aspects of comfort that were recorded in the AMNIOTIC SAC workshop included the concept of a hug. AMNIOTIC SAC Respondent 17 described "being touched on all sides, like a cuddle". Furthermore, co-researchers explained how comforting items of clothes, gently squash them; and the comfort of a hug can be evidenced in the tender squeeze experienced as part of the embrace.

This motion, manifest as pressure, can directly link to the spatial bounds of the womb. The AMNIOTIC SAC circumstance could be considered the origin of this construct of comfort. Potentially, this aspect of comfort and pressure may mimic feelings of psychological and physiological warmth. For example, the comfort of a duvet's weight may be one factor that stimulates warmth; however, if 'pressure' could replace 'weight' a novel type of bedcover could be devised.

The experiential perceptions recorded in the AMNIOTIC SAC workshop by co-researchers are recorded in Figure 61. It classifies the 2D and 3D feedback in order to analyse what types of membrane qualities inform lifelong comfort.

FIGURE 61. PSYCHOLOGICAL, PHYSIOLOGICAL AMNIOTIC SAC COMFORT MEMBRANES

Psychological
- Limited, Purposeful, Childlike, Financial, Privilege, Wellbeing, Spirituality, Un/Conscious, Oneself, Family, Friends, Partnership

Physiological
- Growth, Sustenance, Envelope, Cocoon, Orientation, Weightlessness, Muscles, Temperature, Ventilation, Fluid, Vacuum, Swaddling, Acoustic, Textile (Touch), Colour (Visual), Distress, Inside/Outside

MEMBRANE QUALITIES INFORMING LIFELONG CONSTRUCTS OF COMFORT
- Time, Security, State-of-mind, Relationships, Development, Shelter, Proprioception, Thermal, Pressure, Senses, Delivery

These fundamental comfort paradigms associated with the AMNIOTIC SAC membranes can be considered to influence future qualities of comfort. It is postulated that unconscious desires influence subsequent use of spaces and circumstances. In this guise (in)tangible comfort motivations are analogous with the concept of desire-lines. For instance, psychologist Maslow's hierarchy of needs can be used to contrast with the membrane qualities expressed by the AMNIOTIC SAC co-researchers. Figure 62 presents an amalgamation of the intimate, personal and

social comfort characteristics evidenced in the AMNIOTIC SAC workshop into a comfort bubble zone; juxtaposing it with Maslow's pyramid hierarchy.

FIGURE 62. AMNIOTIC SAC COMFORT MEMBRANE QUALITIES V'S HIERARCHY OF NEEDS

SOCIAL
•Time,Delivery,
Development

PERSONAL
•Relationships
Shelter,Security

INTIMATE
•Proprioception
Senses,Pressure
State-of-mind
Thermal

Self Actualization

Esteem

Love

Safety

Physiological'

(Maslow et al. 1943, p.372-82)
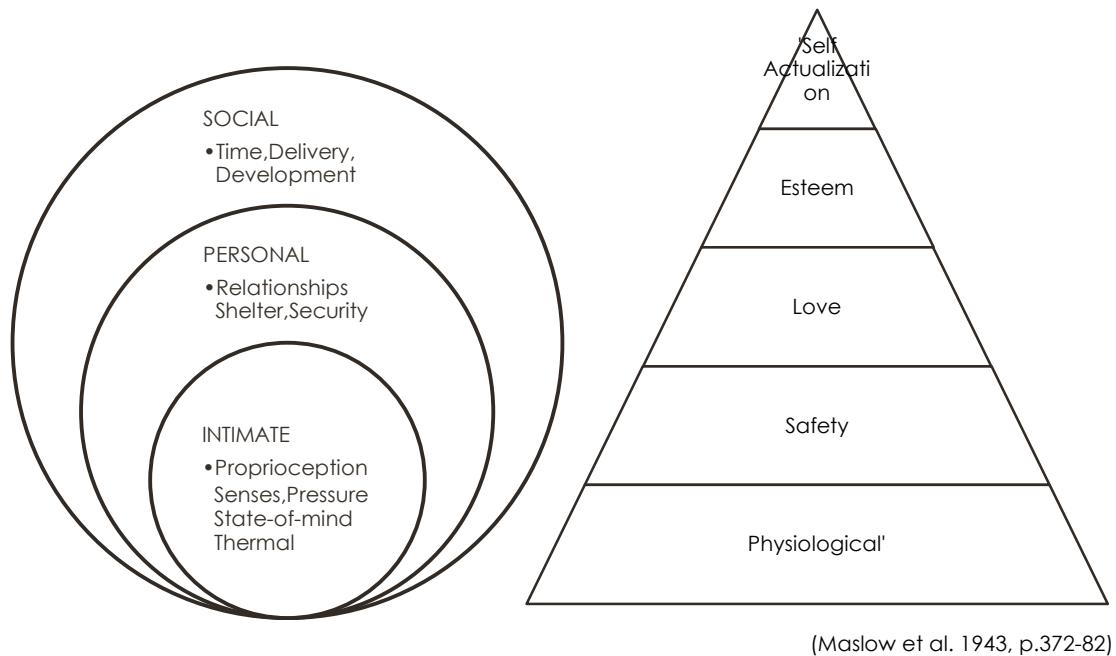
Maslow et.al's theory sets up a list of basic to complex needs, each level has to be consecutively negotiated to proceed up the levels. Distinctly, he classifies these as motivational goals, rather than instigating drives – the latter correlates more with desire-lines. The needs flow from 'physiological... safety... love... esteem' to the summit of 'self actualisation' (1943, p.372-382). Major critiques of this theory criticise its sequential nature, and the order of identified needs. In contrast, the interconnectivity of the AMNIOTIC SAC comfort membrane zones, correspond with multi-level identifications of the prenatal situation that can be transposed to later life. Maslow's linear pyramid theory fails to consider the changing complexities and inter-relations between each comfort desire expressed in the Figure 62 bubble.

If comfort desire-lines are related back to this 'universal' AMNIOTIC SAC spatial interior, it should be possible to project forward to articulate our constructs of

comfort throughout life with added input from life's experiences. These
circumstances are explored in the following section through life-sized props.

5.2.2.C.   **What this AMNOTIC SAC Study Adds to Existing Knowledge**

Metaphysically, the AMNIOTIC SAC comfort membrane bubble zones
illustrated in Figure 62 can become a comfort metaphor, correlating with Sloterdijk's
AMNIOTIC SAC analogy of a 'lost twin' or 'guardian angel' (2011, p.327). This new
bounded atmosphere of the AMNIOTIC SAC comfort membrane, would have
interdependent qualities that encase a person throughout their life. These
(in)tangible elements include, mind-set and sensual intimacy; personal connections,
sanctuary and safety; and social phases of progression and release. Instead of the
paradigm where of the AMNIOTIC SAC membranes are physically and
psychologically discarded after birth; the symbolic AMNIOTIC SAC bubble metaphor
would consciously become a life-long companionate membrane, developing
metaphysical comfort for people.

This metaphoric 'AMNIOTIC SAC bubble' would psychologically enable
individuals to consider and communicate their trajectories or efficiencies of comfort.
For example, co-researchers' comfort desire-lines are interpreted in Figure 63. It
shows the visual re-assembly of the AMNIOTIC SAC workshop feedback in relation to
the human form. When the membrane representations are collated in this way, the
comfort membranes are primarily located interstitially, within the bounds of clothes
and the building skin. There is only one representation of clothes, shown in the woolly
jumper with sheep; and one representation of the building skin in the archetypal
frame of a house.

FIGURE 63. REPRESENTATIONS OF (IN)TANGIBLE AMNIOTIC SAC MEMBRANES
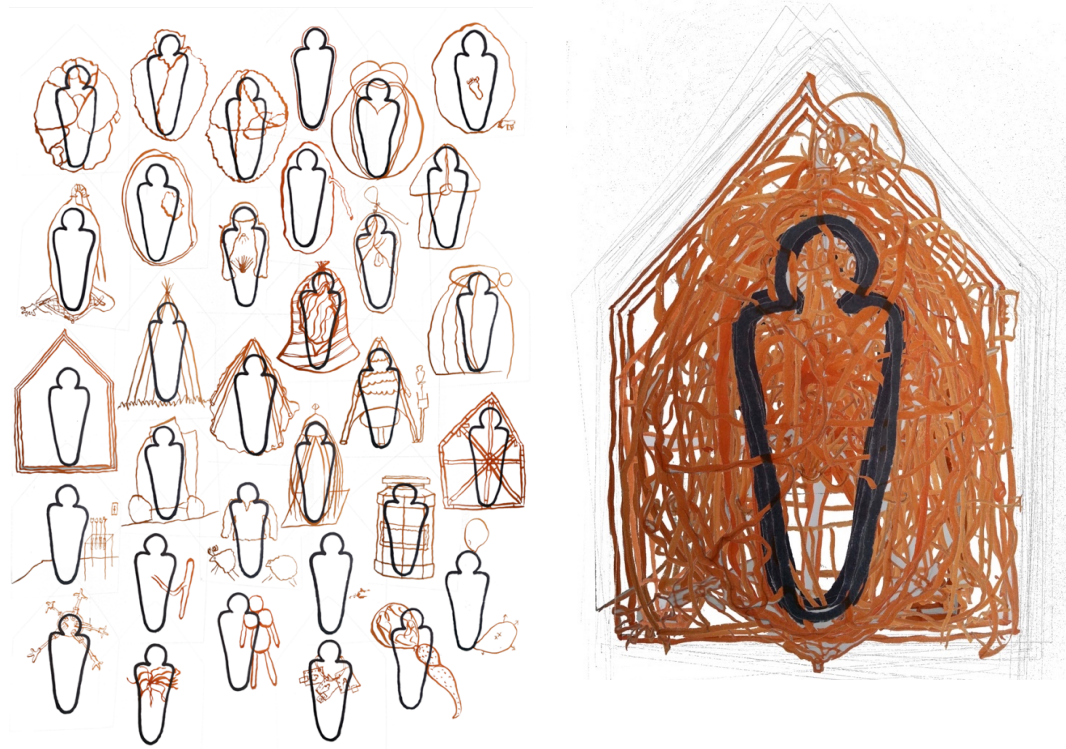
These insights are significant because in grouped data analysis, co-researchers are choosing, or attempting to control, the (in)tangible comfort membranes within the immediate environments of their bodies.

When considering what this research stream adds to existing knowledge, implicit understandings have been made explicit because our fetal experiences within our AMNIOTIC SAC membranes influence our constructs of comfort. The visceral and behavioural transference throughout life onto our perception and understandings of comfort, relate back to the efficiencies of comfort and enable the development of desire-lines. Norman gives an example of instances where 'the person is gently nudged toward the appropriate behavior' by 'visible… signifiers, forcing functions, and feedback' (2011, p.86). If individuals are able to articulate and then track their comfort desires, starting within this space of origin, they may become aware of elements that are personally inefficient. This is not an exhaustive

list but these findings impact the disciplines of interior design, architecture, sociological, anthropology and psychology.

5.2.2.D.   Limitations – You have to recall it, to remember it

The AMNIOTIC SAC membranes represent the research subject topic. Clothes can be equated with the foetus, and the building skin with the uterus. Nevertheless, as a concept it has unconscious control and can be considered ambiguous and tacit.

On reflection, the specific points about 'gestation' as opposed to 'birth' may have been a source of confusion. This pre and postnatal constituent should have been clarified more explicitly or more instruction was required.

Furthermore, subject topic and research method issues were blurred in the design of the survey questionnaire. On analysis of the data, a leading question about "security and shelter" was found to have influenced a large number of psychological responses. However, as quoted by Wilde 'experience' is 'the name we give to our mistakes' (Ramsden, 1998, p.5) and this flaw was learnt from in the subsequent workshops.

The tacit – almost taboo - psychological elements of the AMNIOTIC SAC subject may have impacted on the workshop attendance rate. The uncanny subject matter introduced limitations to the study as it relied on contributors being creative and taking active, playful roles. This led to methodological limitations where population samples were statistically unrepresentative. This limited group selection enabled further exploration of this topic in a wider audience in the next COSY workshop and highlighted the possibility of constructing individual and group comfort desire-lines.

5.2.2.E.　　　AMNIOTIC SAC Research Method Discussions

The AMNIOTIC SAC research stream initiated an experimental interior design method that utilised action research and immersive techniques. The informal group setting facilitated qualitative interactions about this culturally sensitive topic.

A key research approach that was learnt in this research stream was my decision to work with a physical method, enabling me to focus on investigations that would enable desire-lines of comfort to be visualised via freehand drawing. This evolved because in early analysis of the AMNIOTIC SAC electronic feedback, the qualitative evaluation of the tone, or para-linguistic cues in the typed text was problematic. The results were difficult to interpret, for example, emoticons do not have the same expressive qualities as a doodle or sketch. Therefore, in instances where the survey was emailed, the digital interface had created a disconnection, and the meaning behind some of the responses lacked expression because they were not freely written. This analysis influenced my researcher decision to focus on a paper hardcopy Designbook for the next experimental COSY workshop.

Other feedback related to text size on the paper survey and ethical and data protection formats. These concerns were rectified in the COSY Designbook.

Research Results Card:– Immersive Spatial Props

Interactive Workshop and Designbook:- Feedback from 71 co-researchers
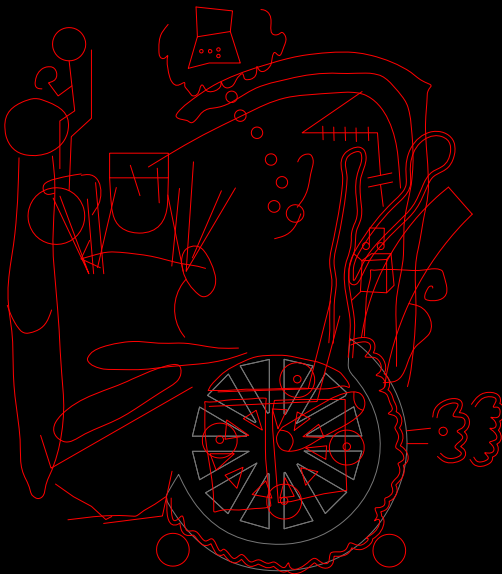
5.2.3.A.   COSY Workshop and Exhibition Results

The COSY workshop developed a lifecycle of 16 scenarios to answer the research question of how people construct comfort in their interior spaces. There were 71 co-researchers to this COSY event and Appendix 6 analyses these responses. In total, two thirds of the Designbook pages were completed; generating 1507 responses, with 64% written and 36% sketched replies. In the COSY workshop demographic data showed a peak age of 20-40 years with another smaller peak at 60-70; the female-to-male gender ratio was 2:1.

The COSY feedback analysis started with tabulating the data within an Excel spreadsheet, but, the enormity of interpretation of the 1500+ qualitative responses to the COSY workshop became apparent. The heuristic analysis process undertaken in the previous workshops was not suitable. So, iterative and novel ways to elicit meaningful results had to be devised and qualitative data that incorporated the Senses, Control, Stimulation, Adaptation and Influence were listed. These themes, shown in Appendix 6, came from the analysis of the GYRO and AMNIOTIC SAC workshops. The totals for each theme are shown in the line graph in Figure 64, which shows that the Adaptation qualities had the highest response rate with Control having the least.

FIGURE 64. COSY SCENARIO FEEDBACK LINE GRAPH
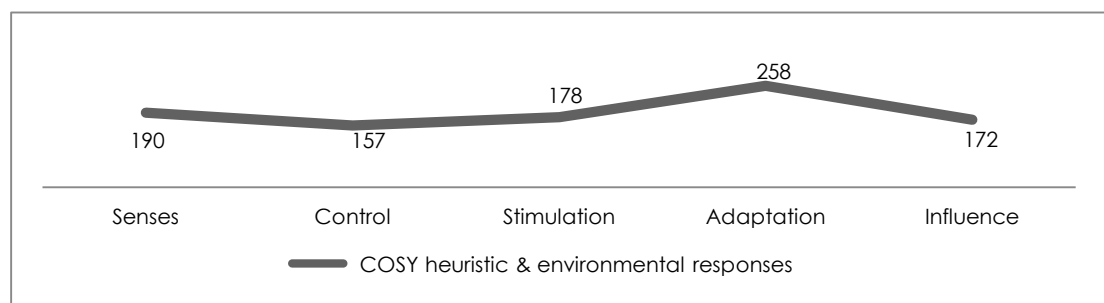
Visual analysis of the COSY sketched responses was undertaken to gain further understandings. This process involved recording the sketches on laminated facsimiles of the Designbook pages, with each line tagged by its Respondent number. When the pages became too crowded, and the diagrams more complicated, the sheets were scanned and the pages were reused in a repetitive analogue recording process. This redrawing procedure enabled the Co-researcher responses to be absorbed in a way that compliments the design research process. As each instance was retraced, this hand-to-brain illustrative action became part of the research assimilation. Figure 65 shows the repeated recording process of the scanned COT scenario images. After this initial mapping exercise was complete, the scanned images were redrawn in CAD and each line was identified with the Respondents gender and age demographics.
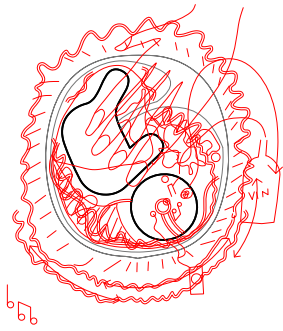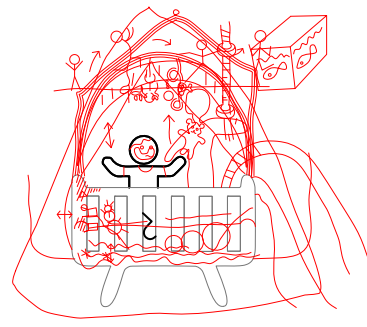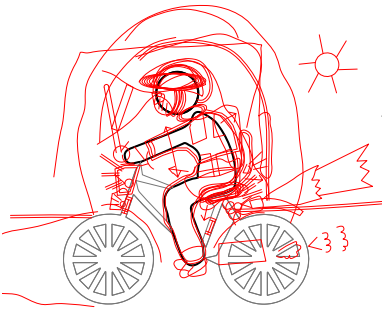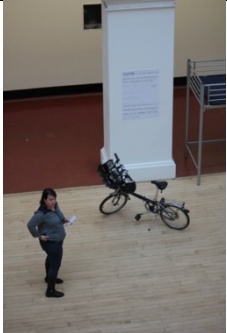
FIGURE 65. COSY ANALOGUE COT RESPONSES: IMAGES A.OJI & O.OJI
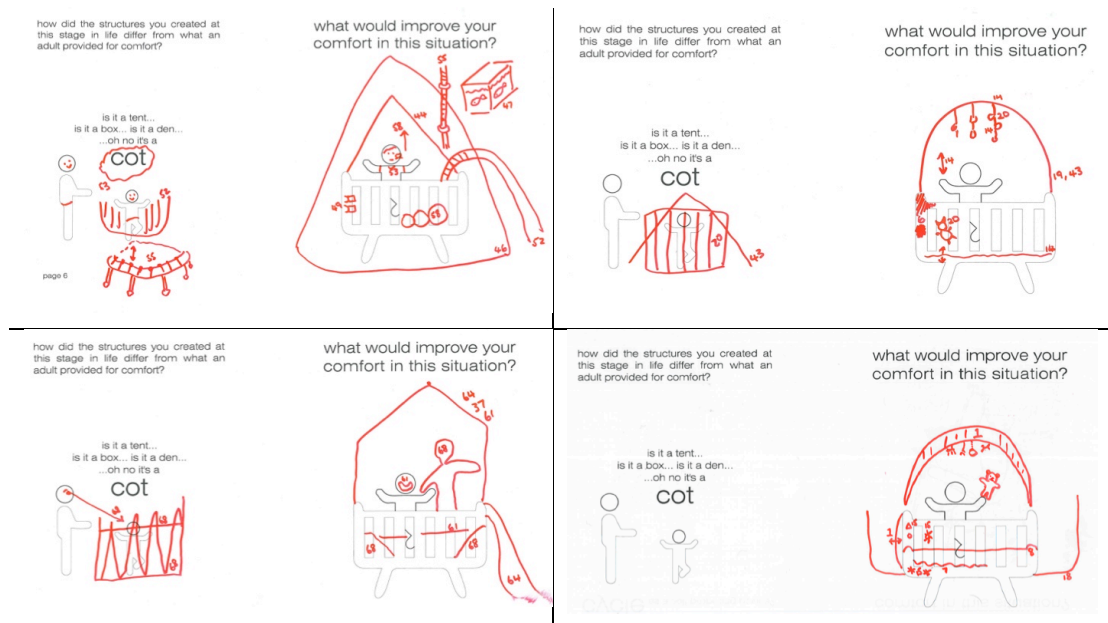
Therefore, the palimpsests of each COSY respondent were drawn in and erased as each response built-up the whole picture. This enabled comprehension of visual patterns so that comfort desire-lines could emerge. Figure 66 shows the visual

feedback representations from the 16 COSY scenarios, with summaries of the textual

interpretations of comfort and their associated (in)tangible membranes.

