SMART TRAY

Speculating The Future
New Zealand Dining Experience

JOE LEVY

Victoria University of Wellington
School of Design

2016

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Design should not dominate things, should not dominate people. It should help people. That's its role.

- Dieter Rams

Upon completing this thesis, and thus six years at Victoria University, I now embrace the chance to say thank you.

To my family, particularly Megan, Ross and Rachel I thank you for the unwavering support you have shown me – its purity is immeasurable.

Tonya Sweet, you embraced the primary supervisor role months into the commencement of this thesis and for that I am truly grateful. The relentless drive and passion you have invested in this project has been invaluable. Ross Stevens, as secondary supervisor I thank you for being the instigator. The opportunities and guidance you have afforded me over the years are greatly appreciated.

Nan O'Sullivan – your warm, yet honest support over the last six years has been absolutely priceless. And to the rest of the faculty staff at the School of Design I extend my sincerest gratitude – notably Margaret Maile Petty, Simon Fraser, Tim Miller, Bettina Neu, Jeongbin Ok and Bernard Guy.

A massive thanks must be passed on to the cohort I am now fortunate to call friends – James Irvine, Oscar Pipson, Annabelle Nichols, Andrew Matautia, Matt Everitt to name but a few.

It is essential too to recognise the contribution made by the participants of my research case studies. Although you cannot be named I thank each and every one of you for your time and gusto.

And lastly to you, the reader. Thanks for showing an interest and I hope my work lends an element of insight or inspiration in whatever capacity you allow it.

Cheers, Joe.

This research proposes a design solution that embraces New Zealander's proclivity for pervasive digital technology and that aims to meet the needs and desires of the future Kiwi dining experience. This research proposition is directed by an approach that situates itself between future forecasting and speculative design, whereby the design output is viable while simultaneously capable of provoking critical reflection about the future of design as it relates to domestic dining appliances. The development of a design solution, the Smart Tray, encapsulates these aims and has been guided by a comprehensive investigation into the points of connection that exist between culture, technology, design and social behaviour.

The Smart Tray seeks to acknowledge New Zealand's history while embodying its contemporary domestic dining culture in proposing an appliance-device that embraces digital technology as part of the everyday dining experience. This research has been supported by the application of various methodologies inclusive of the critical review of academic literature that has functioned to frame and support the scope of the research proposition; case studies in which a selection of Kiwi households have been interviewed, observed, and their behaviours analysed in order to gain a greater understanding of contemporary dining habits and their relationship with pervasive digital technologies at home; and iterative design development inclusive of concept sketching, sketch modelling, experience prototyping, and user feedback. Although this research is contextualised within New Zealand, the general research outcomes are applicable to a wide market. The outputs produced as a result of this research, including the exegesis and design of the final Smart Tray, are intended to offer a valuable critical perspective and viable future design solution that will aid in furthering the professional field of dining design.

INTRODUCTION

New Zealanders, commonly known as 'Kiwis', are increasingly connected and dependent on technology. The wide consumption of digital tools and applications have found their way into the Kiwi home where these pervasive technologies have begun to reshape traditional behaviours. In the case of contemporary domestic dining habits, the behaviours associated with dining have seen a shift from a traditional emphasis on socialisation around the dining table to a more individual experience in which digital interfaces play a central role. Socialisation is now often mitigated through social media, and people are increasingly tuned in to screens rather than tuning in to face-to-face conversations during mealtime. Looking ahead to the future of the New Zealand dining experience, it is reasonable to speculate that our dependence on pervasive technologies will continue to shape our behaviours and traditions and that digital technology will have a growing impact on the way Kiwi households dine.

The inspiration for the development of this research stems from a personal position that was fostered in my undergraduate studies regarding the role of the contemporary designer in having a responsibility to design a better world. This is arguably achievable through the application of a critical consideration towards human needs and in taking full advantage of our technological developments in an effort to strike a balance between traditional values and future possibilities. This research was also inspired by an invaluable three-month internship at Fisher&Paykel Appliances in New Zealand where I was exposed to the professional practice involved in the cultivation of innovative design within a New Zealand context. This combination of educational and professional experience provided the foundation of knowledge and awareness necessary to successfully direct this research project independently and with a high degree of critical reflection.

This research proposes a design solution that embraces New Zealander's proclivity for pervasive digital technology and that aims to meet the needs and desires of the future Kiwi dining experience. This research proposition is directed by an approach that situates itself between future forecasting and speculative design, whereby the design output is viable while simultaneously capable of provoking critical reflection about the future of design as it relates to domestic dining appliances. The development of a design solution, the Smart Tray, encapsulates these aims and has been guided by a comprehensive investigation into the points of connection that exist between culture, technology, design and social behaviour. The Smart Tray seeks to acknowledge New Zealand's history while embodying its contemporary domestic dining culture in proposing an appliance-device that embraces digital technology as part of the everyday dining experience. This research has been supported by the application of various methodologies inclusive of the critical review of academic literature that has functioned to frame and support the scope of the research proposition; case studies in which a selection of Kiwi households have been interviewed, observed, and their behaviours analysed in order to gain a greater understanding of contemporary dining habits and their relationship with pervasive digital technologies at home; and iterative design development inclusive of concept sketching, sketch modelling, experience prototyping, and user feedback.

ABOVE: Figure 22. Famous throughout the southern regions of New Zealand's South Island, the Cheese Roll was a more edible Kiwi experience during my three-month internship at Fisher&Paykel Appliances.

LITERATURE

The study of literature has been essential in supporting the conceptual development of this research. The literature reviewed in the following pages has functioned to frame the scope of the research proposition and methodologies applied, as well as to provide a critical understanding of the various topics considered as part of this thesis. This material is presented chronologically – from the past, to the present, and looking onward to the future – in five sections. The first section, From Kai to Kiwi Kitchen, provides a historical overview of the origins of New Zealand dining traditions and behaviours. The second section, The New Zealand Kitchen from the Twentieth Century to Today, reviews a brief history of domestic meal preparation according to its designated space within the home and various social implications. Section three, Smart Homes, Pervasive Technology, and the Dining Table, introduces some of the key considerations around the application of technology to the future New Zealand dining experience. The fourth section, The Social Implications of Tech-Driven Dining, considers the ways in which technology has impacted our everyday lives. Lastly, in section five, Speculating the Future of Dining Design, future forecasting and speculative design will be introduced as avenues for exploring and supporting the development of a design outcome that aims to meet the future needs and desires of Kiwi households.