FIGURE 66. CO-RESEARCHER FEEDBACK FROM THE IMMERSIVE COSY WORKSHOP

SITE | DESIRE-LINES	COMFORT | *MEMBRANE*	IMMERSIVE | EXPERIENTIAL
	1. AMNIOTIC SAC *Flexible immersive membranes*	
	2. PRAM *Protective communal membranes for movement, interpersonal connections and environment*	
	3. COT *Enclosing canopy membranes and escape devices for private control and experimentation*	
	4. BICYCLE *Protective membranes for safety and environment*	
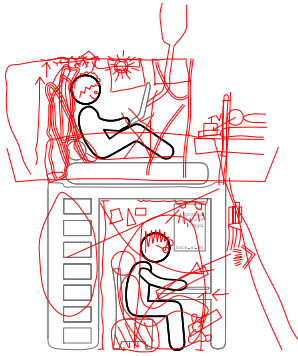
5. LOFTBED

Adjustable fabric acoustic and visual membranes

6. BUS

Personalised defensive bubble membranes excluding unwanted visual and olfactory inputs
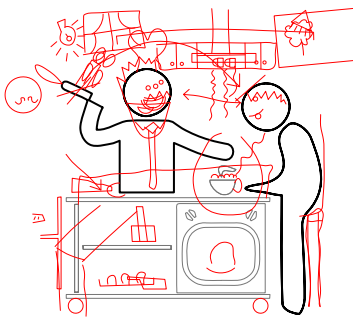
7. KITCHEN

Intangible but interactive adjustable efficiency membranes
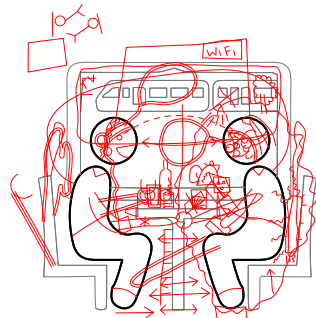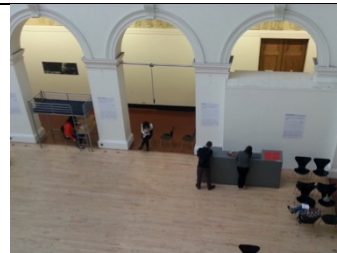
8. TRAIN

Personal and social interdependent membranes incorporating gustatory & entertainment needs

9. WORKPLACE

Ergonomic and individualised membrane controlling levels inputs and outputs
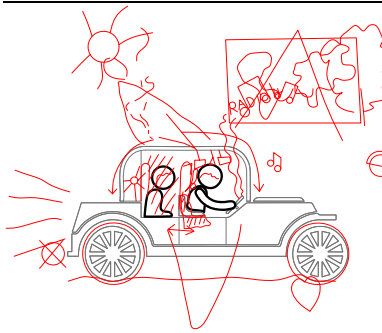
10. CAR

Controlled communication and spatial entertainment membrane
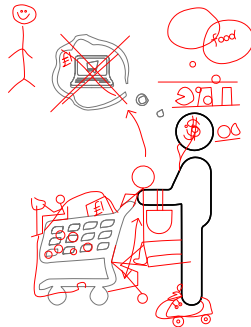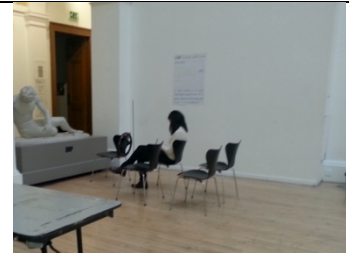
11. SHOPPING

Intangible relationship membrane
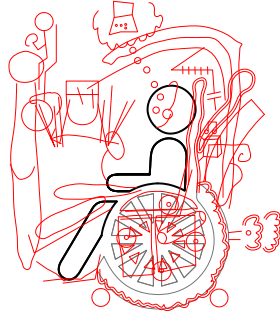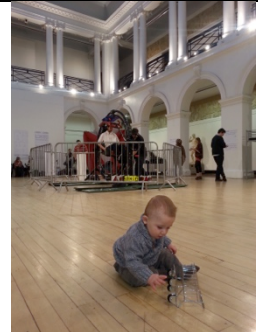
12. WHEELCHAIR

Independence membrane augmenting interpersonal communication with applied environmental and thermal canopy
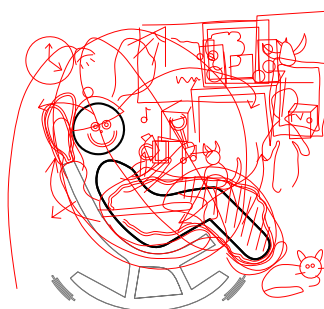
13. LOUNGE

Time-bound, companionate acoustic and visual entertainment membrane

197
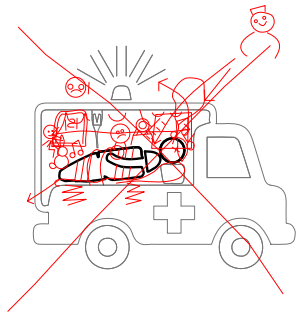
SITE | DESIRE-LINES	COMFORT | *MEMBRANE* IMMERSIVE | EXPERIENTIAL	
	14. AMBULANCE *Familiar relationship membrane with reactive expert communication within intimate boundary*	
	15. COFFIN *Enveloping membrane with memorable associations*	
	16. HALO *Ethereal energy membrane*	
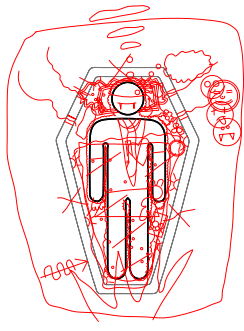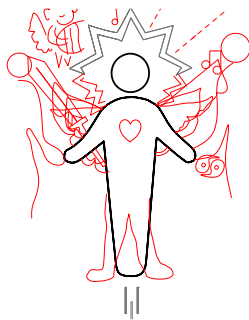
5.2.3.B.   COSY Workshop Main Findings

Throughout the immersive COSY event co-researchers gave insights that were directly related to their life experiences from which patterns of visual or textual responses have been assembled. This immersive research created real-world representations of (in)tangible membranes between clothes and the building skin.

The 'Relationship' category emerged in each COSY circumstance, both in transcripts and sketched human forms, faces or limbs, or cat forms. This relates back to Van Gennep's rites of passage framework, as discussed in Chapter 4.4.2. When

co-researchers traversed between each COSY life stage, changing aspects of 'status... place... situation... and time' (Hendry, 2008, p.68) were negotiated.

The mutable status of the individual affected the qualities of the (in)tangible membranes delineated. For example, the infants' membrane in the AMNIOTIC SAC and PRAM is dependent on the caregiver and visual and auditory connections maintain these coverings.

The PRAM also evidences movement in relation to comfort, shown in the changing swivelling, skating and flying positions.

The fixed COT had a transitional relationship. COSY Respondent 68 ruled the space as their "own kingdom", with the proviso of "attention and closeness of mother". Images and descriptions of teddies, blankets and toy depictions link to Winnicott's 'transitional objects' theory (1953, p.5). These liminal membranes are described in psychoanalysis as serving the function of intermediate comfort in place of the adult-child bond. To articulate this link, COSY Respondent 27 wrote "toys, teddybear, ~~someone~~". Whilst COSY Respondent 4, accepted the COT's function as "a place to sleep", but communicated that it "creates a barrier between parent and child. It exhibits the child and separates them from adults or other children. Not comfortable. Feels isolated, not secure". In this scenario the expressions of relationships and (dis)comfort are clear.

The simulated enclosures surrounding the COT scenario also provide explicit representations of the simple beginnings of active tent or den creation. COSY Respondent 2, describes their den making activity as "simple – rudimentary copies of adult versions of things". Some responses linked back to (in)tangible aspects of comfort in the AMNIOTIC SAC membranes, discussed in section 4.3.2. Such as, COSY

Respondent 45, who expressed how they "enjoyed the idea of crawling into somewhere but usually hated being in it".

Escape depictions in the slides and ropes in the COT may relate to release or flight responses. This was an aspect of choice where embellishments to the basic scenario evidenced how energies would be used by the child.

The CYCLE and LOFTBED develop these self-sufficient tendencies and energy use priorities.

The BUS is linked to the individual creation of defensive personal space membranes to control human interactions, especially touch and smell.

In the KITCHEN, respondents considered more familiar relationships, creating functional comfort membranes and their ergonomic efficiencies.

On the TRAIN respondents described how they interacted with fellow passengers or generated their own membranes; COSY Respondent 19 explained how "creating my own bubble with my stuff" simulated an (in)tangible boundary.

In the WORKPLACE adaptable sheaths were identified so that colleagues had to approach with caution as they may or may not be invited in. Again, confirmation of membranes to keep people out.

The CAR scenario incorporated ergonomic, thermal and audio comfort with communication between passengers or by telephone. The autonomy of this vehicular space was clear with choices as to whom to share the metal and plastic membrane space with.

Physical SHOPPING modes were facilitated by human interaction, whilst internet shoppers purposefully avoided this contact.

Interestingly, independence was paramount in the WHEELCHAIR scenario, COSY Respondent 72 described how "pushing yourself is satisfying but someone else

pushing is horrible". Other measures suggested by many co-researchers included changing the body position to be at the eye level of a standing adult, implicitly changing status by using height differentials. Furthermore, COSY Respondent 10 advised, "Wheelchair users often suggest they are invisible to others" and protective membrane measures such as, "Bodecia (sic)type knives on the wheels would give them clearance". Another defensive reply from COSY Respondent 28 involved "arm mounted rocket launchers; ejector seat; electronic counter measures; laser targeting; all controlled from my Ipod". These protect and attack components have interesting (dis)comfort connotations.

In the LOUNGE, individuals conveyed their personal comfort interactions. Bonding membranes showed how co-researchers were able to choose their companions, with animals added into the mix.

The AMBULANCE scenario showed how reliance on a medical expert, as well as dependency on a familial or friendship relationship, were crucial for comfort.

These dependent relationships were especially pertinent in the COFFIN, as expressions of comfort within this shell transferred to family or friends.

The HALO scenario relocated the illustrative lifestyle comfort membranes into incorporeal attachments, with linkages back to the first space of comfort in the AMNIOTIC SAC. Expressions from COSY Respondent 58 embraced this returning state "I'd love to be weightless just like in the amniotic sac; being made of light!" This is a corroboration of my premise that unconscious desires influence life choices.

5.2.3.C.   What the COSY Research Stream Adds to Existing Knowledge

The investigation of how people construct comfort within their interior spaces, was set in a lifetime context in this COSY research stream. This experimental

immersive interior design workshop elicited heuristic information about comfort membranes from co-researchers. Praxis was achieved at many levels as this risky but productive research approach expanded the investigations within the constraints of a PhD-by-practice framework. This merging of practice and theory was evidenced in the preceding organisation of the event; during the immersive workshop and exhibition that enabled co-researchers to expand their understandings of comfort; after the event, in the debriefing and repurposing of the articles; and the dissemination of my findings.

Responses illustrated that the desire-lines of comfort were frequently marked out and shown in proximity to the body. These visual expressions of (in)tangible membranes and structures between clothes and the building skin, emphasise that greater understandings of comfort in relation to the changeable, proximate space around a person is essential for efficient use of internal spaces. These aspects of human comfort and the (in)tangible membranes that we interact with critically influence the design of interior space and can develop individualised concepts around efficiencies of comfort.

In the PRAM scenario, COSY respondent 45 expressed how "freedom to change at will from cosy warm seclusion to watching the world, wriggling, sitting up, standing up!" clarified a wish to control these comfort scenarios. It also resonates with the GYRO concept, and these inter-relationships will be discussed in section 5.3.

Overarching (in)tangible comfort membranes came in the guise of dependant and autonomous relationships with other beings. The significance of choice, in these interactions is paramount as illustrated in Figure 67.

FIGURE 67. COSY TRAIN INTERCONNECTIONS
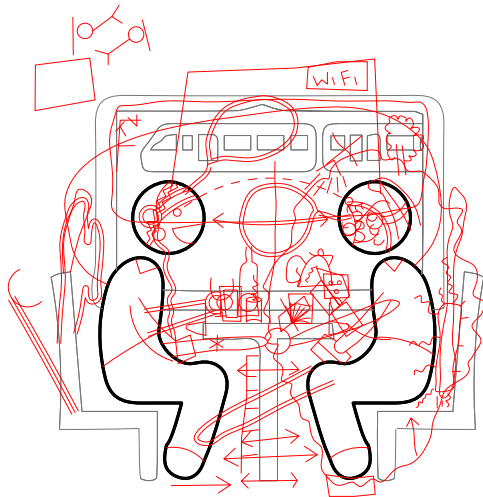
For example, in the TRAIN scenario, autonomous representations are shown in the headphones, individual membrane bubble and distancing comfort desires. Dependant aspects are marked out in the speech bubbles, holding hands and the visual connection represented in the dotted lines and arrows between the two people.

In summary, aspects of social interaction, and defence against it, are subjective responses. These desire-lines to objective scenarios may explain how individuals construct (dis)comfort to aid their pleasure within interiors. These comfort efficiency motivators are analysed demographically and discussed in section 5.4.

5.2.3.D.   COSY Limitations – You have to experience it, to know it

Personal, time, scope, design and economic limitations were facets of the COSY research stream. The researcher-by-practice analogy war scenario discussed in chapter 3.4. describes some of the contradictory roles exposed in its organisation.

Design elements included specific details in the Designbook. Reference to headphones as a suggestion of an acoustic (in)tangible membrane may have biased some of the responses because illustrative headsets are drawn in 6 of the COSY scenarios. Nevertheless, the ambiguity of the (in)tangible membrane subject matter was possibly too simply explained. Further work would encourage better instructions and examples as a prerequisite.

The overarching limitation to this COSY research workshop was its ephemeral atmosphere, which could not be conveyed without personal immersion. This was problematic in a PhD-by-practice assessment because the major practice element was relatively intangible. However, text and image based tools, used in the basis of this thesis, aimed to express these qualities.

5.2.3.E.   COSY Research Method Discussions

My reflections on the event were disseminated online to respondents and others via this link: http://www.eca.ed.ac.uk/school-of-design/news-events/ reflections-on-the-cosy-gyro-workshop 19/12/2014,23:40. The documented reactions to the overall COSY workshop and exhibition included feedback from a family group of four "who commented on their differing positive responses to the interactive, experiential nature of the event".

Furthermore, other research method discourses include responses to the Designbook's facilitation of the meaning, layout and content of the exhibition. COSY Respondent 35 stated, "the design-book was the key to my engagement with the exhibition - it led me into it quickly… the visual objects were so familiar but you've never thought of them in that way". However, contrasting reactions about the length of time it took to complete the Designbook were also noted.

Learning from my experience in the creation and accomplishment of the COSY workshop, a shorter lifecycle would be devised for future research forays. Figure 68 gives a summary of the progression of the 16 COSY scenarios that were filled in the Designbook, showing the right and left page response comparisons. The set progression of scenarios from birth to death and beyond meant fewer responses to the Ambulance, Coffin and Halo situations. It shows the elements that co-

researchers felt most comfortable to communicate about, perhaps giving an indication of implicit familiarity or approachability. These results will be used to restructure potential future studies. The Pram, Kitchen and Car were most popular, with the Amniotic Sac, Bus and Lounge having 98 -100 responses.

FIGURE 68. COSY DESIGNBOOK RESPONSES PAGES FILLED COMPARISON
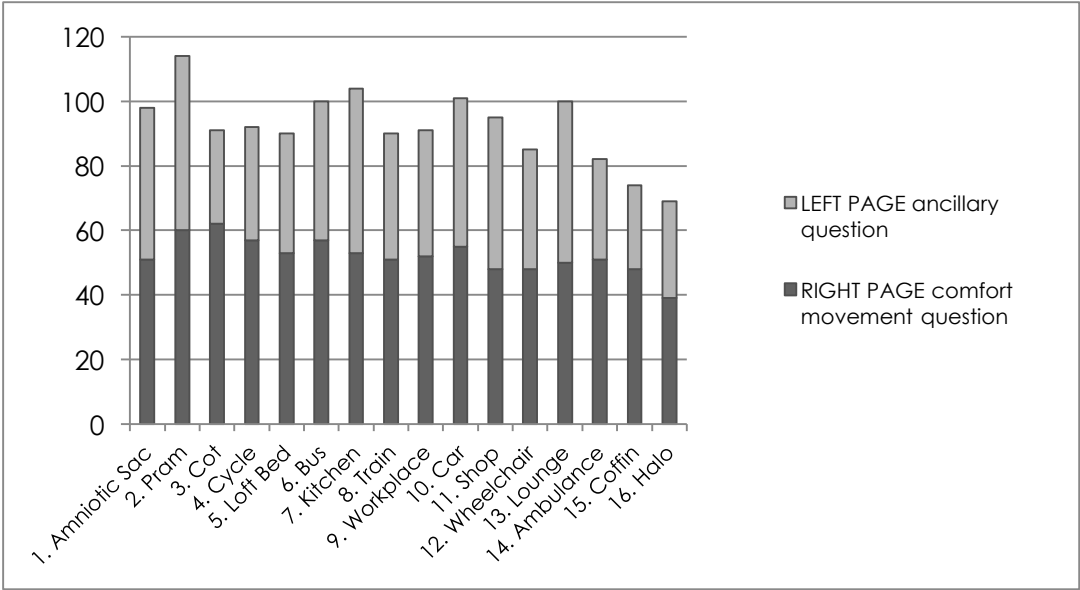
Unanticipated responses to some of the Designbook's option-based questions included some reactions within the KITCHEN category. Methodologically, a Likert scale, which consists of a gradation of 5-7 pre-coded responses, seemed too prescribed. Therefore, co-researchers were asked how they valued elements of their kitchen. This open question, enabled co-researchers to create their own scales of reference, including value ratings such as: 1-8; 8-1; percentage; 1/100; £'s; and happy or sad faces. This survey choice allowed personal values to be given in the KITCHEN scenario, circumventing issues of power dynamics within the home, which is discussed in chapter 2.3

One such interpretation was that of COSY Respondent 53, who was within the 0-9 age demographic. Their articulation of emotional desires recounts Wong and Baker's faces® scale (1988, p.11) a research tool that enables children to communicate about pain – a subjective sensation. As illustrated in Figure 69, smell was expressed as a frown, taste stimulated a smile, whilst the visual, touch, ventilation, occupants and colour categories inspired toothy grins.