In addition to the literature reviewed, this section includes supplementary imagery, and visual precedents inclusive of existing commercial designs within the categories of interior architecture, kitchen appliance design, furniture design, and digital technological design. These precedents have been beneficial in providing a wider understanding and appreciation for the considerations that have given shape to this field of study, as well as inspiring the development of the final design outcome. As a comprehensive whole the visual precedents and literature reviews have supported an in-depth investigation into the potential of design as a process through which solutions to complex issues may be realised.

ABOVE: Figure 1. From Kai to Kiwi Kitchen: New Zealand Culinary Traditions and Cookbooks by Helen Leach.

FROM KAI TO KIWI KITCHEN

This section provides a historical overview of the origins of New Zealand dining traditions and behaviours.

'Kia whakatōmuri te haere whakamua.'
'My past is my present is my future.
I walk backwards into the future with my eyes fixed on my past.'

(Māori Whakatauki)

The Maori proverb above is an appropriate point of departure for my research: the act of looking back as we move forward is equally important in the evolution of cultures as it is for the designer. Media theorist, Marshall McLuhan, reflected this same idea when he was quoted as saying, "we look at the present through a rear-view mirror. We march backwards into the future" (Hefner, 1969). While this research investigates possibilities for the future of the New Zealand dining experience, it deserves thorough consideration of New Zealand's short but substantial history. Of particular interest is the evolution of our culinary traditions and how these traditions have shaped our contemporary dining behaviours at home, and the subsequent effect this has had on our interactions with household spaces, furniture, appliances, and associated products.

While there is limited academic literature on the history of the New Zealand kitchen and dining

tradition, Professor Helen Leach from Otago University of New Zealand has offered sizable contributions to New Zealand research, including her book 'From Kai to Kiwi Kitchen.' Exploring New Zealand's history offers great insight into our cultural heritage, and forming an understanding of the evolution of our national culinary traditions has been an important undertaking throughout this research. A culinary tradition can be defined as the combination of edible items, material culture or artefacts, customs and ideas that undergoes progressive development adapting to changes in food supply, new technology, social trends, and external influences (Leach, 2010). A perfect example of this, looking back a few centuries in time, is the first Eastern Polynesian Maori settlers to Aotearoa who went through a period of progressive change soon after their estimated arrival in the thirteenth century. As an essential means of survival they were required to adapt to their new climate. Having originated from warmer, more humid climates that boasted temperatures between twenty and thirty degrees Celsius, upon landing they immediately met a much cooler climate than their pervious home (Leach, 2010). Acting intuitively they replaced their dwindling tropical crops with harvests of wild bracken fern and cabbage trees. Perhaps this

ABOVE: Figure 2. British settlers meet local Maori in Hawke's Bay, New Zealand in 1863.

aptitude for adaptation and progressive change may serve as one of the earliest examples of New Zealand resiliency and our culture's renowned 'can-do', 'number eight-wire' attitude. The same attitude seemingly saw early Maori not only develop but succeed in effectively living off the land, and this was observed with interest by British scientists and crew: "They speculated whether the Maori camping at nearby Purangi River [Whitianga] were eating roasted fernroot, fish and shellfish because they had been defeated in war and lost their provisions" (Leach, 2010). Although the patriotic ignorance of the British in question provides the reader some comical reading today, it significantly suggests the contrast between the two traditions as early British struggled to maintain an ordered meal structure made up of imported food types barely sustainable in their new surrounds.

'From Kai to Kiwi Kitchen' identifies two key events

that have shaped New Zealand's culinary traditions: The first is the aforementioned beaching of Eastern Polynesian voyage canoes on our shores in the thirteenth century, and the second case being the first recorded arrival of English ships in Northern harbours in 1769 (Leach, 2010). With these landings New Zealand was bound to its predominant cultural influences: the Maori and the British. As relations developed between the Maori and British inhabitants, overtime the culinary traditions began to reflect a mingling of both cultures. This includes the integration of elements centred on hygiene, such as the washing of tea towels and tablecloths separately from clothes - the timeless binary principle of Tapu and Noa (Leach, 2010) -, to the embodiment of the traditional British meal structure. It is worth noting that this meal structure was adopted as a more relaxed version inclusive of a three-meal day culminating with dinner that consisted of starters, mains and desserts (Leach, 2010).

THE NEW ZEALAND KITCHEN FROM THE TWENTIETH CENTURY TO TODAY

This section provides a brief history of domestic meal preparation according to its designated space within the home and various social implications.

ABOVE: Figure 3. Pikopiko, a Maori term for wild bracken fern, was part of the adaptive diet of early New Zealand Maori.

As we enjoy our meals at home it is interesting to acknowledge the link between our culinary traditions and the design of our kitchen and living spaces. How does the organisational relationship between the kitchen and dining area impact upon one another? What correlations exist between the degree of dining formality with an open or closed plan kitchen? Of particular relevance to this research is the evolving transition of these spaces throughout the twentieth century to today within the New Zealand domestic environment. For more consideration on this topic this research looked again to the academic contributions of Professor Helen Leach in her book 'Kitchens: The New Zealand Kitchen in the 20th Century'.

The early twentieth century kitchen's design and layout can loosely be described as a transitional space. Although in 1900 housewives were advertising for servants in their local newspapers (Leach, 2014), domestic households were increasingly taking steps towards self-sufficiency. As housewives regularly took on the cooking duties for their household, products and appliances began to reflect the evolving demand for high quality, ergonomic kitchen tools and furniture. This trend has continued in the design of contemporary high-end commercial products that

must meet the decisive demands of a diverse market of home chefs who take great pride in preparing quality New Zealand food.

The evolution of the British home in the twentieth century was also a key influence as select trends were adapted in the development of the modern Kiwi kitchen. As post-war reconstruction commenced in the 1920s and peaked after World War II, the British home underwent drastic redevelopment that resulted in open-plan interiors. This new interior layout addressed the need for better quality and quantity of fresh air, sunlight and proximity to outdoor areas. It also constructed a sociologically more efficient home, prompting its occupant's greater equality of household roles and the celebration of open-plan, social spaces. Before open-plan living became the norm in New Zealand, the Kiwi kitchen underwent various changes that embraced greater efficiency. The Scullery, for example, which was often found adjacent to the kitchen and pantry, went away along with the servants. The kitchenette made its first public appearance in Auckland real estate publications in 1913 in an attempt to minimise and simplify the kitchen. The end had finally come for large, segregated kitchens with separate scullery and pantry spaces (Leach, 2014). Instigating a

long-term trend in kitchen design, architects and designers alike continually seek to minimise the size of kitchens with particular focus on improving the efficiency of use for the household it serves. In serving the household the seamless integration of kitchen appliances and technologies have thus continued to develop in enhancing the efficiencies of open-plan living.

The evolution of the open-plan kitchen underwent significant developments in the 1960s with the removal of a wall being key to the layout. In place of the wall was now a peninsula bench and overhead cupboards. By the 1990s Kiwi homes had largely adopted the open-plan kitchen-living area now commonplace in most new construction today. It is interesting to consider that up to this point kitchen

walls were essential to enclose the space in order to define boundaries around the task and role of meal preparation. A contemporary wall-less kitchen, in contrast, celebrates the seamlessness between not only the spaces of the home but of the roles and behaviours of its occupants. The removal of kitchen walls has effectively enabled a social connection between the space allocated to meal preparation with general 'living' and dining spaces. Based on this, one could hypothesise that with the dismissal of traditional spatial boundaries in meal preparation is the dismissal of traditional boundaries related to the enjoyment of those same meals. As the upcoming generation of Kiwis adopt an increasingly casual and 'laid back' attitude, it is little surprise that the formal dining experience (and formal dining table) are rapidly becoming a relic of the past.

SMART HOMES, PERVASIVE TECHNOLOGY, AND THE DINING TABLE

This section introduces some of the key considerations around the application of technology to the future New Zealand dining experience.

ABOVE: Figure 4. Contemporary open-plan kitchen-living space in Westmere, Auckland by Gerrad Hall Architects, Wood-Tech Kitchens, and Fisher&Paykel Appliances.

No object can compete with the simultaneous functional and symbolic value of a dining table. The dining table has been a central archetype within the home throughout history. Historically purposed to commune with the Gods, the dining table first set out to offer a raised surface in sharing meals, representing the verticalisation of religion and the desire to reach closer to heaven (Kaufmann, 2010). As a result of the changes that occurred between the eighteenth century and recent history, however, the role of the dining table has transformed. Throughout this period in history the dining table became a permanent fixture with a specific function in the domestic setting. Sharing meals at the dining table became a staple behaviour, and sitting around the table to eat while facing one another became an ethical standard. These are the models that our contemporary notion of the dining table is built on today.

We live in a rapidly changing period of time. Within the past fifty years the time allocated to cooking meals at home has drastically fallen. Thanks to longer working days, the evaporation of traditional household roles, and the development of instant meals and ever-accessible fast-food restaurant markets, half of all households now spend less than

twenty minutes a day cooking (Kaufmann, 2010). Our dining experiences and behaviours around meal time have began to reflect this too as more and more households ignore the traditional act of sharing a meal at the dining table in preference of a more adaptable, relaxed dining context. Dining at home today frequently means eating in front of the television or a desktop computer, while potentially also staying connected to the world of pervasive computing through our tablets and mobile phones. How might the dining table evolve or redevelop with increasing reliance on the integration of digital technology at home?

French Sociologist Jean-Claude Kaufmann offers useful insight into the contemporary dining experience in his research into the power meals have in structuring everyday relationships and the contemporary behaviours central to dining at home. Although written from a French perspective the ideas expressed provide an applicable framework to better understand contemporary dining trends within a 'Western' context. In his book, 'The Meaning of Cooking', Kaufman considers the impact of technology on traditional dining practices. Instead of resenting the move away from traditional practices, Kaufmann embraces the changes that have

occurred in contemporary dining. "There is nothing anecdotal about watching television over the family meal. The television plays an important role and tells us a lot about what is at stake at mealtimes. Meals are part of the architecture of family life, not least because they involve us in conversations that can be about anything" (Kaufmann, 2010). Since its first inclusion in the 1950s the TV has led the revolution in integrating technology into mealtime.

Today we not only watch television during meals, but we are increasingly tapped into various pervasive technologies. Pervasive technology (also referred to as pervasive computing, or ubiquitous computing) is the growing trend towards embedding microprocessors into everyday objects so they can communicate information. The words pervasive and ubiquitous mean, "existing everywhere", and this is possible through a convergence of wireless technologies, advanced technologies, and the Internet (Rouse, 2010). Pervasive computing devices are completely connected and constantly available and include laptops, smart phones, tablets, wearable tech, and other data-collecting devices that users may or may not be aware of. What is the potential impact of these pervasive technologies to our dining traditions? In their article 'Digitally enhanced food'

authors Johannes Schöning, Yvone Rogers, and Antonio Krüger speculate on the design evolution of the dining table: "Someday, a new kind of table might combine computational and digital aspects of food design, technology, and engineering. With the advent of pervasive computing environments and infrastructures that support smart artefacts, new opportunities are emerging" (Schöning, Rogers & Krüger, 2012).

Many of these pervasive technologies are already in place. 'Smart Home' is a term in circulation associated with the integration of digital technology within the domestic environment. A smart home primarily refers to home automation, energy costs, interactive appliances, remote controlling, home networking, wireless devices, entertainment centres, and security (Bell & Kaye, 2002). In the case of dining, home automation, interactive appliances, remote controlling, wireless devices and entertainment centres inclusive of pervasive technologies are found in many contemporary homes. According to this growing trend, it is not difficult to predict that the use of advanced pervasive technologies will persist in the future home environment and, in particular, our approach to the dining table. Author MG Siegler, a blog writer for TechCrunch and general partner at

ABOVE: Figure 5. Smart Lock by home automation startup August is an example of pervasive technology's integration within the home allowing the user to secure their home via their smart phone.