FIGURE 69. COSY RESPONDENT 53'S KITCHEN CATEGORY REPLIES & FACES® SCALE
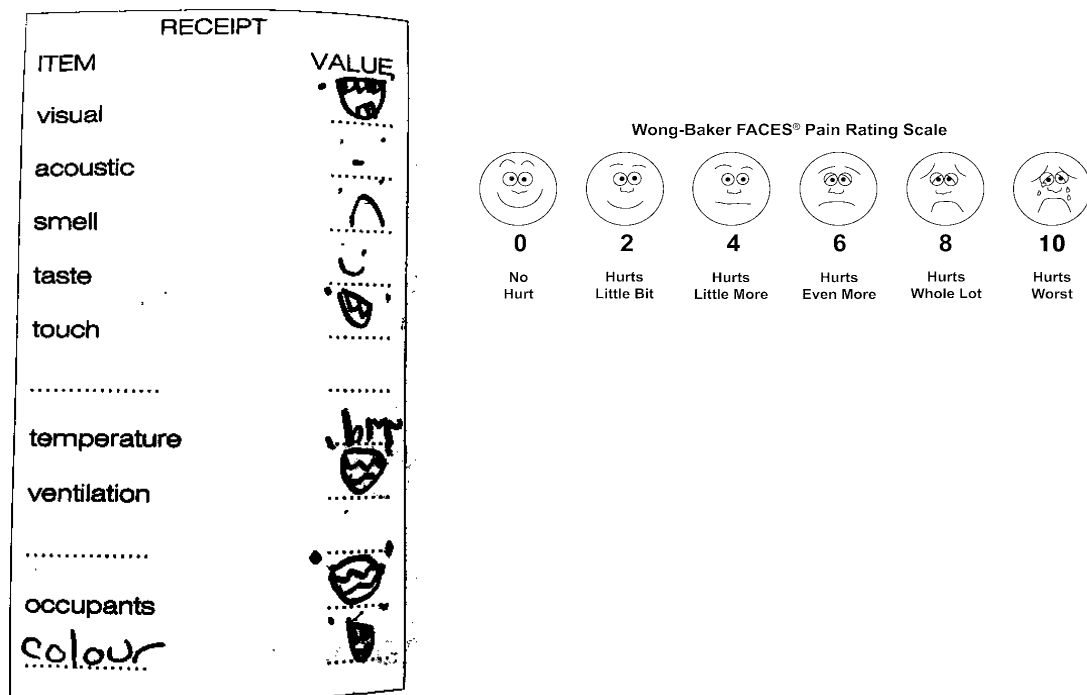
Further KITCHEN responses are discussed within a demographic context in section 5.4. The next section examines the interconnections between the three GYRO, AMNIOTIC SAC and COSY research streams.

5.3. INTERELATIONSHIPS BETWEEN THE 3 RESEARCH STREAMS

The inter-relationships within and between the GYRO, AMNIOTIC SAC and COSY research streams are explored in this section. Figure 70 visually amalgamates the investigations to show how all three contribute to past, current and future experiences of (dis)comfort and movement in everyday efficiency routines.

FIGURE 70. INTERRELATIONSHIPS BETWEEN THE 3 RESEARCH STREAMS
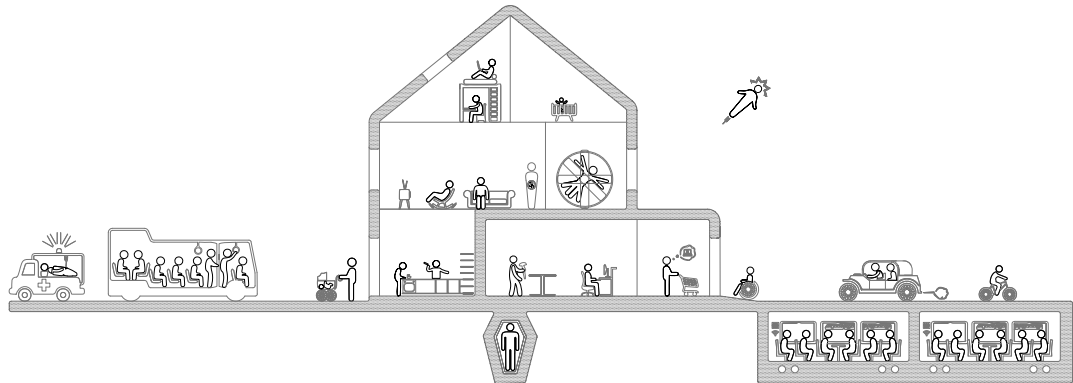
This research journey created fusions and cross-fertilisations and these are now discussed from subject topic and research method perspectives.

5.3.1.Subject Topic Cross-fertilisations

Chronologically, the GYRO concept sparked the AMNIOTIC SAC study. In turn, its connection to lifelong comfort was the basis for the COSY life story exploration. These iterations enabled a refining of the research question.

The COSY scenarios show how people expend energy to construct (in)tangible membranes to interact with, or defend themselves against, their changing environments and other people. Therefore, an AMNIOTIC SAC bubble metaphor could be developed into a psychological comfort companion membrane. Figure 71 re-illustrates the metaphysical AMNIOTIC SAC bubble in Figure 62.

FIGURE 71. AMNIOTIC SAC COMFORT BUBBLE
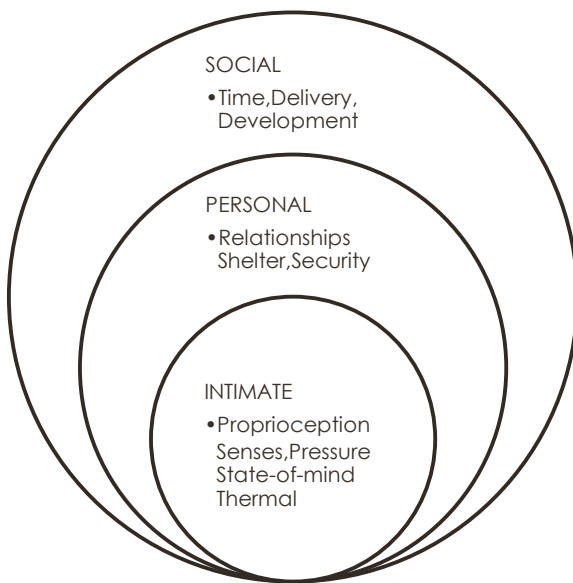
This metaphoric comfort bubble could be applied in spatial design. For example, attention could go towards creating intimate, personal and social spaces, so that individuals can make dependant and autonomous choices.

The AMNIOTIC SAC connected to the GYRO by constructs of comfort, such as weightlessness and other senses governing movement and the immediate environment. Some bodily states, that were recorded in the AMNIOTIC SAC feedback were induced in the GYRO. Furthermore, new areas of sensory research into comfort products and services should consider pressure and body swaddling. Products designed for individuals who struggle with sensory input are highlighted in the contextual review chapter 2.1.4. Membranes, such as the sensory sack, could be reworked to facilitate comfort in wider domains. Experimentation about the comforts of weight versus pressure could be explored in the GYRO's proposed inner hammock membrane.

Linkages to COSY include the LOUNGE scenario. Figure 72 illustrates the sketch by COSY Respondent 75 where, the curved structural elements of the GYRO concept have been drawn over the human figure in the rocking chair. Matching

contours, closeness to skin and feelings of comfort all attest to a new global

paradigm for energy efficiency within interior space.

FIGURE 72. LOUNGE, COSY INTERCONNECTIONS WITH GYRO
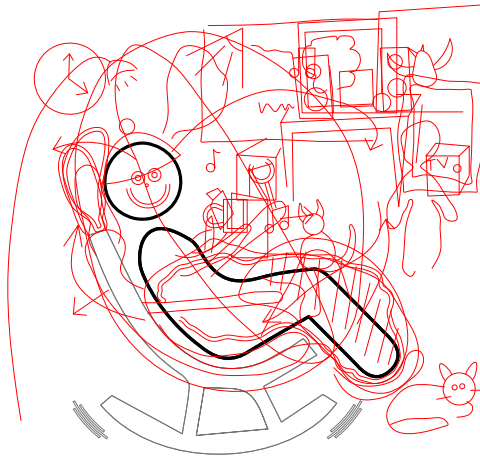
Explicit comfort desire-lines include the controlled, time-bound nature of the LOUNGE circumstance. The rocking motion or pressure of the blankets around the individual. Additional thermal comfort in the real-fire and window ventilation; with gustatory comfort via the cup of tea or wine glass.

Aesthetic stimulation and nature was shown by windows drawn by

respondents, whilst sketches of lighting and entertainment options, corresponded

with expressions of visual and auditory relaxation. The inclusion of other human and

animal forms were autonomous and/ or dependant choices associated with more

communal comfort circumstances. Such additional modes of comfort were not

proscribed in the Designbook. Their connection with (dis)comfort may relate to pre

or post-natal experience.

Other metamorphic objects and circumstances were used to glean

information pertinent to the innovative GYRO sleep | relax | work concept and life

experiences. Data gathered from the COSY CYCLE scenario explained how

familiarisation with the device was attained primarily by childhood assimilation. This

feedback confirmed that the bicycle as a ubiquitous form of transport may not be

applicable to the GYRO device. Different challenges will apply if introducing this

"uncanny" product concept to market. For example, Hiester's hammock tricycle in

chapter 2.4.2, or Carver's Invalid Chair, in chapter 2.5.3, would need to be used to compare how others may react to my GYRO conception.

The LOFTBED, COSY category was, in part, strategically chosen as a direct functional analogy for the GYRO, due to its similar functions. Co-researchers' desires about body positions in conjunction with the related tasks show how shifting variations of posture augment comfort and these are shown in Figure 73. The person at the lower desk is shown in a reclining position with a tilting desk, footstools, and cushioned seating to facilitate these transitions. The upper bed area illustrate how a person would watch television whilst lying on their front; or lumbar, neck and head padding would allow for work and leisure in bed, illustrated by the ceiling mounted book or laptop rest.

FIGURE 73. LOFTBED, COSY INTERCONNECTIONS WITH GYRO
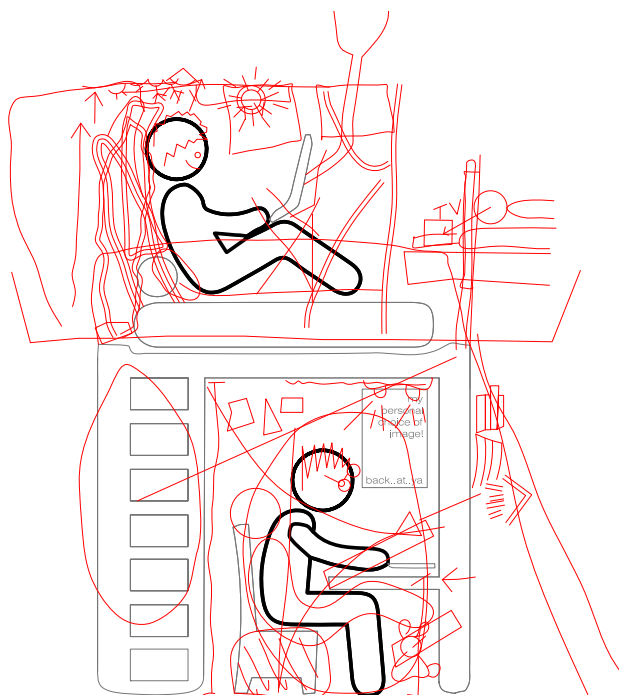
Ocular comfort desire-lines include light for the varied tasks in the upper and lower areas.

Gustatory needs have been shown by COSY Respondent 44's desire for "a range of tasty snacks dangling down from under mattress area".

Co-researchers' (dis)comfort manifestations for this scenario included physical accessibility issues concerning the ladder and, in one instance, a slide was added as a solution. The fact is, the LOFTBED's high level restricts its use for sleep to

young, single, agile people - limiting its use. This is evidenced in heuristic feedback from COSY Respondent 10 who stated, "my son had a similar arrangement it was impersonal when reading to him, difficult to nurse him if he was ill... bed making was a problem, he however really liked it". These results apply to developing the GYRO concept, as although the inner circle can be spun to any angle, accessibility concerns are real. For example, would a user fall into the hammock membrane, or be spun or bounced off it? These considerations would influence safety features and a 1:1 model would permit this appraisal.

Thermal, visual and acoustic privacy membranes in the form of curtains and screens were also detailed in responses and retrofitted onto the LOFTBED circumstance. These manifestations provide insights into experiential desire-lines for similar circumstances such as the GYRO's outer enclosing membrane and link back to control, as enclosure and escape desires are evidenced in the feedback.

5.3.2.Research Method Fusions And Justifications

The research workshops aimed to collect evidence about the (in)tangible membranes people construct for (dis)comfort. Appendix 10 tabulates the visual and textual data, evidencing that 49% of co-researchers responded about tangible or physical constructs of comfort; and 51% were intangible or psychological. The research methods enabled this information to be articulated - proving that tangible constructs, such as objects are equal to intangible circumstances.

Experimental interior design tools that combined immersive, ephemeral environments were devised to enable co-researchers to react with and record their replies in an innovative way through 2D and 3D exhibition props and graphic elements.

The methods used to gather data followed a recursive journey where the design process was made visible. For example, in the formation of the AMNIOTIC SAC and COSY questionnaire surveys where standard written questions were juxtaposed with drawn response templates. Text based survey questions were found to result in open-ended feedback. However, when given as an image based answer, a coherent visual structure elicited responses.

Consequently, to articulate the different research scenarios cohesively, the architectural graphic sectional archetype was used as a valid drawing method across all visual information in the workshops. As a communicative tool, a sectional drawing prioritises the human form, but also gives meaning to their proximate actions and surroundings. A hieroglyph style symbology, allowed specialist and lay audiences to contribute within a visual and textual format - blank pages may have stifled input. The 'red-pen' aspect of charting the data linked to architectural graphical critique and revision exercises.

These underlying graphic research method choices, discussed in chapter 3 enabled co-researchers to communicate freehand, which animated responses and captured representations of (in)tangible comfort membranes.

5.4. DEMOGRAPHIC ANALYSIS

5.4.1. Subject Topic Perspectives and Analytical Interpretations

Demographic data, in the form of gender, age, ethnicity and occupation, was collected in the GYRO, AMNIOTIC SAC and COSY research stream for analysis of group and individualised patterns. Figure 74 illustrates the differing bodies that comprise the research scene, as each human in black or white could represent any demographic category alluding to our changeable comfort identifiers.

FIGURE 74. DEMOGRAPHIC ANALYSIS
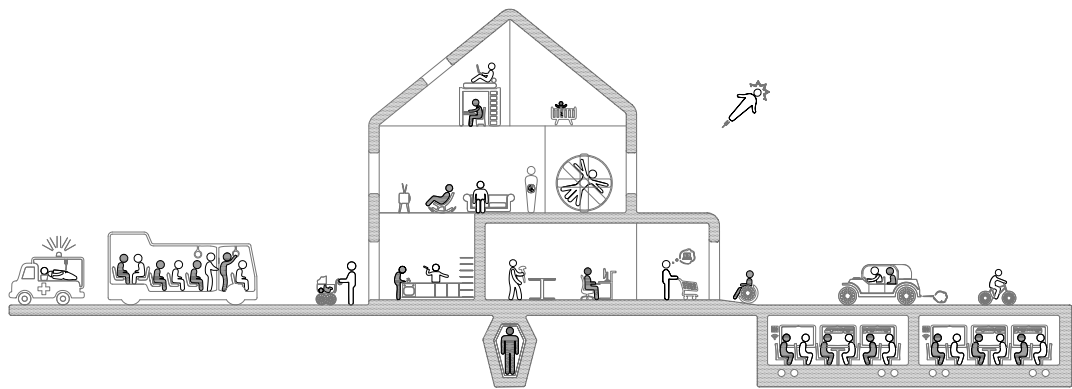
In this subchapter, when demographic populations are referenced, the labels assigned describe comfort behaviours that co-researchers demonstrate. Each individual response may not correspond to all people within the same demographic, but represent a spectrum of comfort desires and subsequent actions. To elucidate this point, feminist sociologists, Gerson and Peiss interpret gender as 'a set of socially constructed relationships which are produced and reproduced through people's actions' (1985, p.327). These non-static classifications guide, rather than dictate, the demographic constructs of comfort discussed in this section.

Perceptions about the constructs of comfort from gender, age, ethnicity or class are interconnected, but generalisations are limited due to the number of research responses. Also in response to a conference presentation (Milan, 2015)

architect and writer Grafe, asserted that ideas of race, gender and individuality are ever changing. He questioned how "we reconcile a universalist approach with the disparate histories of human experience?" These caveats are necessary to understand the interpretive dichotomies arising in this style of research analysis.

This demographic analysis section considers gender; then age; followed by the intersections of gender and age. Finally, some individual patterns are discussed.

5.4.2. Demographic Results and Scope of Current Enquiry

The demographic data was collated across all the GYRO, AMNIOTIC SAC and COSY research streams. Demographic questions about disability were not included in the surveys but in retrospect this may have explained some variability.

Demographic respondents were predominantly female, between the ages of 20 – 59, which is similar to wider UK social sciences sampling evidence described in Chapter 3. Figure 75 charts the gender and age demographics.

FIGURE 75. GENDER AND AGE DEMOGRAPHICS
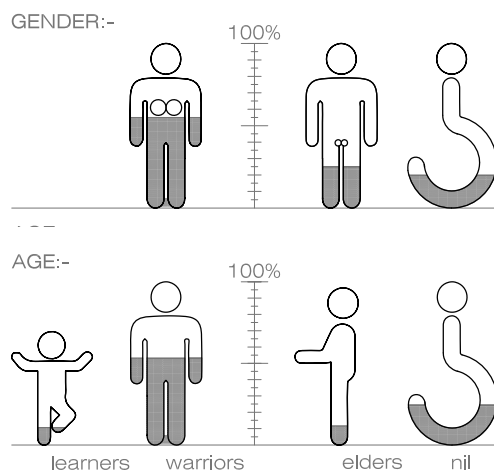
In total there were 55% Female and 26% Male responses, with 19% having no gender data.

Age ranges, were grouped into sets of: Learners ("youths" under 19's) which constituted 11% of replies; Warriors (20-59) had 53%; the Elders (over 60) group had 12%; and the no data set was 24%.

Ethnic group categories were based on Question 16 of the UK Census 2011 categories "What is your ethnic group?" Figure 76 shows a 51% majority White ethnicity for the workshop respondents, whilst Professionals and Students make up 60% of the occupational demographics.

FIGURE 76. ETHNIC GROUP AND OCCUPATION DEMOGRAPHICS
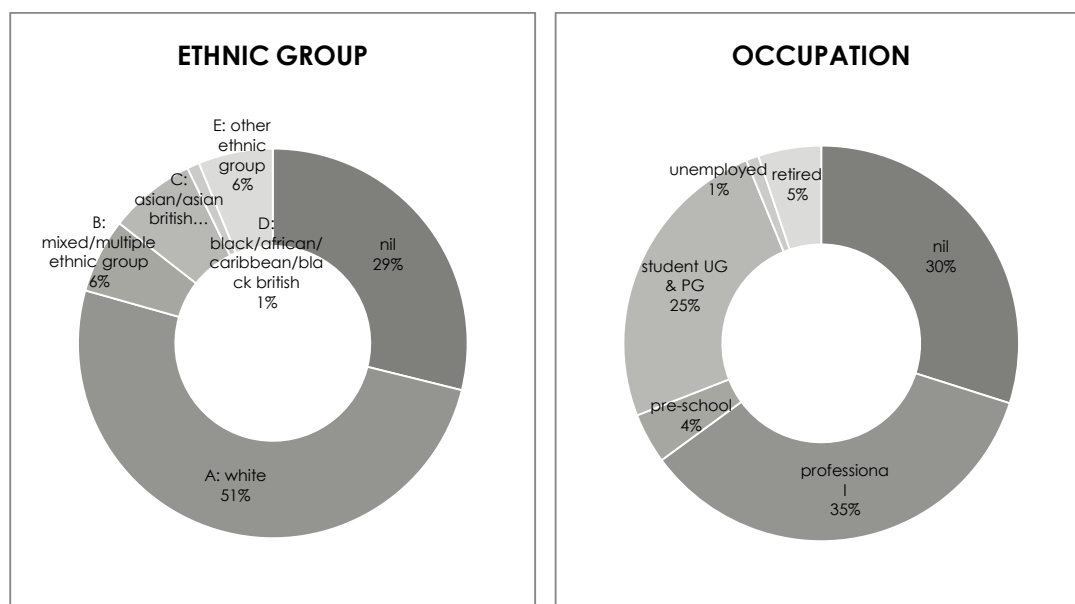
The statistics show ethnic diversity, but without holding workshops in different geographical locations adequate group numbers could not be achieved skewing the data. Murray and Chamberlain argue that research 'facts as well as theory' are 'necessarily value-laden' because of the constraints surrounding the 'possibilities and limitations of the physical, social and historical context in which it was conducted' (1999, p.7). Therefore, in a bid to strategically analyse the 1585 responses gathered across all of the research streams, only gender and age demographic categories will be discussed in detail. Yet, even this reduced intersectional analysis comes with forewarnings as Bechhofer and Paterson reflect that, 'disentangling age, cohort and individual effects' can be difficult. Explaining the main supposition that 'differences within the cohort will be less important than

differences between them' (2000, p.112). For example, what younger females consider comfortable may be discomforting for older females; or 20-59-year-olds of all genders may not have similar comfort constructs.
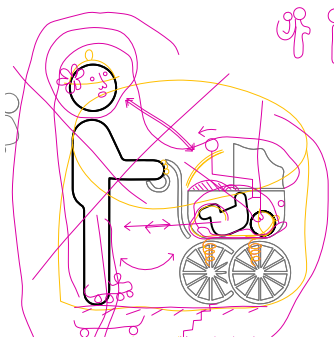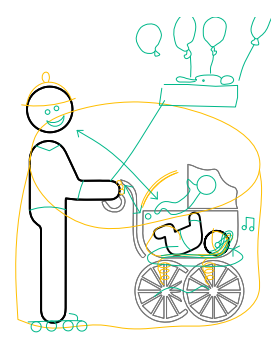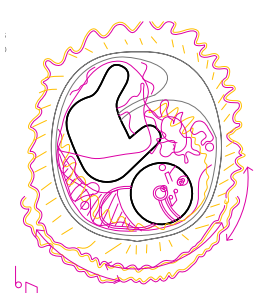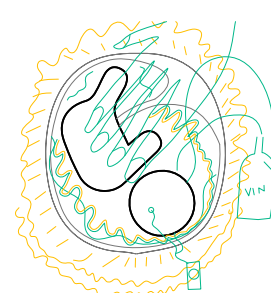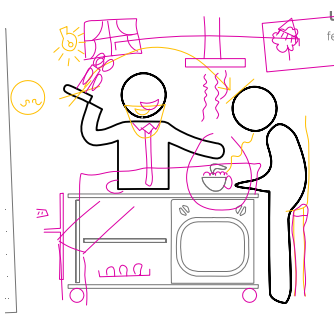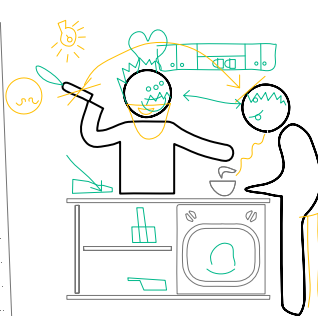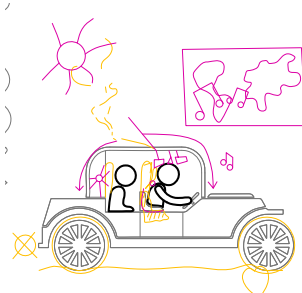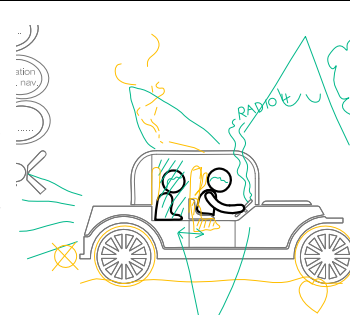
5.4.3. Gender Group Analysis

Proportional calculations of responses in each research scenario were quantitatively analysed into (fe)male and nil respondent groups. The bar chart in Appendix 7 demonstrates that because of its larger capacity, the COSY workshop had more responses.

Females were the most common respondents to the PRAM, AMNIOTIC SAC and KITCHEN scenarios. Males responded more frequently to the PRAM, KITCHEN and CAR scenarios. Associations between comfort experiences and attitudes from these four scenarios allow for gendered comfort constructs to be comprehended and responses are mapped in Figure 77. Gender typologies are colour coded: yellow lines show NIL demographic responses; magenta lines indicate FEMALE feedback; and cyan marks reveal MALE replies.

In the PRAM scenario females depicted enclosures around the adult and child. (Fe)males depicted these through faces and arrows delineating a connection. Further visual connects to external views were expressed in written responses. An interesting gender variable that arose in this PRAM scenario was female COSY respondent 44's remark that "have you ever noticed how buggy's are marketed like cars for dads?" Both genders suggested alternative objects and circumstances to move with a child; in an enclosure carried on their body, or by flotation using helium balloons. Other mobility aids included skates for the adult (whilst sitting) and, a functional option to rotate the child within the pram.

FIGURE 77. DEMOGRAPHIC ASSOCIATIONS OF PRAM, KITCHEN, AMNIOTIC SAC, CAR

	FEMALE	MALE	
REPRESENTATION			REPRESENTATION

PRAM

FEMALE	MALE
Enclosure	Enclosure
Cushion	Cushion
Adaptation	Adaptation
Suspension	Suspension
Face	Face
Relationship, eye contact	Relationship, eye contact
View	View
Rotation	Rotation
Position - Upright	Position - Upright
Redesign - back	Redesign - float
Obstacles	Obstacles
Skates/board	Skates
Clothes	Clothes
Acoustic	Acoustic
Handlebar	Handlebar
Blanket	Blanket
Attitude	Attitude

AMNIOTIC SAC

FEMALE	MALE
Inner buffer	Inner buffer
Outer enclosure	Outer enclosure
Transitory object	Transitory object
Relationship, siblings	Relationship, hand
Acoustic	Acoustic
Awareness, face	Awareness, face
Orientation	Orientation
Cushion	Cushion
Stimulant	Stimulant, vin
Attitude	Attitude

KITCHEN

FEMALE	MALE
Window	Window
Clothes	Clothes
Shelving	Shelving
Ventilation	Ventilation
Picture	Picture
Lighting	Lighting
Seat	Seat
Ergonomics, height	Ergonomics, height
Workspace	Workspace
Food	Food
Utensils	Utensils
Relationship	Relationship
Attitude	Attitude

CAR

FEMALE	MALE
Atmosphere, sun	Atmosphere, gas
Terrain, map	Terrain, hill, tree
Acoustic	Acoustic
Enclosure, opening	Enclosure
Gustatory	Gustatory
Lighting	Lighting
Ergonomic, seat	Ergonomic, seat
Visual	Visual, privacy
Wings	Wings

All the 16 COSY gender responses are illustrated in Appendix 8.

The AMNIOTIC SAC circumstance, showed that males mark out inner

membrane buffers that are closer to their bodies, whilst females also depicted outer

enclosing membranes and cushioning buffers further from their bodies. Females

denoted a face on the infant, other siblings and transitory objects; whereas a hand

partially covered the baby in the male scenario. Gustatory comfort, in the form of

wine was marked by males, and both genders suggested auditory comfort in the

form of headphones and music notes.

Both (fe)males depicted gustatory comfort and functional KITCHEN

preferences with females representing a greater range of ergonomic comfort

situations. These included items such as; lights, chairs, adjustable workspace width

and height, mechanical and natural ventilation, and a view. Males showed

relationships through the faces and arrows between occupants. Females showed a

desire for a positive person with a shirt and tie in the space. These elements link to

Cieraad's comments in chapter 2.3, where the kitchen has 'become the

battleground for domestic responsibilities' as it exposes 'plain domestic labor' and is

'full of illusions, contradictions, and myths' (1999, p.10-11). The desire-lines in this

scenario corresponded with these perceptions. Males connect this scenario with

basic utility, but also through relationships with others; whilst females consider a wide

variety of ergonomic and functional comfort with less emphasis on relationships.

As an aside, some co-researchers articulated mock alarm at the KITCHEN

diagram presented in the Designbook. For example, COSY respondent 44 expressed

"what is this scene?" Whilst COSY respondent 31 stated "not having my dick nearly

chopped off". Modifying ambiguous images is a design lesson from this feedback.

The CAR scenario showed comfort desires in the form of external travel, seen

in the drawing as a sun, mountains and trees and world map. Adaptations to this

metal membrane included a privacy window to the rear, dorsal wings or fins, and go-faster air streams all in the male responses; females opened the roof. Both genders noted acoustic comfort in the form of music notes and radio waves.

In relation to the depiction of (in)tangible membranes and comfort desire-lines, an interesting pattern was emerging in the gender data. Visual gender comparisons across all the 18 research scenarios (GYRO, AMNIOTIC SAC and COSY) illustrated that 2/3 females purposely delineated personal space bubbles; whereas in contrast only 1/3 males specifically marked out enclosing membranes.

To demonstrate this pattern, some of these gender comfort membrane representations were transposed onto the COSY | GYRO spectrum. Figure 78 charts some of the postural modes associated with each research stream alongside (fe)male patterns of enclosing comfort membrane. The FEMALE feedback is illustrated in magenta and MALE replies in cyan.

FIGURE 78. COSY|GYRO SPECTRUM GENDER MEMBRANES
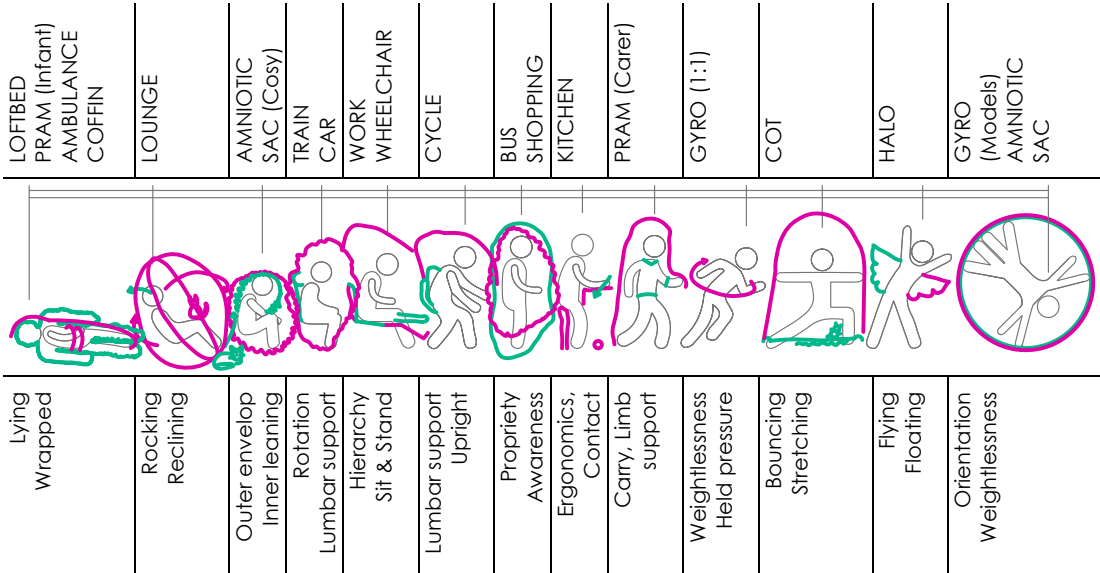
Relating back to the contextual review in chapter 2.2, these membrane arrangements might be explained by correlations with wider socio-cultural

processes. 'Outer' influences on comfort, where the male paradigm is constituted as normal, may be the cause of the comparatively higher proportion of female bubble encircling manifestations. Females explicitly and implicitly construct their own comfort paradigms, by altering these male archetypes. As a result, they actively have to create (in)tangible membranes to exert some control of comfort in their 'Inner' environments. These themes of gendered personal space membranes correspond with Cieraad, Madigan and Munro's research, discussed in chapter 2.3.

Nonetheless, it must be reiterated that there was a 2:1 ratio of female-to-male demographic responses across the three research streams, accordingly, female responses evidenced a greater variety of membrane type. So, the binary characteristics of gendered group comparisons will be re-analysed from individualised perspectives in section 5.4.5 to enable comfort narratives to emerge. The next section analyses age data in relation to constructs of comfort.

5.4.4. Age Group Analysis

The demographic age groups use Hendry et. al's anthropological interpretations of 'elder… warrior' and 'youth' or 'learner' age-sets (2008, p.176). Constructs of comfort were prioritised differently amongst the three groups of learners 14%, warriors 70% and elders 16% with the response ratio being 3:14:3. When looking at the types of comfort membranes prioritised at each life phase, we can appreciate the conflicting attitudes and motivations for each age-set.

Figure 79 shows the preferred value given by each group from the data analysis in Appendix 10. The "visual" and "temperature" senses of comfort dominate. These constructs correlate to chapter 2.2.1 and the predominance of architectural aesthetics within the built environment; whilst the prevalence of

thermal comfort discourse outlined in section 2.5.1, highlights the value of these

comfort desire-lines. "Shared" relationships and "enclosure" being the next highly

valued elements across all the three-age sets.

FIGURE 79 AGE SET COMFORT HIERARCHIES

LEARNERS: under 19	WARRIORS: 20-59	ELDERS: over 60
shared	**shared**	**visual**
visual	**enclosure**	**temperature**
temperature	**visual**	position
enclosure	auditory	security
gustatory	**temperature**	translation
auditory	rotation	**enclosure**
	position	**shared**

When looking at each individual age set Figure 80 shows how the warriors

group incorporates "position" and "auditory" comforts from flanking age sets. It also

illustrates how comfort desire-lines change as age increases.

FIGURE 80 AGE SET COMFORT MEMBRANE PRIORITIES
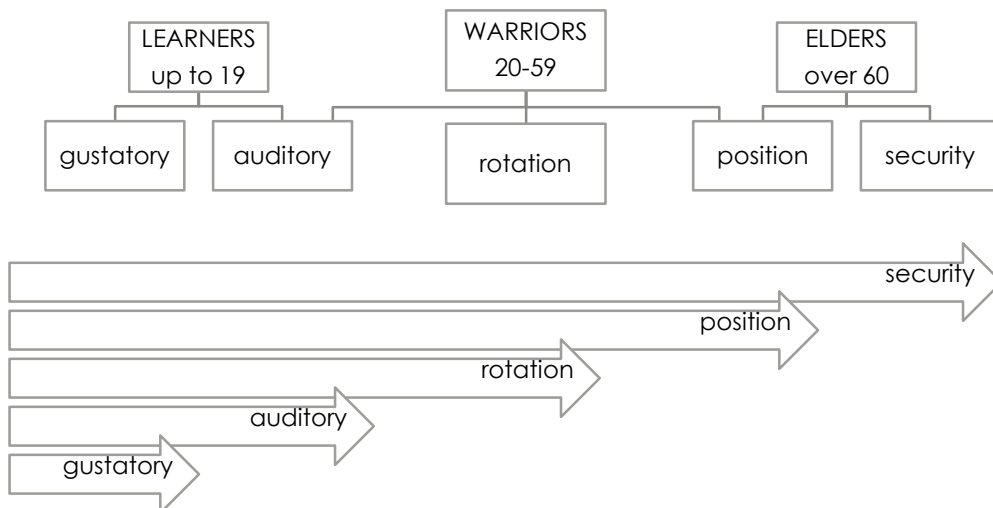
These understandings about the correlating and contrasting priorities each age-set evidences in their comfort desires-lines, allows for negotiation of these elements when designing interior spaces. For example, "auditory" comfort is given less priority in the over 60 group, could this be linked to decreased levels of hearing as we age, or it being displaced by other comfort constructs?

The "rotation" category in the 20-to-59-year old's may relate back to earlier childhood or prenatal comfort conditions and the perceived freedoms that flying or weightlessness induce. On reflection, it may be that our experiential understandings of integrating comfort into our postural bodily "positions" becomes more explicit as we age.

The "gustatory" and "security" constructs relate back to basic human needs. This links to the AMNIOTIC SAC comfort bubble and the over-60's "translation" category correlates with the "state-of-mind" intimate comfort bubble.

Nevertheless, this age group analysis does not consider the inter-related demographic variables that influence comfort desire-lines. Therefore, the next section intersects gender, and age-set data, to investigate multifaceted perspectives about how people construct comfort within their interior spaces.

5.4.5. Intersectional Group Analysis of Gender and Age

Appendix 9 displays the intersections of gender and age demographics and the bar chart gives a breakdown of these dual variables across the three research streams, demonstrating that the female 20-59-warrior group predominate. The table compares the different gender and age attitudes, behaviours and motivations in the four most popular research scenarios of the PRAM, AMNIOTIC SAC, KITCHEN and CAR categories. These demographic group analysis themes examined comfort

variables by considering: attitudes, that is, approaches to comfort; the behaviours inherent in their sense based responses; and their comfort motivations.