Google Ventures, foresees the merging of tables with technology:

> "What's more likely? In ten years, everyone goes to a restaurant and talks to one another without pulling out their phones at the table — or in ten years, the table is designed in a way to enable you to more easily use your phones? That's an easy one." "Forgive me, but it's Dinner 2.0. And again, I'm having more fun at these dinners than I ever have. Is part of it antisocial? Sure. Can it lead to distractions if you read a work-related email that you need to respond to? Of course. But this is the way the world works now. We're always connected and always on call. And some of us prefer it that way" (Siegler, 2011).

As pervasive technology continues to integrate itself within our daily lives at home it is essential to critically assess its sociological impact and effectiveness. Of critical significance is the relationship we share with pervasive technology and the utilisation of its capabilities to enhance our daily functions without becoming socially destructive. As designers work to negotiate the increasing reliance and expectations around the accessibility and fluid integration of pervasive technologies, they must provide solutions that critically consider the implications of their design decisions on their human users. Common within contemporary design practice, the application of experience design (XD) to the design process is valuable in realising empathetic, user-centred design solutions. Tom Wood of Norwich-based XD design agency Foolproof defines experience design as "a design practice focused on human outcomes, particularly the level of engagement and satisfaction that the user derives from a product or service and the relevance of the experience to their needs and context" (Wood, 2013). While user-centred XD design commonly focuses on sociology, it is worth noting that there are also implications of this design approach on culture. Mike Press and Rachel

Cooper in their book 'The Design Experience' offer an interesting perspective on the direct association between culture and experience design in the following scenario: "You enter the bathroom and are confronted by a low stool, plastic bowl and small hand towel. What do you do? How should you behave? What does all this mean? This is a bathroom in Japan, and you are desperately trying to understand Japanese culture" (Press & Cooper, 2003). By introducing specific artefacts into a space we have the power to indicate and provoke a new understanding of culture, interaction, and behaviour. Press & Cooper assess the potential consumer-based and commercial-based value in developing such experience driven designed solutions: "Experiential-based design seeks to so thoroughly understand the consumer's experience that it can identify the values that he or she perceives as defining. It then fashions a product and marketing design strategy to mirror that experience in a brand culture underlying the product and inspiring passion. A successful brand culture cannot be contrived or dishonest. It must be authentic and consistent with corporate values to connect on an intuitive level with the consumer's experience of the dining object" (Press & Cooper, 2003).

Considerations situated within an XD approach have been applied to the design development stage of this research, particularly in proposing a critical design solution that aims to meet the future needs and desires of Kiwi households, essentially seeking to deliver complex technology with utmost simplicity. This solution intends to celebrate the significance of our Kiwi culinary traditions while envisioning a future understanding of the New Zealand dining experience reflecting the foreseeable needs of individual users with particular emphasis on their reliance on pervasive technology applications, and the integration of dining surfaces, traditionally identified as a dining table, with pervasive technology.

TOP LEFT: Figure 6. Concept Kitchen 2025 is a collaborative project lead by Ikea and IDEO with students from the School of Industrial Design at the Ingvar Kamprad Design Centre at Lund University, and the Industrial Design department at Eindhoven University of Technology. The project includes a reimagined dining table integrating cooking and digital technology elements.

BOTTOM LEFT: Figure 7. Presented at CES 2014 the Whirlpool Interactive Cooktop, activated by the sound of your voice or the touch of your finger, is another example of digital technology integrating within the food preparation context. The cooktop connects to online platforms such as Spotify and Facebook while providing online recipes.

3.1 million Kiwis aged fifteen and over spend fourteen hours online a week

The average American adult checks their phone every six and a half minutes

Fifty-two per cent of Baby Boomers and forty-two per cent of Silent Generation say their mealtimes are not technology free

Of the average hour that dinner spans a typical American family manages six to seven simultaneous streams of digital information

ABOVE: Figure 8. Pervasive digital technology usage summary.
Sources: Boyte, 2016 & Turkle, 2015.

THE SOCIAL IMPLICATIONS OF TECH-DRIVEN DINING

This section considers the ways in which technology has impacted our everyday lives.

Conversation is a fundamental human value, a tool we use to form relationships, learn, discuss and share. It evokes our experiences and desire for intimacy, community, and communion while remaining a key element in constructing our sense of empathy (Turkle, 2015). While technology affords society a wide range of alternative formats for communication and connectivity, the impacts of digital technology on social relationships have often sought negative connotations as an unhealthy distraction. According to Sherry Turkle, Professor of the Social Studies of Science and Technology at the Massachusetts Institute of Technology in her recent book, 'Reclaiming Conversation: The Power of Talk in a Digital Age', we should not become anti-technology but rather pro-conversation. As Turkle explains, we still want to be *with* each other but today we also want to be elsewhere, digitally connected to wherever we choose as we now have the opportunity to be constantly connected to the online world wherever we go (Turkle, 2015). We have learned to place significant value on this connectivity, none more so obvious than our sidearm smartphone, now an indispensible utility to our everyday lives. Increasingly this level of technological dependence is also inundating our homes.

Connectivity, however, comes at a cost. Turkle elaborates on this point by identifying an iconic moment of her research "when fifteen-year-old Chelsea, who is on summer vacation at a device-free camp, describes her disappointment when her father interrupted their dinner during parents' weekend by looking things up on his phone" (Turkle, 2015). Admittedly doing the same to her friends outside the device-free camp, Chelsea hints that removing digital tech made her realise the intimate importance, and empathetic yearning she had for dinner with her dad, and her family. Our social behaviours have evolved at the same pace of technology and now, in the year 2016, to have a conversation with family and friends, colleagues and lovers, we simply pick up our phone. It is worth noting that a 'conversation' may actually consist of text messages rather than a verbal dialogue, and that we may engage in multitasking while 'conversing'. Turkle has expressed the implications of our reliance on technology on our ability to pay attention to one another:

> "We now rarely give each other our full attention, but every once in awhile, we do. We forget how unusual this has become, that many young people are growing up without

ever having experienced unbroken conversations either at the dinner table or when they take a walk with parents or friends. For them, phones have always come along" (Turkle, 2015).

To provide a clearer scale on contemporary connectivity the average American adult checks their phone every six and a half minutes. Every morning a quarter of American teenagers connect to a digital tech device within five minutes of waking, while eighty per cent sleep with their phones. And if we look more closely at the dinner table and the average hour that dinner spans, a typical American family manages six to seven simultaneous streams of digital information across phones, tablets, laptops, a desktop computer, and a TV (Turkle, 2015). Contemporary households are now not only connected, but consuming and interacting with multiple devices simultaneously. To contextualise this specifically within New Zealand, 3.1 million Kiwis aged fifteen and over spend fourteen hours online a week, an equivalent of two working days. And of that 3.1 million, two-thirds access digital content on a smartphone and over a quarter via their tablet (Boyte, 2016). According to the Nielsen Company's recent 'New Zealander Connect Consumers Report', our desire to be connected online is and will continue to increase. To assume Turkle's comments are strictly applicable to Americans only would be incorrect.

It is not only teenagers and young adults who are addicted to technology: Although there is a common misconception that the younger generations are more distracted by their devices at mealtime than their older counterparts, "fifty-two per cent of Baby Boomers and forty-two per cent of Silent Generation respondents say their mealtimes are not technology free, compared with forty-per cent of Millennials and 38% of Generation Z" (Distracted by Technology at Mealtimes, 2015). This particular point has guided the identification of case study groups within this research.

Looking to Experimental Psychologists Charles Spence and Betina Piqueras-Fiszman and their 2013 publication 'Technology at the Dining Table,' the advancement of future pervasive technology within the home, and dining in particular, is addressed with both hesitation as well as celebration. Spence & Piqueras-Fiszman believe that a tremendous

opportunity exists to revolutionise our eating and drinking experiences and behaviours through innovative integration of food and drink with the latest in digital technology (Spence & Piqueras-Fiszman, 2013). The authors highlight "the theme of bringing digital technology to the dining table [that] relates to the possible use of tablet computers as intelligent 21st century plateware" (Spence & Piqueras-Fiszman, 2013). This notion of allowing the tablet to inspire future plateware and to enable an interactive "table" has been a key departure point in the development of the design outcome that has resulted from this research.

In linking the ideas around the development of a 'smart home' with a sociological awareness of the impacts of pervasive technology, this research has also benefitted from a review of the article 'Evolution towards smart home environments,' by Tiiu Koskela and Kaisa Vaananen-Vainio-Mattila. In this article the authors evaluate alternative digital user interfaces (UIs) that control devices within a smart home environment by investigating users' expectations and requirements of a smart home through the application of an ethnographic study (Koskela & Vaananen-Vainio-Mattila, 2004). The structure of this study has been adopted in the case studies conducted as part of the research disseminated in this thesis. In the article the authors consider the value of developing a centralised approach to the control of household devices and, more specifically in the context of this research, a device that connects dining with greater integrated digital connectivity and general control of pervasive technologies within the home. (Koskela & Vaananen-Vainio-Mattila, 2004). These ideas have been very influential in the development of the design outcome pursued within this research project.

To summarise, it is imperative to acknowledge the significance of social structures that support family time, intimacy and empathy with family or friends, while it is equally important to contend with reality of the increased presence and reliance of digital technology within the home and our everyday lives. With the application of a critical, user-based design approach designers are better equipped to create design solutions that provide increased connectivity through pervasive technology while upholding traditions and values that are central to our social well being.

ABOVE: Figure 9. The 2015 release of the Apple Watch is an example of pervasive digital technology becoming more integrated in our daily lives - connecting the ergonomics of a wristwatch with digtal connection.

SPECULATING THE FUTURE OF DINING DESIGN

This section introduces future forecasting and speculative design as avenues for exploring and supporting the development of a design outcome that aims to meet the future needs and desires of Kiwi households.

As a sector subsumed in rapidly changing and innovative development, it is safe to assume that digital technology will remain a constant companion as we stride into the next millennium. In the field of design we are required to look beyond the products and services available to us today in imagining how to meet the needs and desires of the future. In professional practice the imagining of design solutions for the years ahead is commonly referred to as future forecasting, of which CEO of international trend forecasting consultancy Kjaer Group, Anna Lise Kjaer defines as being:

"A crucial way to be informed about society and understand people, their behaviour, needs and mindset, and how that could impact the future. There are Macro trends (five to ten years) and Micro trends (one to three years). These trends ideally should inspire and inform companies' future vision" (Sheppard, 2010).

In addition to applying some of the strategies identified in future forecasting, the development of this research has benefitted from considering the value of speculative design as an approach to imagining and designing for the future. Speculative design thrives on free flowing imagination and the development of fresh perspectives in creating spaces for discussion and debate on alternative ways of being (Dunne & Raby, 2013). Unlike future forecasting, speculative design practice does not aim to solve problems through the development of commercialisable outcomes; instead it strives to interrogate future possibilities and provoke critical discourse about what might be. "Its main purpose is to make us think. But also to raise awareness, expose assumptions, provoke action, spark debate, and even entertain in an intellectual sort of way, like literature or film" (Dunne & Raby, 2008). Researchers/authors Anthony Dunne and Fiona Raby admit that their work usually relies on future forecasting as a way to identify new trends or to simply challenge narrow assumptions on the role products play in everyday life (Dunne & Raby, 2013), yet the futures predicted through this approach, although probable, remain fictitious. As speculative design projects are usually based on scenarios regarding the rapid changes caused by technological advancements, the research explored within this thesis has identified parallel trajectories from which to draw from the two approaches of both future forecasting and speculative design.

ABOVE: Figure 10. John Anderton played by Tom Cruise interacting with the gesture recognition system in Minority Report.

The media entertainment industry has a long tradition of utilising speculative thinking and fictional forecasting in the framing of imaginary futures that have the potential to manifest real, commercially viable products and systems. One example that effectively showcases the application of speculative innovative technology is found in a 2002 episode of the science fiction television series 'Star Trek'. Authors Schöning, Rogers, and Krüger reflect on this episode in their article "Digitally enhanced food":

"… Captain Jonathan Archer and his crew—Ensign Hoshi Sato and Commander Tucker—are standing around an empty table. Commander Tucker asks about the table, and Sato responds that it's a "molecular synthesizer of some kind—similar to a protein sequencer." She then asks the table for some cold water; they hear a "swuz" sound and a glass of water appears. Commander Tucker asks for a pan-fried catfish, and "swuz"—a plate of fish appears. …This Star Trek scene, taken from a transcript of the TV series is futuristic. However, this type of application is becoming more feasible with recent advances in technology" (Schöning, Rogers & Krüger, 2012).