Intersectional age and gender comfort hierarchies are ranked in Figure 81, which illustrates the preferred sense and motivation value given by each group to the constructs of comfort. Across the groups, the visual and temperature comfort senses dominate, alongside shared connections.

The under 19 female learner group positively rank shared, acoustic enclosure. Whilst male learners positively value visual and thermal stimuli; secondarily, gustatory and shared membranes. Both 20-59 (fe)male warriors were motivated by shared enclosure and temperature; with auditory and visual responses being preferred. Female warriors valued additional positional and rotational aspects of comfort and movement. In the 60 and over elder age-set, the visual, temperature and positional stimuli are valued. Female elders are influenced by shared space, with enclosure, security, weight, translation, and gustatory and auditory comforts. Male elders only responded in two of the scenarios, so their proportional preferences are shown.

FIGURE 81. GENDER AND AGE-SET MEMBRANE COMFORT HIERARCHIES
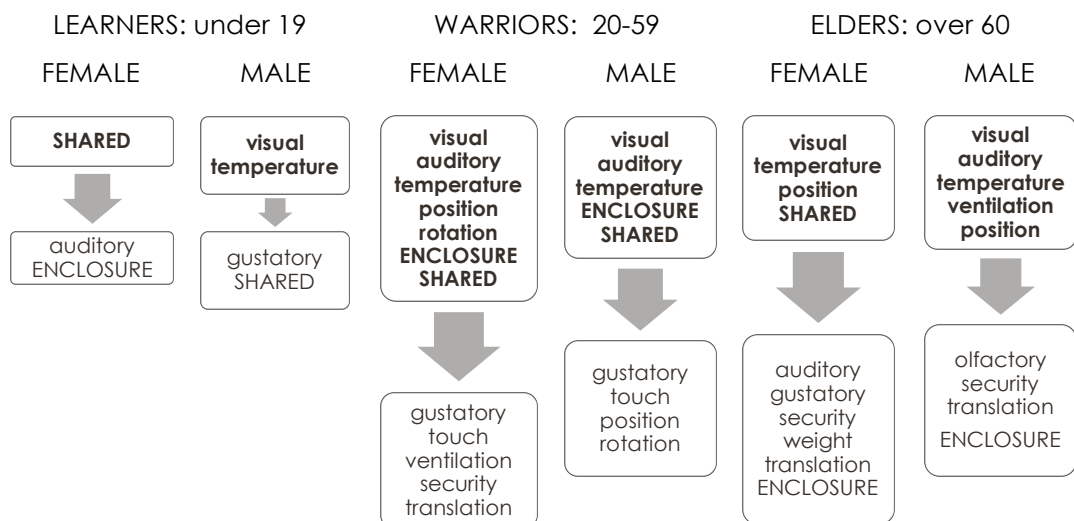
These findings show that attitudes, behaviours and motivations toward constructs of comfort change over a lifecycle. Attitudes to comfort were predominantly positive, with more comfort critiques in the female warrior and elders age-sets. Behaviours generating comfort prioritised visual, auditory and temperature senses. Comfort motivations evidenced shared and enclosure aspirations.

Therefore, when defining the types of comfort membranes prioritised at different life phases, there are conflicting attitudes and motivations in each group. These qualities of comfort should be used to guide discourses about efficiencies of comfort throughout life, showing the temporal aspects of (in)tangible comfort desire-lines. Hence, although this research has limitations, clear distinctive priorities were recorded for each group as evidence of comfort desire-lines.

Analysis of gender and age has demonstrated differences in the constructs of comfort within some demographic groups. Other demography may be relevant such as ethnic and occupational, or class-based angles, but constraints and the scope of this PhD research prevent further analysis. However, some individual instances of research data are described in the next section to develop discourses about personalised constructs of comfort.

5.4.6. Individual Viewpoints

In this research, up to 724 individual constructs of comfort were expressed. Some of these responses are chosen to develop further narratives about comfort, desire-lines and energy-use.

In discussions about the GYRO and its links to inhabitation within the AMNIOTIC SAC, GYRO model Respondent 20 portrayed a correlation with scuba diving. They described how weightless is induced by floatation aids and everything

decelerates because of submersion in water, prompting a "mindful" thought process, which enables "your brain to go into a flow state".

These aspects of inhabitation and the dual aspects of pressure and weightlessness occur within the AMNIOTIC SAC or GYRO, linking to Csikszentmihalyi's concept of flow, outlined in chapter 2.6. This is 'when a person faces a clear set of goals that require appropriate responses' (1997, p.29-30) and describes an immersive state of positive creativity.

Figure 82 charts the challenges and skills that are conducive to the state of flow. When relating this concept to constructs of comfort, the feedback evidenced time-bound distinctions of control, relaxation, anxiety and arousal (in the form of excitement). All these comfort states evidenced in the research are beneficial for this creative state. Therefore, could these constructs of (dis)comfort be used as an analogy for flow, because the fluidity and changing desire-lines that enable individuals to re-enact comfort have similarities?

FIGURE 82. CSIKSZENTMIHALYI'S FLOW
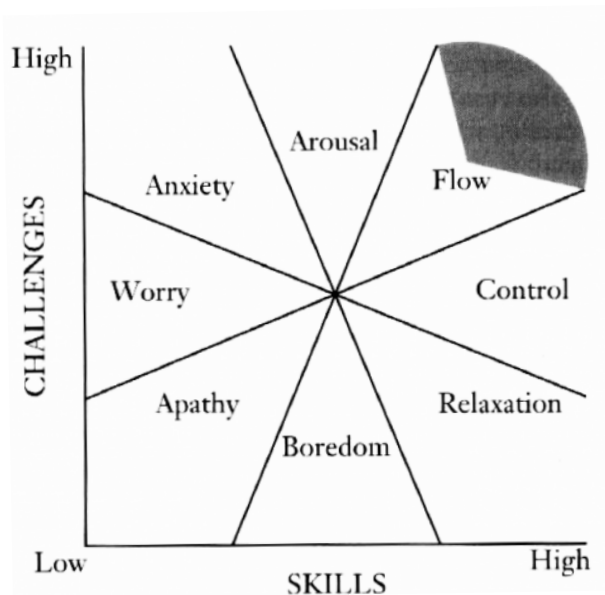
These connections could also relate to individualised energy use - this focusing activity enables maximum output to be achieved.

If individuals understand their specific desire-lines of comfort, they can channel their energies appropriately.

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The design research methods cultivated engagement with the research subject matter generating many surprising associations to the constructs of comfort. An unanticipated response included AMNIOTIC SAC respondent 10's creation of a visual metaphor about their first interior space, illustrated in Figure 83.

FIGURE 83. AMNIOTIC SAC FEEDBACK

When informally asked about this conception, the co-researcher explained their constructs of comfort as:

the individual (a piece of purple plasticine);

inhabits the interior of the AMNIOTIC SAC membrane (the balloon);

a connecting conduit provides sustenance (the blue rubber connection and tubes);

a trampoline, located underneath, provides a safety net (the atom set, straws and stretched bit of balloon);

a placenta like construct anchors the tubes and net (the pink plasticine)

the hand of (m)Other is there for comfort (the purple plasticine)

In my interpretation, this artefact is the embodiment of the creative energies in this research.

The COSY research stream evidenced other types of individual comfort constructs. The data patterns led to interpretations of how close to their body, people represent (in)tangible membranes. Liberating these notions from a gender lens, the enclosing membrane patterns could be linked to a continuum of individualised desire-lines of comfort in their life journey.

Some individuals have represented encircling membranes at the extents of their reach, whereas others denote membranes closer to their bodies. Does the proximity to the human body mark out implicit comfort constructs and priorities about energy use?

These distance associations could explain what motivates attitudes towards comfort and efficiency. If a person's comfort zone is wider than another or differs during life changes, it will affect the individual and those within their intangible comfort bubble. What may be important to consider are the reasons an individual finds comfort within their intimate zone, because this may impact on their energy efficiency. At this time, physical, physiological and psychological factors all may be considered to contribute.

Thus, the dimensions of (in)tangible comfort membranes, perhaps explain individual differences in environmental control. In interior spaces, where individuals are competing to construct comfort, their personal space, as opposed to intimate space zone is harder to control. These imperceptible boundaries may compromise personal space.

In his studies into proxemics discussed in chapter 2.6, Hall delineates gender and ethnic variables for intimate, personal and intimate space zones. In relation to constructs of comfort and the people and objects within a person's reach, this research enabled individuals to visibly articulate their individual desire-lines.

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If an individual understands their own changeable comfort dimension bias, and can convey them to other people, this can support adjustments and action to create comfort. For example, the busy ironing bubble discussed in chapter 2.3, is an intangible way to be separate within a shared space. Those with a wider comfort membrane, may control how they go about their daily lives. The individual may reconsider why their comfort has to encompass other people's comfort. Those constantly having to compromise within their zone may need to readjust. In contrast, if an individual has a smaller zone, an awareness that they might inadvertently influence another person's comfort could benefit relationships. They would both have the tools to explicitly readjust their comfort.

Therefore, to cultivate new understandings of the constructs of comfort, education and research activity about (in)tangible membrane creation needs dissemination to expand insights into how this minutia of comfort choice affects individuals and energy use.

5.4.7. Analysis Chapter Summary

The outcomes of this research process encompass the organisation, completion and analysis of the GYRO, AMNIOTIC SAC and COSY research streams. In pursuing and advancing this interdisciplinary subject topic, the experimental research methods chosen allowed for an investigation of the constructs of comfort within interior space. The nature of effects includes a greater understanding of pedagogies of the body that are evidenced in different physiological sensations and psychological associations.

It was in the enclosure of space that desire-lines could be used to identify comfort and their variability may represent how individuals assign their energy use.

Initially it was surmised that the unenclosed transport objects, such as the pram or

cycle would be covered for protection from the elements. In fact, 92% of enclosure

elements reoccur in each scenario within the proximate environment of the human

body as tabulated in Appendix 10. The membrane representations by co-

researchers incorporate similar types of encircling in different research scenarios, but

these enclosing depictions are countered by escape portrayals - hence the

appropriateness of this thesis about questions of (dis)comfort and energy use. These

responses correspond with aspects of control, where individuals express their desire-

lines to enfold themselves and then break free, within their own comfort parameters

evidencing territoriality around comfort interactions. Figure 84 gives a visual synopsis

of some of these (in)tangible membranes of comfort.

FIGURE 84. VISUAL SYNOPSIS OF COMFORT MEMBRANE RESEARCH
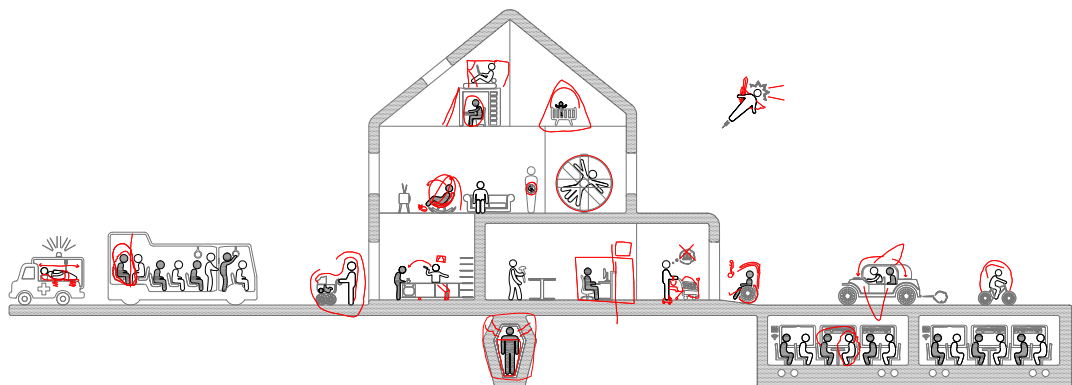
Visual and textual constructs of comfort, not unnaturally, are shown to be

influenced by relationships with others. As described in section 5.2.3.B, where the

lifecycle scenario feedback evidences comfort relationships progressing from

dependence to autonomy, and back to dependency.

In the next chapter the implications and synthesis of the subject topic,

research methods, procedures and analysis are discussed.

6. INSIGHTS

6.1. Implications and Synthesis

This chapter begins by appraising the development of this PhD-by-practice research journey. Distinct strands came together to answer the overarching research question of "how do people construct comfort in their interior spaces?" Figure 85 reiterates the supplementary queries highlighted in Figure 3 that have implications within this chapter.

FIGURE 85. SYNTHESIS OF ANALYSIS RESEARCH QUESTIONS

The next section gives a synthesis of the subject topic answering the question of what patterns of comfort are evidenced in the data; whilst the following section discusses research method insights specifically focusing on the research contribution to design and other disciplines.

6.2. The Evolving Design Research Journey

In an overview of this research journey, each of the research streams including the pilots, evolved the subject topic of comfort by focusing on: Comfort in an open interview question; Comfort in a metamorphic GYRO conceptual object; Comfort within the primary space of the AMNIOTIC SAC; and Comfort and movement desire-lines in a variety of COSY circumstances.

The constructs of comfort, in the form of (in)tangible membranes were also investigated within each instance. This elicited information about: Membranes and

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structures of past, present and future objects; Membrane conceptualisation in a metamorphic GYRO sphere; Membrane beginnings within the AMNIOTIC SAC; and Membrane circumstances throughout a COSY lifecycle.

Evidence about desire-lines was collated as an implicit side-effect of the comfort and interstitial membrane studies. In the process of detailing comfort in interior space the increasing influence of desire-lines became clear: Desire-lines of individualised comfort; Desire-lines of comfort and efficiency within a GYRO membrane; Desire-line comfort origins within the AMNIOTIC SAC membranes; and Desire-lines of movement and efficiency in the COSY comfort scenarios.

Additionally, efficiency routines were also elicited, these included: Efficiency in individualised energy use comfort values; Efficiency in the GYRO relating to ergonomic and functional comfort; Efficiencies of original comfort within the AMNIOTIC SAC membranes; and Efficiency comfort membranes and the desire-lines around COSY situations.

These instances chronicle the evolution of the overall research journey. Burgess and Bryman describe how 'events look more ordered with the benefit of hindsight' (1994, p.208) and digressions occur in the research journey. In hindsight, my early expectation was to have created lightning bolts in world changing design; but the reality of my development was evidenced in small increments of everyday enlightenment.

This research began in practice with the GYRO followed by theoretical elements. As the research continued these two elements became indistinct and developed into praxis. Nevertheless, in reality, academic theory still prevails as the orthodoxy by which knowledge is substantiated within higher education.

Within these theoretical text-based discourses, it must also be acknowledged that female to male author references were calculated at an approximate ratio of 1:2 in this research. This insight alerted me to the gender disparity in knowledge derived from textual sources.

Research themes were generated by using design research processes and grounded-theory methods. These grew, creating dots, such as the COSY categories, that were connected over time. Charmaz gives an analogy where the 'bones of... analysis' are constructed into a 'working skeleton' (2006, p.45). As the subject topic was enriched by the workshop data, research concepts were clarified. Smith and Smith recommend building time into the research process to allow for changes and uncertainty, warning that a 'too complete model becomes so precious that you are afraid to alter it' (2015, p.85). The data was analysed between each workshop so that the new knowledge generated in the iterative research process could be learnt from and taken into the next phase of investigation. My Research Illumination document - to be read in conjunction with this thesis - chronologically documents this progression, where each procedure informed subsequent events.

A rigid research style may have eliminated the movement and desire-line variants that allowed for transformations in thinking within this research. Furthermore, the efficiency discourses moved from a direction of the energy conservation of objects, to interactions surrounding people's energy use in their relationships with other people and objects.

6.3. Subject Topic Synthesis Of Comfort Constructs

The analysis chapter 5 interpreted the research data on various levels. Whilst comparing research findings to the contextual review and methodology, concurrent themes have emerged blending past, present and future research trajectories. Figure 86 re-uses chapter 2's visual signposting framework to reconsider the research from these interrelated perspectives.

FIGURE 86. INSIGHTS CHAPTER THEMES

OUTER

6.3.1 OUTER – COMFORT HEIRARCHIES
Comfort Rankings

INNER

6.3.2 INNER – SPACES OF COMFORT
Interior Comfort Awareness

MEMBRANES

6.3.3 MEMBRANES – A BALANCE
Half and Half

INTERACTION

6.3.4 INTERACTIVE - COMFORT RELATIONSHIPS
The Comfort of Others

BODY

6.3.5 BODY - DIMENSIONS OF COMFORT
In The Comfort Zone
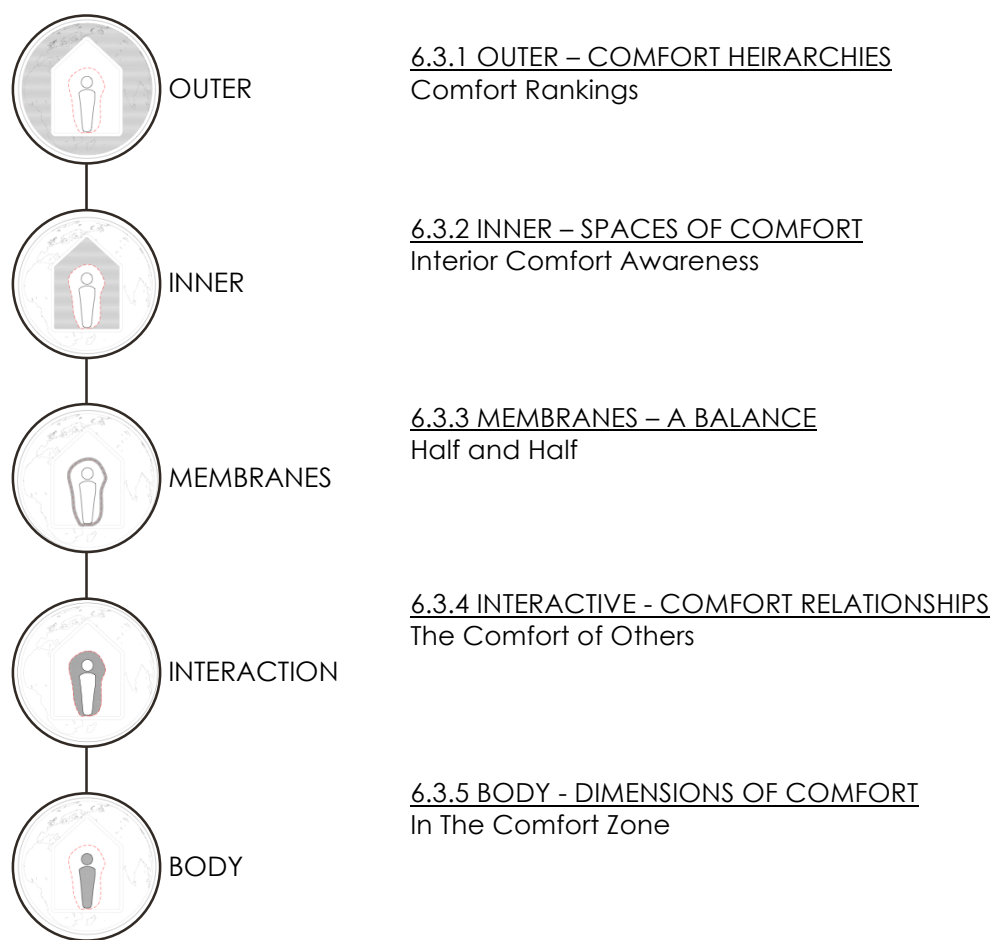
6.3.1.OUTER Comfort Hierarchies

Societal and cultural factors that influence constructs of comfort can be seen in the data. Figure 87 visualises age related Outer comfort constructs.