Notable contributions from the film industry include the gesture recognition scenes from the movie 'Minority Report' (Spielberg, 2002) and the use of augmented reality in 'Back to the Future' (Zemeckis, 1985). These are prime examples of how critical fiction inspired advances in technology that were eventually developed into commercially viable systems. This suggests that the future is imminent and that it only needs to be imagined to become reality. The two movies are explored in greater detail below:

The lead production designer for Steven Spielberg's Minority Report, Alex McDowell, in reflecting on his work as well as its subsequent standing as a leading speculative fiction film envisioned an entirely functional city that included transport infrastructure, social, political, and cultural systems, and even digital tech for its inhabitants. McDowell is aware of the impact of his creations in "the ability to influence the way things develop" (Fairs, 2015). In identifying one piece of digital technology as the most influential to modern society McDowell

indicates "the gesture system in Minority Report is the best example I've come across yet" (Fairs, 2015). Elaborating further McDowell confidently concluded that gesture recognition would not have evolved the way it has without Minority Report as the 'spatial operating environment' supplied new pathways for technology innovators, graphic designers, and interaction designers alike to dream and develop.

Back to the Future Part II was released in 1989 and is now infamous for its depiction of 2015 America. Director Robert Zemeckis has recently revealed the film did not aim to accurately predict the future, speculative elements from the film such as ubiquitous cameras, unmanned drones, flat panel televisions and hover boards can now all be found within the contemporary marketplace. Founder of design studio Fuseproject, Yves Behar states, "these types of films do not guide design, but rather, they represent ideas that are pre-existing in our culture" (Winston, 2015). Behar concludes that as we find new ways of inventing the designer's role is to ensure utopian aspects of innovative, speculative thinking come to life. Speculative design, and thus future forecasting, seems to want to provoke reason by providing a mixture of fantasy and opportunity.

As a result of digital technologies, industrial designers are now able to create working, material prototypes of imagined possibilities. Accordingly, designers are more easily able to address social and political issues and communicate their ideas through the medium of bespoke designed objects. These bespoke objects must reflect necessity and provoke desire of use where the critical study of market segments and their engagement in user testing processes is an essential element in presenting impactful bespoke designed objects. Anthony Dunne and Fiona Raby extend on this in 'Fictional Functions and Functional Fictions' (2008) stating the presenting of impactful designed objects is:

"…About a designer being involved in the definition of values that are embedded in an object. Questioning the implications of ideas and ideologies locked into the operation of a product. With electronics we are not simply talking about form and visual aesthetics, but the function of the product, and what it allows us to do and what it prevents us from doing" (Dunne & Raby, 2008).

ABOVE: Figure 11. Starring Michael J. Fox, Back to the Future Part II is infamous for its valid depiction of 2015 America.

ABOVE: Figure 12. Open-plan apartment Casa MJE by PKMN
Architectures boasts moving walls and adaptive spaces.

ABOVE: Figure 13. The Fisher&Paykel Cooktop range is a key
precedent for user interface and layout.

ABOVE: Figure 14. The Dishdrawer range by Fisher&Paykel is an example of Kiwi appliance design placing the user at the centre, and the ergonomic act of living from drawers.

ABOVE: Figure 15. The Dishdrawer extends Fisher&Payel's user-centred product family.

ABOVE: Figure 16. Designed in 1955 Poul Kjærholm's PK11 Chair and PK55 table are timless precedents for postmodern furniture design.

ABOVE: Figure 17. Max Lamb's Plank table incorporates functional storage.

ABOVE: Figure 18. Through elegant design and minimal aesthetics the Serif TV by Samsung is an example of ubiquitous integration of digital technology at home.

ABOVE: Figure 19. SieMatic's Multimedia modules act as precedents for digital interface integration within the kitchen.

ABOVE: Figure 20. Project Soli by Google explores the developemnt and application of gesture recognition user interfaces.
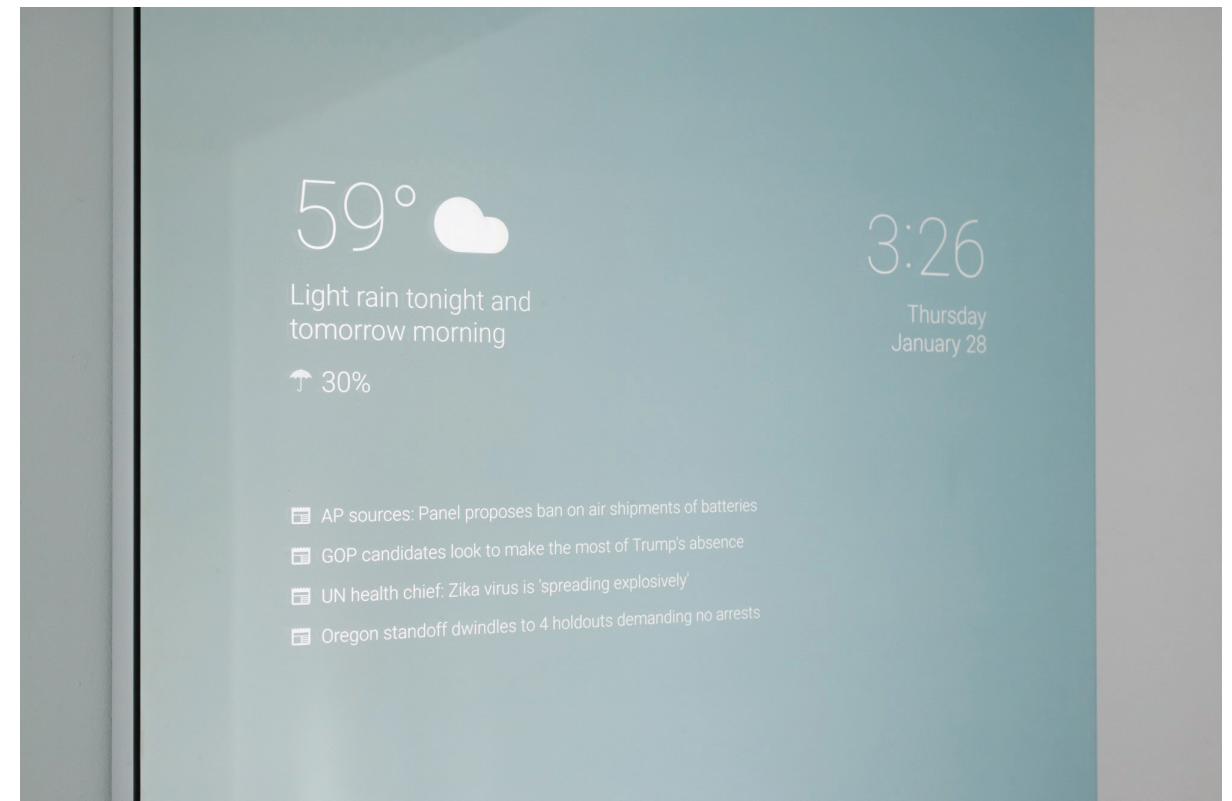
ABOVE: Figure 21. Max Braun, an engineer at Google, recently released a concealed digital display within a mirror, another precedent for integration of digital technology at home.

METHODOLOGIES

The methods applied to this research were chosen based on their capacity to support the intentions of the research in considering the impacts of technology on the New Zealand domestic dining experience and the proposition of a design solution that aims to meet the future needs and desires of Kiwi households. The methods applied have been categorised according to the three predominant modes of research: literature reviews, case studies, and design development.

LITERATURE REVIEWS

Literature reviews have aided the research in regards to contextualising New Zealand's culinary history since the arrival of early Maori, and the development and evolution of its kitchen and living spaces throughout the twentieth century. This is essential in investigating and observing contemporary contexts as a means to consider appropriate elements past and present in suggesting designed solutions for the future. In doing so it has been concluded that visiting households in order to observe and participate in everyday Kiwi dining experiences would be the most authentic approach, presenting the research as a case study series.

The aim from the outset was to visit the widest variety of households possible identifying four groups of household types based on age and generation – Millennial Generation, Generation X, Baby Boomers, and Silent Generation. These household groups were selected in this manor as they offer the most variance within elements such as dining behaviours, appliance use, and digital technology etiquette while still reflecting an average Kiwi household without emphasis on elements that include race, religion, or income. Four methods were used within each case study at various stages of the research – participant observation, semi-structured interviews, movement mapping, and personas.

These methods have been influenced by and loosely adopted from Damjan Obal and Emilija Stojmenova's research paper 'Experience to Understand' which investigates dining design evolution in providing an effective anthropologically based precedent for research into household kitchen interactions and data collection methods. Forming a twenty-nine-month study visiting more than forty-five households across Finland and Slovenia, the resulting methodology was termed EPUI: exploration, participation, understanding and integration - although when broken down these terms result in the methods identified above. Obal & Stojmenova validate the wealth of adopting such a method around the designer's role of continually designing for the end user and developing user experience research as an essential element to a user experience design process. Parallels can also be drawn between user experience design processes and speculative design practices, as the aim to speculate future design solutions must evoke strong user experience elements and sensitivities.

CASE STUDIES

Participant observation is extensively used across anthropological and sociological studies as an effective qualitative method for collecting data on people, processes and cultures (Kawulich, 2005). For this reason the research method has been utilised to gain a better understanding of contemporary New Zealand dining behaviours. It was concluded during the early stages of literature research into New Zealand culinary traditions that dinner was the dominant meal of the day and thus would be the subject for the case studies and participant observation. Dinner can also be identified as the most opportune in extending academic commentary on contemporary dining experience. The participant observation was framed on sharing a meal within the four homes of willing participatory households – of which a typical meal would take place, offering accurate insight into dining behaviours that include locality within the home, basic meal structures, household member roles, archetypes & appliances used, and of course any interaction with digital tech and its role while dining. Photography was the primary method of data collection throughout the course of the meal where emphasise was placed on participant interaction with spaces in the home, archetypes, appliances and digital tech.

Immediately following the participatory meal a *semi-structured interview* took place. Framed more as a casual discussion, the semi-structured interview provided participants with a prompted discussion on their meal preparation and dining patterns of behaviour, the basic archetypes and appliances most commonly interacted with, meal structures and food types reflective of their own culinary tradition, and identifying their own digital tech etiquette at home and around dining. Using an interview guide afforded the prompting questions a structure while creating a casual discussion provided opportunity for participants to discuss and elaborate freely on areas of their choosing. This effectively allowed for critically assessment on aspects they instinctively did and did not value. The semi-structured interviews were voice recorded to ensure the discussion flowed naturally without following a formalised sequence that other recording techniques would create, such as written recording. The recordings were then transcribed using the intelligent transcribing

technique, offering easily readable content that excludes emotions, half-sentences, or garbled speech.

Published in 1913 as a provocative study into the reforming of the housewive's kitchen in early twentieth century America, Christine Frederick's 'The New Housekeeping' employs movement mapping as a visual tool to validate her own belief in constructing more efficient and time-management-conscious kitchen designs and layout solutions. The adoption of *movement mapping* as a research method has afforded a secondary visual supplement to the research: a minimal, stylised floor plan of the household was initially defined inclusive of identifying relevant rooms and spaces adjacent to the kitchen and living areas. Within this floor plan all apparent digital technology was indicated. The movement patterns of the case study participants were then interpreted and plotted within the floor plan as a dotted line path. A circular symbol is used to represent the specific location where the participants most commonly dine.

The final stage of the case study analysed the four household personas and presented them collectively in a sequential format. From this data the four personas were defined as: Millennial Generation Household, Generation X Household, Baby Boomers Household, and Silent Generation Household. These personas each represent their respective generation-based demographic in regards to meal preparation, dining, and interaction with technology.

Jean-Claude Kaufmann's 'The Meaning of Cooking' has also inspired the adaptation of persona research as an effective tool to contextually present a household's patterns of behaviours and their own analytical thinking towards these patterns (Kaufmann, 2010). Additionally, the persona method is of interest in order to differentiate and present target demographics individually, allowing critical reflection and acknowledgment equally across all four household types. This then supports the intentions of the research in considering the impacts of technology on the New Zealand domestic dining experience.