FIGURE 87. AGE RELATED COMFORT RANKINGS

outer socio-cultural
constructs affect everyday
contexts of (in)tangible
comfort membranes...

rotation
position
auditory
position
security
auditory
gustatory

visual & temperature
shared connections
enclosure
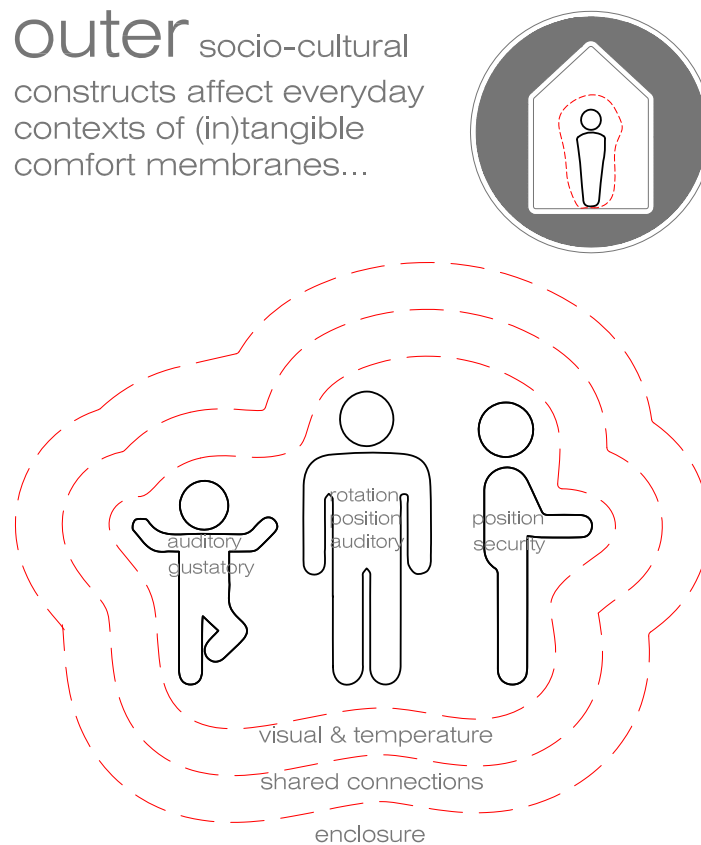
Relating back to chapter 5.4.4, the age-set data from under 19's, 20-59 and over 60's, ranked comfort membranes in differing orders. There was a correlation across all the groups to comfort elements such as visual, temperature, shared relationships and enclosure. It also demonstrates that our comfort priorities change as we age with gustatory-to-security comforts spanning a lifecycle.

6.3.2.INNER Spaces of Comfort

Figure 88 visually highlights the proportions of Inner (in)tangible membranes

represented by co-researchers in the data.

FIGURE 88. INTERIOR COMFORT AWARENESS

the influence of our inner environments is significant as we spend much time indoors…

building skin 5%

proportionally participant responses (#724) in this research evidenced…

(in)tangible membranes 92%

clothes 3%
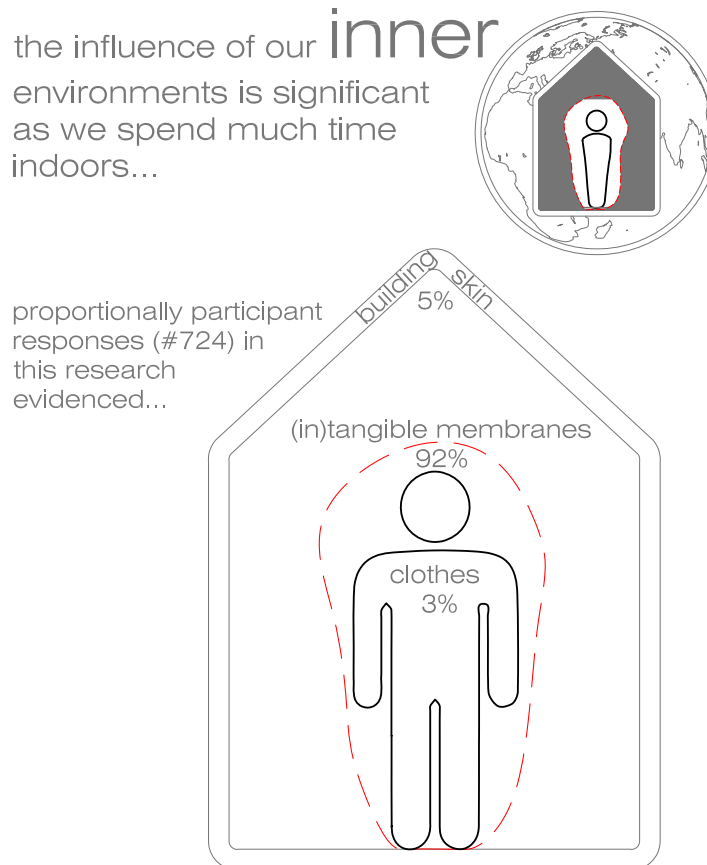
In the research workshops co-researchers were asked about their comfort in

different research sites. Chapter 5.4.7 charts that many people responded about

constructing comfort within the proximate space around their bodies.

Thus, the Inner space around a person is key to their constructs of comfort.

6.3.3.(IN)TANGIBLE MEMBRANES – A Balance

A nearly equal number of tangible and intangible constructs of comfort

were evidenced in the data and Figure 89 visually highlights this.

FIGURE 89. HALF AND HALF
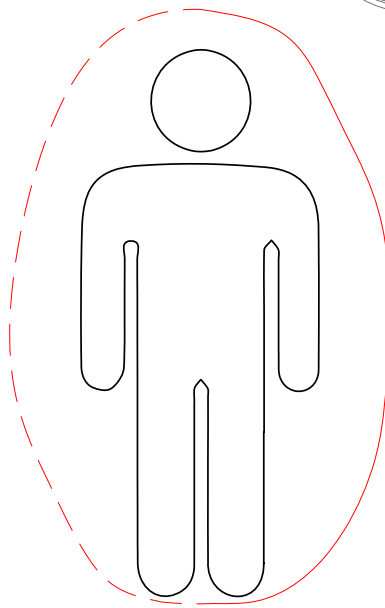
This research has proved that tangible and intangible constructs of comfort

have equal value. Chapter 5.3.2 describes how the research methods assisted in this

finding, because visually and textually 49% of co-researchers responded about

tangible or physical comfort membranes and 51% were intangible or psychological.

6.3.4. INTERACTION - Comfort Relationships

Patterns in the research analysis showed the importance of relationships with other people and animals as an influencing factor in the constructs of comfort. Relationships to objects, and things came after this, which is illustrated in Figure 90.

FIGURE 90. THE COMFORT OF OTHERS, AND THINGS
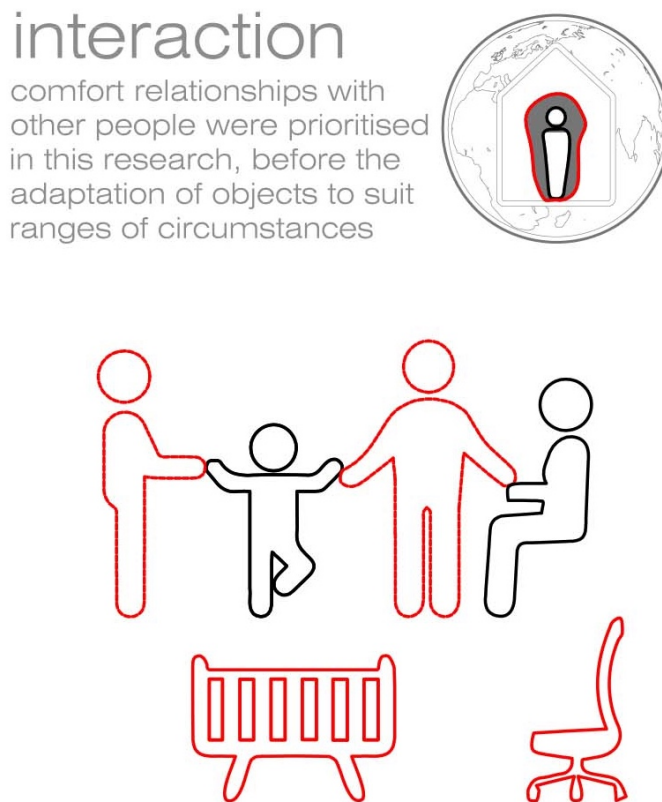
Co-researcher response patterns showed how they valued the comfort of others. Chapter 5.2.3.B describes how these interactions cycled from dependent-to-autonomous-to-dependent relationships as they reacted to the immersive lifestory of research scenarios.

The aspect of control or choice within these comfort relationships was identified and warrants future study.

6.3.5.BODY – Dimensions Of Comfort

The visual data illustrated individual (in)tangible membrane enclosures that were different distances from the body. Figure 91 illustrates these intimate and personal dimensions in relation to these comfort constructs.

FIGURE 91. IN THE COMFORT ZONE

the research found a difference in the way membranes were portrayed in relation to dimensions around the body
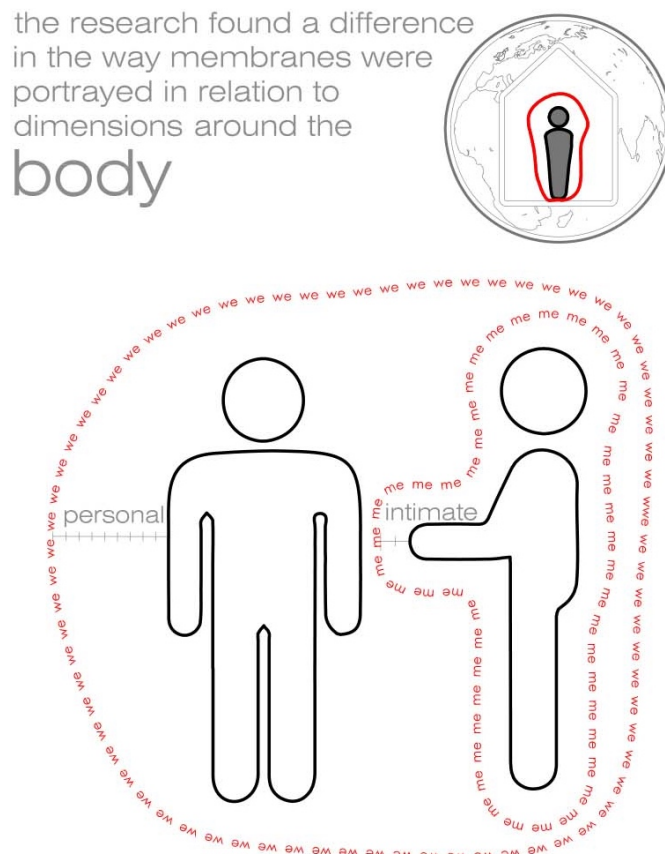
As outlined in chapter 5.4.6 individuals explicitly mark-out different sizes of membrane, illustrating that these dimensions influence (dis)comfort desire-lines. They may also describe the energies expended by different parties to augment their comfort as being the intruder, or intruded on, generates a reaction.

In situations where these comfort desire-lines collide, conflicts arise - as evidenced in chapter 5.2.3.B.

6.4. Research Method Insights - Design Reflections

In this research my implicit assumption was that "everyone is an expert in their own comfort". It was clearly stated in the COSY exhibition interpretation and instruction page of the Designbook. However, on reflection my analysis has led me to determine that individuals are on a non-linear comfort spectrum.

Comfort has its origins in the AMNIOTIC SAC object and circumstance, however, translating this prenatal experience to postnatal constructs of interior comfort was a challenge. Nonetheless, different ways of disseminating and applying this knowledge were devised. The design and action research methods employed in this study, enabled two-way engagement of comfort to be shared between myself, professionals and the public.

Academic dissemination commenced from the outset of my PhD journey. Internal institutional lectures at various junctures in my research journey explained my work-in-progress. External dissemination activities were strategically targeted so that the practice, theory and immersive aspects of my research could be effectively shared. These academic exercises were constructive and networking at the events generated a critical interest in my research.

For example, the inaugural PhD by Design (5-6 November 2014) Conference held in London, UK, thematically focused on the complexities of practice-based research and Contributors presented their research work-in-progress. This created an informal yet professional atmosphere for discussions, synergies and networking throughout the conference.

A theory-based conference that was attended as an author and speaker was the Interiors Forum World (21-22 May 2015) Conference in Milano, Italy. Its thematic aim was to discuss the topic of 'living and inhabiting in an age of

migrations'. Specific feedback from other academic attendees about my research presentation included interpretive dissemination and ideas for further study. My peer reviewed paper for this conference was included in an eBook publication, 'Nomadic Interiors: Living and Inhabiting in an Age of Migrations', as a chapter titled the 'The Space Between: How People Use Space Efficiently - Obioma Oji, University Of Edinburgh' (2015, p.372-415).

A third conference that focused on embodiment was the International Metabody Forum - IMF 2016, in London (7-9 April 2016). A small workshop was held to communicate my research topic and my respondent role enabled me to give feedback to other attendees. In this performative context aspects of immersion and action research were discussed and enacted with other interdisciplinary academics. My personal engagement with the Metatopia membrane, enabled me to gain experiential insights that could not have been communicated in text or visually.

These conference contributions, with outputs in the form of papers and published book chapters, have enabled dissemination within my research community of practice.

6.5. Design Opportunities

When reflecting how this research knowledge can contribute to design and other disciplines, looking to other fields for exemplars can aid shifts in understanding.

Darlington, a neuroscientist, describes how disciplinary knowledge 'progresses in stages'; 'initial interesting observations' are trialed and tested as the 'necessary and sufficient conditions to produce the event' are problematised. The next phase established the 'conditions required for the event' from which

'predictions about the event can be generated and tested' (2002, p.197-8). This concept gives a synopsis of how this research could impact interior design futures.

The innovative design of the experimental workshops - with their prop-based immersive features, the exhibition interpretation, and the survey questionnaire articles - drafted a new research methods framework within this field.

In future exploration of this or similar topics, the same action research methods crafted in this research could be revised in different scenarios and venues.

Additionally, future workshops into constructs of comfort could involve residential workshops, where selected participants interact with the subject topic over a number of days.

Or, with greater resources, such as access to industrial product prototyping capabilities, 1:1 GYRO prototypes could be created for experiential feedback.

Last but not least, a Comfort Passport, or ID based on the COSY Designbook could be designed for various purposes, such as personalised objects, lifestyle circumstances, or virtual apps to compare intersectional comfort relationships. These articles would enable individuals to articulate, illustrate, discuss and disseminate their past, present and future comfort desire-lines.

7. CONCLUSIONS

7.1. To Conclude And Suggestions For Further Work

This research journey has iteratively developed from problem-solving to problematising the study of objects or circumstances between clothes and the building skin that influence comfort and the use of energy. A series of experimental interior research design workshops investigated the question of comfort and movement, eliciting real-world responses surrounding (dis)comfort, desire and personal energy use patterns.

The research methods rigorously investigated the subject topic through distinctive, but ephemeral interior design techniques of data gathering. These immersive workshop experiences were augmented by textual and image based research materials that advanced alternative ways to map (dis)comfort. The data gathering workshops used methods that have a repeatable structure and the three research streams were triangulated and their data was cross-referenced. The validity of the methods was tested against known theories and experience, as well as across grouped data.

New knowledge produced in this PhD-by-practice investigative journey involves the notion that the human form is an entity enveloped by constructs of (dis)comfort and energy use, expressed through explicit and implicit layers. As the sedentary human form moves through different time phases and structural conditions, the positions of these layers transform. The interwoven aspects of comfort and movement, and their relationship to desire collude to create dynamic interactions. An individual efficiently passes from one phase to another, based on their subjective requirements.

Currently these layers have been related to the building skin resulting in intrinsic high energy consumption of the worldwide building stock, as highlighted in the introduction section 1.1. This focus on comfort acclimatisation via this outer layer has developed to a point where relying solely on the building skin provides an unsustainable tool for regulating our physical, physiological and psychological comfort. It is recognised that individuals use their clothes to regulate their intimate requirements, however, the data from this research evidences that people demark a zone of comfort within the proximate spaces around their bodies. Therefore, we need to reconsider the priorities given to interior spatial design to aid building energy use by shifting the emphasis of building energy use debates from the outer skin to the space surrounding the human form.

This research examines how we use our interior spaces to effectively respond to (in)tangible comfort constructs. Hence the structural comfort membrane in the GYRO concept developed as a metamorphic furniture idea with obvious limitations for the main research questions. But as a concept it encompasses, thermal, acoustic, visual and spatial efficiencies whilst also catering to mental and bodily comfort in more sedentary modes such as sleeping, relaxing or desk working. Reactions to the concept and an actual gyroscope developed new understandings about the complexities of end-product and process.

The AMNIOTIC SAC workshop invented playful ways for co-researchers to articulate comfort memories of their first interior space. This produced responses, such as pressure and weightlessness that could be taken into other research areas, but can be used to develop comforting interior space constructs.

Another conception was evidenced in the COSY Designbook, which facilitated the mapping of co-researchers' comfort desire-lines via an image and

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text survey. This data showed how respondents signified their comfort desires through their relationships with others, as well as objects. Within a lifelong context, these connections cycle from dependence to autonomy and the (in)tangible membrane representations show how co-researchers desire control within these interactions. Group analysis evidenced that females produced a higher proportion of (in)tangible comfort membranes in their environments. Individual patterns of personal and intimate spatial comfort membranes were also demonstrated. These constructs of comfort provide insight into competing comfort aspirations and more research in this area would develop these insights further.

This research produced new interpretations into constructs of comfort. Its interdisciplinary focus has added new knowledge into the fields of interior and industrial design; whilst also developing synergies with the fields of architecture, engineering, immersive performance, social and cultural anthropology, social science and behavioural geography.

The design and action research methods utilised in this research facilitated the effective sharing of the information in the interactive workshop events. This strategy informed the lay audience of co-researchers about the research. From an academic viewpoint, the research was communicated in a range of disciplinary conferences. This has allowed for the practical, theoretical and immersive elements of the research to be shared within an interdisciplinary context, developing a community of practice. These include the inaugural PhD by Design (2014) Conference held in London, UK; The Interiors Forum World (2015) Conference in Milano, Italy; and the Metabody Forum (2016) held in London UK.

When answering the "so what" question about this research-by-practice journey, this study has sparked new ideas and generated additional routes of

enquiry. The data gathered in the GYRO, AMNIOTIC SAC and COSY research streams allowed individual and group analysis with relevant conclusions to the research questions. However, the interdisciplinary nature of the research created avenues that the current PhD scope and timescale did not permit. For example, experimenting with the form and application of the GYRO concept - through product prototyping, construction, and development of a service process - was not possible. Furthermore, the COSY data set produced ample individual cross-sectional data for this PhD-by-practice research phase.

Future developments in this field of research could be undertaken by designers from a range of disciplines; for example, the creation of teaching of teaching aids for the fields of interior design – developing new physical and psychological comfort configurations that focus on the proximate space around a person. Furthermore, a research unit or think tank that developed this area of interior spatial-psychoanalysis could generate further insights into implicit comfort influences from age, gender, ethnic, disability, and class-based viewpoints. This would assist designers, researchers and policy makers in developing appropriate building energy use strategies. In particular, my concept of the GYRO as a potential product illustrates how my conclusions can be applied in practice to thermal energy conservation because it permits a smaller interior energy footprint.

The achievements of this research on the "stuff" between clothes and the building skin include the development of methods that map a person's comfort desire-lines; it has obtained meaningful results about human efficiency routines. Comfort desire-lines formed from individual responses may change over time so as Bechhofer and Paterson suggest 'the next step is to have repeated measurements at different times' (2000, p.114). Hence this investigation could incorporate larger

samples to widen demographic insights into psychological, physiological and physical energy consumption patterns that influence climate change. Methodologically, these interrelated constructs of comfort and desire-lines could be applied in future studies to renegotiate (in)tangible energy use measurements.

This PhD-by-practice contributes to design at all levels through investigative reporting of interior comfort interactions. The findings and scope of the research presented is the spark to promote further interdisciplinary studies.

APPENDIX 1 – PILOT RESPONSES TO QUESTION "WHAT IS COMFORT TO YOU?"

Respondent #	Gender	Age	Feedback
1	F	61-65	Safe and held; Has to do with feelings and physical presence Communicate easily Feel safe when travelling because not connected to anything, I'm free to dream Of hot-water bottle, physical and aesthetic warmth i.e. beauty, noticing random moments of... Clothes that hold you that allow stretching Being engaged with what you're doing Being with people in a shared experience, round table, i.e. in a corner Change of perspective Being available to see what's around you Rocking i.e. ship train, hammock, chair, car
2	F	31-35	Finger sucking Sun and wind blowing (warmth & ventilation) Food Drink drugs Perspective Daemon Decanting things Soft bedsheets
3	F	66-70	Feeling warm and moving without restriction Access an environment in which you don't feel too hot or too cold, nicely warm were you don't feel sweaty Wearing clothes that breathe Physiological views above Satiated and relaxed in the company of friends, also in the presence of media such as music, radio, TV with some control over time etc. And choice of media, friends... blaa blaa Prayerful approach, meditation Private space, quiet time Sharing things that you enjoy ideas, back and forth
4	F	31-35	Being warm Being in soft clothes that fit comfortably, I always get changed into my comfies Not feeling any pain in your body, body feels relaxed Light, low light levels Not much noise Suppose people, but the right people, not just any people All the things you associate with 'home' Tea, nice food, not just any food
5	M	41-45	58, 85 kilos, balding, bear bare Temperature - warm hot - absence of cold Feeling the ground on a mountain or by the sea, being outdoors Natural fibres, not man made My mother's breast, from her bosom Love at its best Long term love and security is comfortable Knowing who you are Knowing where you are Not having broken bones so not perceiving pain Certain poo's Weeing in a warm bath
6	M	36-40	Warmth Protection from the elements Security - physically and mentally Getting errands done Relaxing on sofa watching TV - chill out time Environment set
7	F	36-40	Clear horizon nothing to worry about Things sorted - nothing to worry about Open fire Dinner cooking - the expectation of food Happiness = comfort Baby hug Weightless - feel as though you're completely supported Temperature just right not too not cold - so you don't even notice Freedom of choice in your activity i.e. sometimes alone, sometimes with friends Something to link you to outside world, radio helps i.e. not only pre prepared music Variety, it's un-comfy to do the same thing all the time Nothing beats a good shit (or pee) it can be pleasurable because of the relief The sound of a wood pigeon

Respondent #	Gender	Age	Feedback
8	F	31-35	Warmth is probably biggest one Softness in term of furniture and clothes I quite like tightness, being wrapped in something Having that security Breathable especially for shoe's i.e. trainer Feeling safe, psychologically Maslow's hierarchy of needs Familiarity with friends, family places Knitting because its repetitive, familiarity, soft TV watch something I know well, revisiting things from the past, comfort Going in my own loo or in a private bathroom, don't really read though I won't poo at work, only one loo
9	F	31-35	The light in the house, to have loads of light in the house, especially in Scotland A nice comfortable kitchen, access to utensils, cooker, table for eating, sink next window How you make your house, the design, what you're comfortable with i.e. I would feel un-comfy with a contemporary, IKEA style flat, I prefer older things with soul i.e. eastern Like my kitchen contemporary as it's more functional, when you cook and bake a lot its important I like it when you have a big kitchen as people can gather socially Miss in my current kitchen no kitchen and lounge together so can't socialize if you are making food I do like when its clean and tidy, that's what makes me comfortable, I could not live in a messy place Heat When I go to bed I like when its warm but when I sleep I need some air otherwise I get a headache It can't be too dark as I find it difficult to get up Bedroom faces garden, quiet, away from car noise, birds (seagulls) Radio in morning, good speakers, could live without a TV, I don't have time Sitting on sofa, putting feet up, cosy - with candles Incense, scented candle Flame in candle burning but ideally an open fire, watching the flames and feeling heat from the flames (simulated not as good as real) A hug An animal, something waiting for you to come home, they want to be with you Having a bath, because sometimes I just want to sink in, water and bath gives you comfort, shower is okay, but having a bath is luxury, you can give yourself the time

APPENDIX 2 – PILOT COMFORT CHECKLIST RESPONDENT FEEDBACK

	ARTICLE	PLACENTA & AMNIOTIC SAC	POP UP TENT (*Decathlon*, 1-5 man)
ENERGY	POWER CONSUMPTION	with blood from the mother	modern tents (not yurts, tippees) negligible as pop-up
	FABRIC PERFORMANCE	.	double skin - inside one like net takes moisture and holds it and outside one takes moisture from outside and holds it
	LIGHTING - LOW ENERGY	.	flaps on the side to allow light in during day, torches at night (LED) wind up
	ECO -LABELLED	.	made of nylon based fabric, visually coloured can affect landscape, but also safety colours
	ENERGY CREATION	there's heat because various metabolic processes go on	No, low energy living
	THERMAL COMFORT (MEMBRANE)	the baby gets heat more from conduction from the surrounding tissues of the mother rather than just the placenta	works well single skin - you get wet as soon as you touch the outside (yurt or tippee) liner on inside. single skin tent is a bivouac i.e. a shelter not a tent
TRANSPORT	ONLINE	.	no
	PHYSICAL	amongst other processes food, oxygen supply and carbon dioxide removal travels via transporting molecules down a diffusion gradient	shop - you want to see it physically, size, strength… 2-3 man tent £100-50. a good mountaineering tent approx north face 'summit series' £500-800 2m dome tent £500 sleeps 8 equivalent of yurt or tippee
	GLOBAL	.	definitely (Vietnam)
	LOCAL	.	no
POLLUTION	INSULANT	.	air pocket, ground sheet
	EMISSIONS	.	synthetic fibre discharge
	CLEANING	baby doesn't poo in womb because baby hasn't eaten, gets food through placenta from mother	scrubbable
	RENEWABLE ENERGY SOURCE	.	no
	PRODUCTION	placenta can biodegrade or can be used for food (by animals or human)	nasty chemical, the nylon making process
MATERIALS	ENVIRONMENTAL IMPACT	.	nylon making, cheap labor
	RESPONSIBLE SOURCING: BASIC ELEMENTS	.	.
	RESPONSIBLE SOURCING: FINISHING ELEMENTS	.	no literature re: look online environmental statement
	RECYCLING	goes out of the body and research - not sure if hormones collected from - if abnormal 10%ish need to find out via tests	none
	WASTE DISPOSAL	incinerated (in hospitals), but also some cultural ways of burial etc.	landfill
WATER	POTABLE WATER	There is a major blood supply to the placenta - output to the heart (most vital liquid) partly red cells partly plasma and there's water in both of them	.
LAND & ECOLOGY	SITE ECOLOGY	.	.
	SITE ENHANCEMENT	.	ground mat or sheet
	PROTECTION OF ECOLOGICAL FEATURES	.	pitch appropriately
	CHANGE OF ECOLOGICAL VALUE	.	none
	FOOTPRINT	.	small
	HOME OFFICE	.	no because you are sitting, lying
	LEISURE	.	great, relaxed, very roomy
HEALTH &	DAYLIGHTING	you can see though the sack clear liquid - gives a certain amount of light - being inside mum	flaps good
	ACOUSTIC - SOUND INSULATION	they hear sound and heart beat from mum and placenta	can hear everything

	ARTICLE	PLACENTA & AMNIOTIC SAC	POP UP TENT (*Decathlon*, 1-5 man)
	KINETIC	placenta, umbilical cord and amniotic sack can move in relationship to other organs of the mother	move and flap in wind
	PRIVACY (MEMBRANE)	.	visual privacy, perception of privacy but not much acoustically and visually at night
MANAGING	USER GUIDE	.	yes, and warnings and labels which take away from aesthetic
	DELIVERY	.	pick up
	MAINTENANCE, TROUBLE-SHOOTING	.	disposable items, can send to be repaired, ground sheet loses waterproofness and this effects all tent, zip breaking, velcro not useful for keeping midges out
	SECURITY	.	keeping insects, and small animals out
PRODUCT	BALANCE	.	Relatively symmetrical, nicer to be in
	UNITY	.	pop-up tent so feels uniform, visual noise takes away from
	VARIETY	.	shelter to sit in or sleep in
	EMPHASIS	.	car camping, festivals - heavy to carry
	SCALE/ PROPORTION	.	3 man tent, good proportion, 1 person to 3 people, depends on occupancy
	RHYTHM	.	yes but different
SENSORY	VISION	.	green
	HEARING-AUDITION	.	
	TOUCH- HAPTIC, TACTILE	.	bad, because of the material, crispy nylons
	SMELL- OLFACTION	.	synthetic - yuck, especially when new
	TASTE- GUSTATION	.	synthetic
	PROPRIOCEPTION- BEARINGS/ ORIENTATION	.	important to orientate towards the wind and sun depending on site features (midges, sunrise, sunset..)
DESIRE	SMOOTH/ ROUGH	.	smooth
	SOFT/ HARD	.	soft (but not as much as would like)
	SHINY/ DULL	.	Want it to be more dull than shiny
	SWEET/ SOUR	.	location sweet, smell , material sour
	FRAGRANT/ MALODOROUS	.	unnatural, synthetic fragrance
	PLEASURE/ PAIN	.	pleasure
	BEAUTY/ UGLY	.	neutral
	HOPE/ DISPAIR	.	hope
	NOSTALGIA	.	no
	CRAFTSMANSHIP	.	factory made
	FENG SHUI	.	minimal, bought slightly more expensive one as had a better feel, twin openings, less costraphobic
	INTERACTION BETWEEN USER AND PRODUCT	.	It's very functional, element of form which is pleasant and allows for exterior experience to be more comfortable and ease of putting up removes stress, no time constraints. Can be done in the dark.

Respondent #	Gender Fe/Male/?	Feedback	Qualities of Experience	Connection to Events & Situations	Feelings & Thoughts	Bodily States	Time & Space Affecting Meaning
1	M	"How do you get in and out of it?" "I don't want to frazzle between the woven heating elements?"	?-		Uncanny	Accessible; Utility; Thermal; Discomfort;	
2	F	"You need to have an 'O' in the name you give it i.e. 'the O' or something like that"	+	Label			Object
3	F	"It would be useful in healthcare scenarios where people are bed bound. You can get under/ behind the patient and they can move about gently, minimising issues with pressure sores."	+	Healthcare	Practical	Regulation	Adjustment
4	M	"The structural elements make it look tortuous?"	-			Discomfort; Pain	
5	M	"Draft up some drawings to get quotes for its construction from metal fabricators" "You should call it cOsmOs"	+	Production; Label			Object; Potential
6	M	"Is it a sex toy/ device?"	+		Intimate	Pleasure	
7	F	"What type of creature would represent this concept?" "What we do when we work, workplace contexts – do we need more productivity?"	+	Biomimetic	Decelerate	Shelter	Potential
8	M	"Workplace futures will have changing 3D interfaces" "How are we suspended and how will the radical effects of gravity influence this?"	+-	Technical	Decelerate	Floating	Potential
9	F	"In practice of tai chi we think of the origin, would feel trapped when coming into smaller spaces i.e. newer architecture and lower ceiling heights"	-	Origin	Restrictive	Discomfort	
10	M	"Regarding the inner hammock membrane, look at animals that go into a cocoon i.e. the Ghanaian weaver bird"	+	Biomimetic; Interior	Intimate		Potential
11	F	"Using gravity in structure so pressure on body simulates a cuddle" "Would want a softer cushioning inner hammock membrane"	+		Intimate; Held; Soft	Pressure	
12	M	"Softness, warmth, support – no pressure on parts – but distributed over body"	+		Soft	Thermal; Float; Balance	
13	F	"Issue of problem solving approach in PhD research; idea of a hug from smart textiles; or latex, rubber like structure"	+-	Technical	Held	Pressure	Potential
14	F	"Suspended by air or gel liquid – solid/ fluid/ gel"	+		Water; Soft	Floating	
15	F	"Movement within gyro [image]"	+	Utility		Ergonomic; Adjustment	
16	?	"Instability"	-		Uncanny	Unstable	
17	F	"You should patent the idea"	+	Trade-mark			Potential

Respondent #	Gender fe/male/?	Feedback Before gyroscope — What are your expectations of comfort and movement before your ride?	Feedback Gyroscope After — What was the reality of comfort and movement after your ride?	Qualities Before	Qualities After	Connection to events & situations	Feelings & thoughts	Bodily states	Time & space affecting meaning
21	F	Looked a comfy seat; well padded; movement. Lovely swinging	Comfort excellent; movement like cradle until double upside down when physical side effects started	+	+-	Childhood	Swaying	Ergonomic; Unstable	Phased
22	M	I'll feel dizzy and the movement will be slow-slow, then fast-fast! Nervous	Dizzy, light, proud and happy	-	+		Anxiety; Elation	Acceleration; Dizzy	
23	?	Lost, wierd, confused, in control? Feeling different	Awesome; the pressure/ tightness made me feel very safe but at the same time ready to give up control; thanks for this exhibition!	-	+		Uncanny; Elation; Held	Unstable; Pressure	Protection; Control
24	F	Discomfort and disallusion; throwing out of balance normal; disconfusulation	Lots of blood in my head; warm and blood everywhere; like an astronaut; not as uncomfortable as i had originally anticipated	-	+	Outer	Discomfort	Unstable; Floating; Rush; Thermal;	
25	?	Dizzy-making. Exciting. 'woah'	Slightly woozy head; very fun; not sure i'd make it in nasa	+-	+-	Outer	Pleasure	Stimulate; Dizzy	
26	M	I think it will be exciting but slightly uncomfortable; i think i'll feel dizzy and sickly and out of sorts	I could feel the blood going to my head and it really made me laugh; i feel all over the place and rather dizzy after being upside down	+-	-		Pleasure; Discomfort	Dizzy; Nausea; Rush	
27	?	Will use lots of tummy muscles; blood rush to head; may accidentally wee a little; think it will be very fun and exciting	Feel weightless and floaty; brilliant experience	+-	+		Pleasure; Elation	Stimulate; Rush; Floating	
28	M	No comfort; a bit of fear	Proud; young!	-	+	Older	Discomfort; Anxiety; Relief		
29	M	Comfortable but nauseating	More comfortable than expected. Did not feel sick!	+-	+		Comfort; Relief	Nausea	
30	F	Scary! Nervous	Dizzy; dizzy!	-	-		Anxiety; Anticipation	Dizzy	

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Respondent #	Gender fe/male/?	Feedback Before gyroscope What are your expectations of comfort and movement before your ride?	Feedback Gyroscope After What was the reality of comfort and movement after your ride?	Qualities Before	Qualities After	Connection to events & situations	Feelings & thoughts	Bodily states	Time & space affecting meaning
31	?	Dizzy; slightly nauseous; disorientated!	Fun! Not so dizzy. Interesting to try and orient yourself by the architecture of the building	-	+	Site	Pleasure	Dizzy; Nausea; Unstable	Perspective
32	F	Looks cosy!	Uncomfortable for head; visually stunning in sculpture court!	+	+-	Site	Comfort; Discomfort	Rush	Perspective
33	F	Soft chair! A little areolar[?] Feel like the space! [love heart]	Amazing! Even much more fun than i imagined; indeed a little areolar though ~	+	+	Outer	Soft; Pleasure; Elation	Ergonomic	
34	F	Might feel ill; could be fun; like a fairground ride	It was fun and i was fine	+-	+	Active	Pleasure; Relief	Nausea	
35	F	Snug, rollercoaster, nervous, excited, dizzy, butterflies in my stomach	Fun, disorientating, exciting, wobbly legs, thrilling, smooth motion	+-	+	Active	Comfort; Anxiety;	Unstable; Balance	
36	?	Looks wierd but comfortable!	Ohh - but uncomfortable; but fun (for brief time)	+-	-		Comfort; Uncanny; Discomfort; Pleasure		Phased
37	?	Loss of balance; disorientation; fluid movement	Fluid movement; constant change of direction = inability to focus on anything; like a ride on the 'waltizer' fairground ride	-	+-	Water; Active		Unstable; Acceleration; Pressure	Perspective
38	F	Dizzy	+ exciting; - blood coming to my head; - feeling	-	+-		Pleasure	Dizzy; Rush	
39	F	Expected to feel disorientated; looking forward to feeling of weightlessness	Unbelievable movement feeling due to upside down motion against gravity; very comfortable and secure	+-	+		Comfort; Held	Unstable; Floating; Acceleration; Pressure	Protection
40	?	Trapped feeling? Unnerving; fear/ queasy; going upside-down	Strangely relaxing! + comfortable but then felt a bit dizzy [spiral sketch] couldn't go in for long; good sense of letting go of control	-	+		Helpless; Uncanny; Comfort	Nausea; Unstable; Dizzy	Phased; Control

Respondent #	Gender fe/male/?	Feedback Before gyroscope — What are your expectations of comfort and movement before your ride?	Feedback Gyroscope After — What was the reality of comfort and movement after your ride?	Qualities Before	Qualities After	Connection to events & situations	Feelings & thoughts	Bodily states	Time & space affecting meaning
41	F	I expect to become dizzy but the seat looks comfortable	It was actually really comfortable, i do feel disorientated though	+-	+		Comfort	Ergonomic; Dizzy; Unstable	
42	F	Seat looks comfortable but i feel that it may be like a rollercoaster	Safe and comfortable but a little disconcerting. Thoroughly enjoyed it!	+-	+		Comfort; Held; Uncanny; Elation	Ergonomic; Unstable	
43	M	Dizzy	Well! No dizzyness; heavier than i thought i was; aware of space	-	+	Site		Dizzy; Gravity; Visual	Perspective
44	F	Disoriented; adrenaline; fun	Amazing	+-	+		Stimulate; Pleasure; Elation	Unstable	
45	M	Being upside down might make the blood rush to my head	An initial moment of euphoria followed by queasiness and a throbbing head	-	-		Pain; Elation	Unstable; Rush; Nausea	
46	M	Vertigo! Expecting gyro to be quite un comfortable	It makes you feel hot!! Dizziness. Lightheaded. Completely disoriented!	-	-		Discomfort	Balance; Dizzy; Unstable; Thermal	
47	F	Worried about my specs! Disorientating. Fun.	Blurry (obviously) but felt vulnerable and completely reliant on operator for guidance; very noticeable pressure points changing as my orientation changed; fun at time, nauseous now!	+-	+-		Pleasure; Helpless	Visual; Unstable; Pressure; Nausea	Phased
48	F	Dizziness and exhilaration.	Dizzy. Strange sensation. Feel comfortable when i expected the rotation and slightly uneasy when not.	+-	+-		Elation; Anticipation; Uncanny; Comfort	Nausea	

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Respondent #	Gender fe/male/?	Feedback Before gyroscope: What are your expectations of comfort and movement before your ride?	Feedback Gyroscope After: What was the reality of comfort and movement after your ride?	Qualities Before	Qualities After	Connection to events & situations	Feelings & thoughts	Bodily states	Time & space affecting meaning
49	F	Trilling… maybe exciting and fun. Quite scared and nervous	.	+-	?		Elation; Pleasure; Anxiety		
50	F	Dread: lack of control, feeling/ being sick, post dizziness hope: might help shake up my my ears which are clogging	Survived! (needed to be alone after) but do feel sick, dizzy and rather sad (???) Think my ears/ deafness opened up a little. Enjoyed the tidal feeling of the weight of my insides moving at a different speed/ direction from my outside. My outside felt light; my inside felt wavy	-	+-	Solitary; Water	Discomfort; Relief; Unhappy; Pleasure; Pain	Nausea; Dizzy; Balance; Pressure	Phased; Control
51	?	Dizzy; disorientating; out of control; (hopefully) held in place	Out of control (in a fun way); comfortable after a while; swimming; exhilarating; scream! Laugh!	+-	+	Water	Held; Comfort; Elation	Unstable; Dizzy	Control
52	?	Fun! Scary eek!	Fun; hilarious; feel a bit dizzy now but happy!	+-	+		Pleasure; Anxiety; Elation	Dizzy	
53	?	I'm expecting dizziness, nausea etc. 0302	I'm feeling great, lighter and worriless	-	+		Discomfort; Pleasure; Elation	Nausea; Dizzy	
54	?	Vomit; dizzy; exciting; fun; friendly; i	Dizzy; but fun! Groovy	+-	+	Relationship	Anticipation; Pleasure	Nausea; Dizzy	
55	?	Bit afraid to be sick excited. Inner child awaken! Want to have a fun break	Feeling very light and full of joy!!!	+-	+	Childhood	Desire; Pleasure; Elation	Nausea	Control

APPENDIX 5 – AMNIOTIC SAC FEEDBACK CHART

Participant	Gender	Birth Year	Ethnicity	Occupation	Thoughts comments	Text - sensory experiences of comfort
1	F	1982	white	designer		Feeling loved by my partner/ family/ friends is a huge source of comfort. It is not a space or environment but an emotional feeling of security, + comfort that being 'loved' provides. Other sources of comfort include feeling warm in cold weather or exposure of my skin to the sun in warm weather.
2	M	1982	pict	warrior	eh?	True comfort is not found externally. True comfort (i.e. peace/ freedom/ joy) is found inside oneself. It is found once one 'lets-go' of burdens placed upon by others or oneself. Freedom means being free.
3	F	1982	white	translator		I imagine that if I had a memory of being in the amniotic sac, it would be quite still, quiet and warm but also reassuring. I think the idea of existing and growing while getting only the essentials in life (food from my mama!) is amazing. It's comforting too to know how little you need in life to progress and become something amazing - a real life living being! And all the while having someone to protect you and care for you. I associate security and shelter with comfort and comfort with happiness. I have lots of happy memories from holidays in Spain. One in particular was when I was about 8 and had lunch with my sister on my granny's tiny balcony. She'd provide us with food (think food is my theme here!) and we'd get to chat to people going past the window, and laugh a lot. On other occasions, the same window provided a great launching point for water bombs that we like to throw onto friends. I think I felt secure then because it was a comforting space but an open one too - window to the outside while still feeling protected by the interior space and people in it.
4	F	1987	mixed race	galerie owner	erm…..	It must have been warm, very safe. Feelings of weightlessness	A warm bath or shower always gives me comfort.	You create a safe place in your Home, Room, Bed within your bedding	In sleep you return to that peaceful, quiet experience. Even physically return to a comforting position	When we are sad or scared we returned to our fetal position hoping to seek comfort from our first safe place	perhaps we spend the rest of our lives trying to find that first comforting place by the things we do or buy ourselves. The new places we seek to find when we travel. New surroundings we encounter. Perhaps if you seek new surroundings with caution you were safe in the womb. But if you throw yourself at new things with no fear perhaps you had a traumatic experience in the womb or the other way around. I'm not sure!
5	F	1980	caucasian	teacher	I don't want to go out!	I loved to be indoors in the warmth. Lying on the sofa or in a den of sheets. I was not an outdoor person when I was young. Now I love to be outside and I think I only feel really comfortable and relaxed after I have spent time outside. [Pictures: 'Making dens' 'lying on mum's lap on sofa']
6	F	1980	syrian	student	secured, security	Warmth, Security and Love! [Pictures: 'face in heart']
7	M	2009	syrian	child		[Pictures: 'stick figure in vehicle going up or downhill']
8	F	1945	british	teacher	(gender - emotional female)	My security was my family and happy childhood I realise now. My shelter was being lucky enough to be unconcerned financially all my life. My main source of both security and shelter is the knowledge I am loved by my God and family - plus the joy I get from music and friends, children and now the confidence that at 69 I have lived a life and would not change anything - either good or less good.
9	M	1972	yes? jew?	engineer	(gender - sheboy)	My imagination, from experience gives me a sense of warmth and wellbeing, perhaps like sex but messy, really very messy. // BUT // I always wear a woolly jumper, without it I feel cold, exposed and frail. // SO PERHAPS // The opposite was my sac warm, internal, and STRONG. [Pictures: 'sheep with horns', 'woolly jumper', 'sheep'] oh and some poo. on the way out.
10	F	1964	white	architect		Unaware but comfortable warm and happy
11	F	1947	british	?		When I was a child I would stay at the bottom of our swimming pool - I believed I wasn't breathing, and could lie still there in the water for hours. // A mouse exploring a new place only ventures out as far as the length of its tail, and then back. And then out to the next length and then back etc. so it has a trail back to its mouse-hole.// The warmth and dark of the soil allows a plants roots and shoots to start without leaving the security of its seed. The roots stay protected, collecting nourishment; the shoot breaks free and provides the inspiration to create from the food the roots provide.// The sea is the source of all life. Its salt density is the density of our blood* (*not sure if this is true)

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Participant	Gender	Birth Year	Ethnicity	Occupation	Thoughts comments	Text - sensory experiences of comfort
12	M					I think I consider the womb as my forgotten space. The space that I no longer remember. It is a space of lost time - one I can never re-visit, never re-enter. My first space - did I actually know I was there? The space I inhabited unconsciously as if in a dream.
13	F	1979	polish	teacher		- tent built of blankets - we used to stay there with my friends when I was a kid (7-8 years), cosy, enveloped, closeness of friends// - my dressing gown (30s) - when I had some difficult time and just moved to a new country// - hugs - warmness of another person// shelter - an egg, especially hidden and sheltered itself; green (nature) wood
14	F	1971	british	architect		Being wrapped in a soft cream piece of cloth - which was then ripped up and became my life long security blanket - known to all the family as **** - and it lived in the fridge as I could only sleep when it was cold.
15	F	1979	caucasian	transport planner		As a child (<5 years) I'd have a recurring 'nightmare', which only on reflection as an adult I've come to wonder if it was a memory of being in the womb, and even the early stages of being born!!// The dream was always the same. Being in an enclosed dark red space I'd feel like I couldn't control my body and I'd be swished around as if on a fairground ride. The sounds of voices, usually my mum's would be muffled but also in slow motion. I'd always wake from the dream very upset and stressed, and the feeling would stay with me for some time.// Was this a memory of being in the womb? Seems at odds with the expected feelings of safety and comfort…
16	M					One of my earliest memories of comfort and security is when I was about 5, I would cram every cuddly toy I owned and put them in my bed with me to the point where there'd be no room left for me. Always liked being cramped in spaces which would make others feel claustrophobic. Made me feel secure.
17	F	1982	scottish/ indian	exhibition designer	Is your first space your mental space - in your head	A warm space, dark, soft, with soft sounds - like being under water. All senses, stimulated. Security being looked after by others.// No air around you, being touched on all sides, like a cuddle. Warmth, heat, being fed - being comfortable within your body - in terms of muscles being relaxed, no physical pain, a clear mind, mental freedom, calm mind - spiritual/ religious? Being - just being - thinking like a child - uncomplicated with freedom!
18	F					
19	M					
20	F					
21	M					
22	F					our lost twin, our spirit or guardian angel, our first instance of security and shelter
23	F					
24	F	1949	british/ scottish	business-woman		
25	F	1975	mixed race	GP		ideas: cannot remember this far back, idea of it mainly as a place of safety and growth, limited time there and purposeful time (to develop and grow in a safe place), cannot last forever. Interesting I don't like to imagine it as being aware of feral development I would not now find being in a tight confined space, very turned in on myself and dependent on another being for everything comforting! I am aware that I have taken it very literally.
26	F	20-59	british	business-woman		

APPENDIX 6 - COSY X 16 SCENARIO FEEDBACK CHART

COSY SCENARIO	# of Responses	SENSES: Thermal	Proprioception	Visual	Touch	Auditory	Gustatory	Olfactory	Weight	Pressure	CONTROL: Dependent	Equilibrium	Instability	Security	Autonomy	Hygiene	Enclosure	Release	STIMULATION: Delight	Expectation	Distress	Resistance	Motion	Soft, Pad	Fluid	Pulse, Rhythm	Quicken	Repulsion	ADAPTATION: Applied	Function	Shelter	Posture	Efficiency	Biomimetic	Ergonomic	Technical	Economic	Spatial	Materials	INFLUENCE: Wellbeing	Strange	Time	State-of-mind	Relationships	Development	Delivery
1a	51																																													
1b	47																																													
2a	60																																													
2b	54																																													
3a	62																																													
3b	29																																													
4a	57																																													
4b	35																																													
5a	53																																													
5b	37																																													
6a	57																																													
6b	43																																													
7a	53																																													
7b	51																																													
8a	51																																													
8b	39																																													
9a	52																																													
9b	39																																													
10a	55																																													
10b	46																																													
11a	48																																													
11b	47																																													
12a	48																																													
12b	37																																													
13a	50																																													
13b	50																																													
14a	51																																													
14b	31																																													
15a	48																																													
15b	26																																													
16a	39																																													
16b	30																																													
		29	16	32	19	24	20	14	17	19	24	16	11	30	22	7	25	22	17	24	22	22	30	22	8	18	13	2	31	30	28	18	25	18	26	18	12	30	22	29	9	25	28	32	28	21

APPENDIX 7 – GENDER RESPONSE ACROSS 3 RESEARCH STREAMS: GENDER AGE COMPARISONS

what would improve your comfort in this situation?

what would improve your comfort in this situation?

what would improve your comfort in this situation?

what would improve your comfort in this situation?

how have you become familiar with the cycle as a self propelling device?

page 8

how do you create a personal comfortable environment in a train without compromising your fellow passengers spaces?

page 16

how do you customise wheelchair to increase your comfort whilst maintaining your kinetic ability?

function independance motion

comfort security materials protection

page 24

page 32

a halo could be an intangible expression of human energy, could you describe yours?

what would improve your comfort in this situation?

what would improve your comfort in this situation?

what would improve your comfort in this situation?

what would improve your comfort in this situation?

how did the structures you created at this stage in life differ from what an adult provided for comfort?

Is it a tent... Is it a box... Is it a den... ...oh no it's a cot

page 6

could you put a value on elements of motion or motion within your kitchen?

please highlight your preferred word choice based on your own style of shopping?

page 14

ITEM	RECEIPT	VALUE
visual		
acoustic		
smell		
taste		
touch		
temperature		
ventilation		
occupants		

OR

recreation..........................utilitarian
entertainment.........accomplishment
comfortable..............uncomfortable
online.................................physical
recommendation...........advertising
function...................................status
public.....................................private
movement...........................sedentary
consumer................................citizen

what would improve your comfort in this situation?

what do you need for comfort in this coffin scenario?

page 30

which words would you associate with each user of the pram?

temperature
adaptability
visual
security
ventilation
movement
ergonomic
functionality
customisation
membranes (foot muff)
[please add]

how close can others get to you before you feel uncomfortable on a bus [or tram]?

what helps to mitigate this? e.g. acoustic: cost, etiquette, community; eco; safety, seeking your progress, motion...

page 4

page 12

what activities do you do in a car to assist your comfort?

page 20

in an ambulance how could you increase your comfort whilst in motion?

ergonomics...function
equipment...membranes...
symptom | cause...stress...
emergency... bollastening...
communal | personal...distance
costs...access...communication
materials...noise...smells...pain

page 28

what would improve your comfort in this situation?

what would improve your comfort in this situation?

what would improve your comfort in this situation?

what would improve your comfort in this situation?

please circle your own interpretations of comfort and movement in relation to the amniotic sac?

page 2

within the realms of sleep, work and play how would you balance comfort and movement in a loftbed?

page 10

how do you personalise or regulate the comfort of your workspace and how much time do you spend moving?

COSY GRYO

what would improve your comfort in this situation?

what would improve your comfort in this situation?

what would improve your comfort in this situation?

please circle your comfort and movement priorities in a lounge?

page 18

what would improve your comfort in this situation?

how have you become familiar with the **cycle** as a self propelling device?

page 8

what would improve your comfort in this situation?

how do you create a personal comfortable environment in a **train** without compromising your fellow passengers spaces?

page 16

what would improve your comfort in this situation?

how would you customise your **wheelchair** to increase your comfort whilst maintaining your kinetic ability?

page 24

what would improve your comfort in this situation?

a **halo** could be an intangible expression of human energy, could you describe yours?

comfort protection function independence motion sources external energy materials

page 32

what would improve your comfort in this situation?

how did the structures you created at this stage in life differ from what an adult provided for comfort?

is it a tent... is it a box... is it a den... ...oh not the a **cot**

page 6

what would improve your comfort in this situation?

could you put a value on elements of comfort or motion within your **kitchen**?

RECEIPT

ITEM	VALUE
visual
acoustic
smell
taste
touch
	temperature
	ventilation
	occupants

page 14

what would improve your comfort in this situation?

please highlight your preferred word choice based on your own style of **shopping**?

recreation........utilitarian
entertainment....accomplishment
comfortable.......uncomfortable
the...................physical
accommodation...advertising
function..............status
public.................private
movement.........sedentary
consumer...........citizen

[please add]...

page 22

what would improve your comfort in this situation?

what do you need for comfort in this **coffin** scenario?

page 30

what would improve your comfort in this situation?

which words would you associate with each user of the **pram**?

temperature
adaptability
visual
security
ventilation
movement
ergonomic
functionality
customisation
membranes (foot muff)

[please add]

page 4

what would improve your comfort in this situation?

how close can others get to you before you feel uncomfortable on a **bus** [or train]?

what helps to mitigate this?
eg. acoustic, cost, attitudes, community, eco, **visit** seating your progress, materials.....

page 12

what would improve your comfort in this situation?

what activities do you do in a **car** to assist your comfort?

page 20

what would improve your comfort in this situation?

how an **ambulance** how could you increase your comfort whilst in motion?

ergonomics....function
equipment....membranes
symptom | cause....stress...
emergency...foreplanning...
communal | personal...distance
costs...access...communication
materials...males....smells....pain

page 28

please circle your own interpretations of comfort and movement in relation to the **amniotic sac**?

[please add]...
acoustic...mothers...
...acoustic...pressure...
psychological | [please add]...
...elements...safety...
...conception...

physical

...tools...
...substance...
...[please add]...
energy...growth...
...[please add]...
...regulation...
...fluid...

physiological

page 2

within the realms of sleep, work and play, how would you balance your comfort and movement in a **loftbed**?

COSY GRYO

page 10

how do you personalise or regulate the comfort of your **workspace** and how much time do you spend moving?

page 18

please circle your comfort and movement priorities in a **lounge**?

[crossword grid with letters: ventilate, recreation, physical, pressure, psychological, logical, sleep, comfort, warm, physiological]

page 26

APPENDIX 9 – GENDER AND AGE INTERSECTIONAL ANALYSIS

FEMALE												GENDER	MALE											
Learners x 5				Warriors x 23				Elders x 7				AGE	Learners x 5				Warriors x 10				Elders x 2			
> 19				20-59				60 <					> 19				20-59				60 <			
PRAM	KITCHEN	A. SAC	CAR	PRAM	KITCHEN	A. SAC	CAR	PRAM	KITCHEN	A. SAC	CAR	SCENARIO	PRAM	KITCHEN	A. SAC	CAR	PRAM	KITCHEN	A. SAC	CAR	PRAM	KITCHEN	A. SAC	CAR
												ATTITUDES												
■	■		■	■	■	■	■	■	■	■	■	Positive	■	■	■		■	■	■	■				
			■			■	■	■	■	■		Negative					■							
												BEHAVIOURS												
	■		■	■	■	■	■	■	■	■	■	Visual	■	■	■	■	■	■	■	■	■	■		
	■	■	■	■	■	■		■	■	■		Auditory		■		■	■	■	■	■	■	■		
	■			■	■			■				Olfactory		■			■					■		
	■		■	■	■	■		■	■	■	■	Gustatory		■	■	■	■	■	■					
				■	■	■		■	■			Touch		■			■	■	■					
				■	■			■	■			Pressure							■					
		■	■	■	■	■		■	■			Temperature	■	■	■	■	■	■	■	■	■	■		
	■		■	■	■			■				Ventilation		■		■	■	■		■	■			
■				■	■	■	■	■	■	■	■	Position	■			■	■	■		■	■			
■		■			■	■	■	■	■	■	■	Resistance			■			■		■				
■			■		■	■	■	■	■	■		Security	■				■				■			
■				■			■	■	■	■		Weight					■							
■			■	■		■	■	■		■	■	Translation	■				■		■		■			
		■	■	■	■	■	■		■	■		Rotation	■		■		■		■					
												MOTIVATIONS												
■	■	■		■	■	■	■	■	■	■		Enclosure			■	■	■	■	■	■	■			
				■								Escape												
								■	■			Solitary												
■	■	■	■	■	■	■	■	■	■	■	■	Shared	■	■		■	■	■	■	■				

APPENDIX 10 – (IN)TANGIBLE COMFORT MEMBRANES O|C 1, 2 & 3

CLOTHES	Tangible | Bodily	MEMBRANE	Intangible | Mental	BUILDING SKIN
1	13	**GYRO**	40	4
1	9	**AMNIOTIC SAC**	22	1
16	305	**COSY**	279	33
18	**327**	**TOTAL**	**341**	**38**

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