DESIGN DEVELOPMENT

Concept sketching was the first research method practiced in the development of the design outcome: a 'Smart Tray' that aims to meet the future dining needs and desires of Kiwi households. This method afforded the ability to document and critically assess the conceptual ideation and its evolution throughout the course of this twelve-month research project. Concept sketching is an integral application for all designers, having been introduced to it at high school level it is critical when actively engaging in iterative design processes. The predominant ways in which it has been utilised is hand sketching on paper with drafting pencils and pens, and digitally via computer aided design (CAD) software. The sketching context has varied at all stages throughout the research commonly composing visual mind mapping, basic concept and form ideation and exploration, details exploration, construction and manufacture exploration, and material identification and exploration. Concept sketching has constructed a strong basis of which supplementary methods can be applied in forming a concise concept research stage, particularly as a means to inform the aforementioned value of material prototype development.

Sketch modelling was the second methodology employed in developing a sequential series of initial material prototypes, in again following an iterative design process. Sketch modelling was used to critically assess the ideas formulated as a result of the concept sketching process, as well as the ideas and observations collected from the case study research. Like the concept sketches, sketch modelling aims to conceptualise but in the form of tangible models. The models produced have the benefit of enabling user testing and the collection of user feedback. As a result of the feedback elicited two design iterations were selected for further development. More specifically, these two design iterations were selected for their contrasting integration of both

digital and tangible interface opportunities. Throughout this stage sketch modelling was continually engaged in as a means to refine the two concepts in to a singular, final design. Ultimately the collective utilisation of these methods provides the opportunity to critically assess the iterative development of the design through to the experience prototyping stage.

Note: Although the digital interface is presented in a static form throughout the prototypes, each iteration supported a series of wireframe mock-ups of the proposed digital interface. The generation of these wireframes were iterative in themselves, and the design was developed to reflect a consistent aesthetic in relation to the physical form.
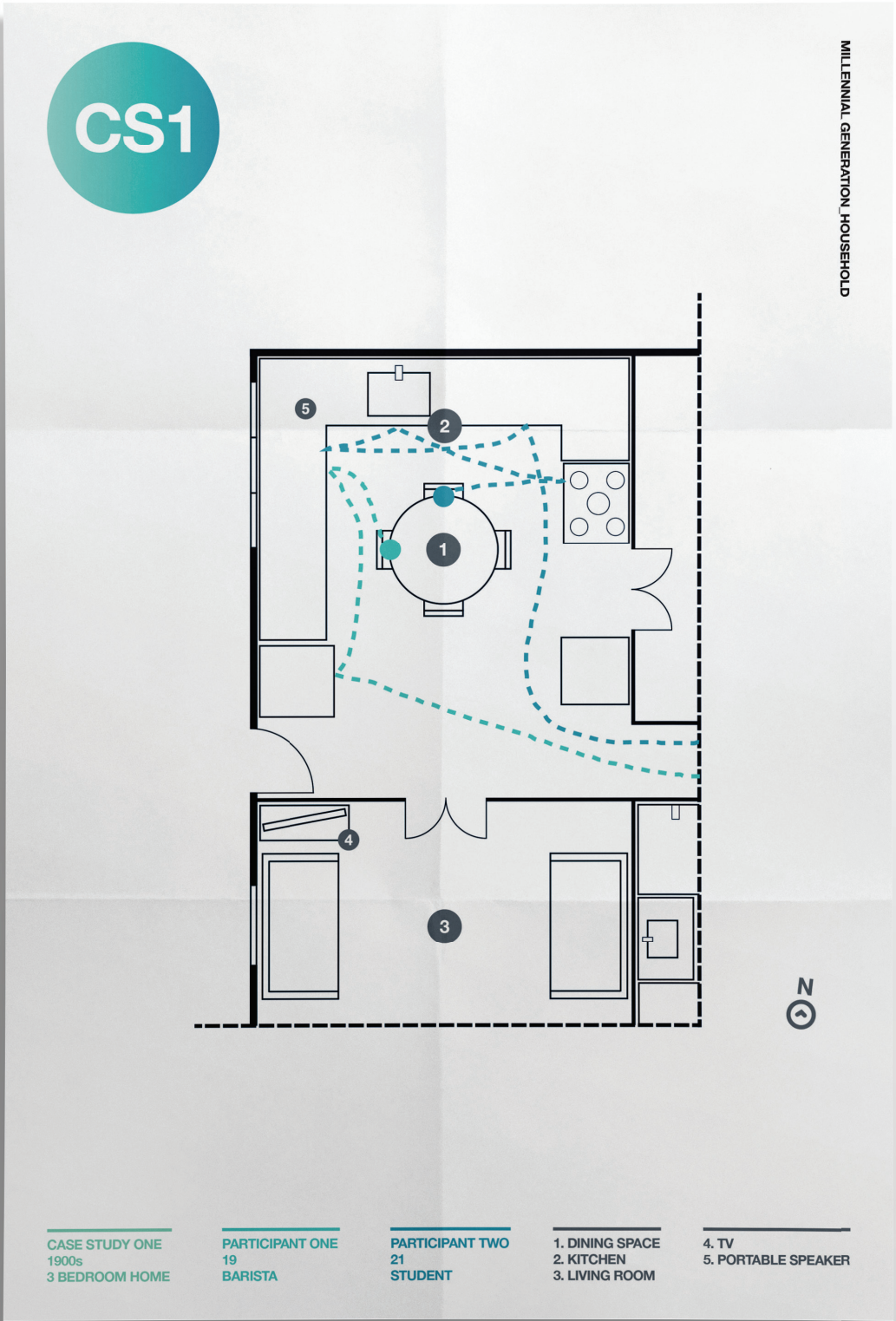
Experience prototyping was the final method utilised in identifying a final design output. Experience prototyping aims to identify and evaluate the successful and unsuccessful elements of a concept through interactive engagement with prospective users. In the context of this research project the 'users' included case study participants. As a result of this process a third, more refined prototype was produced to specification. This version of the prototyped design more clearly represented the proposed digital interaction display, materiality, and design details. By offering participants the chance to interact with this refined version of the design, they were better able to provide critical commentary on the tray's tactile elements. Of particular concern was the tangible interface and overall scale of the Smart Tray prototype where the physical grasping and positioning of the tray in various contexts by multiple participants allowed for clear and concise critical feedback. Upon completing this stage the participant commentary was assessed and implemented within considerations that lead to the further refinement and production of the final designed object.
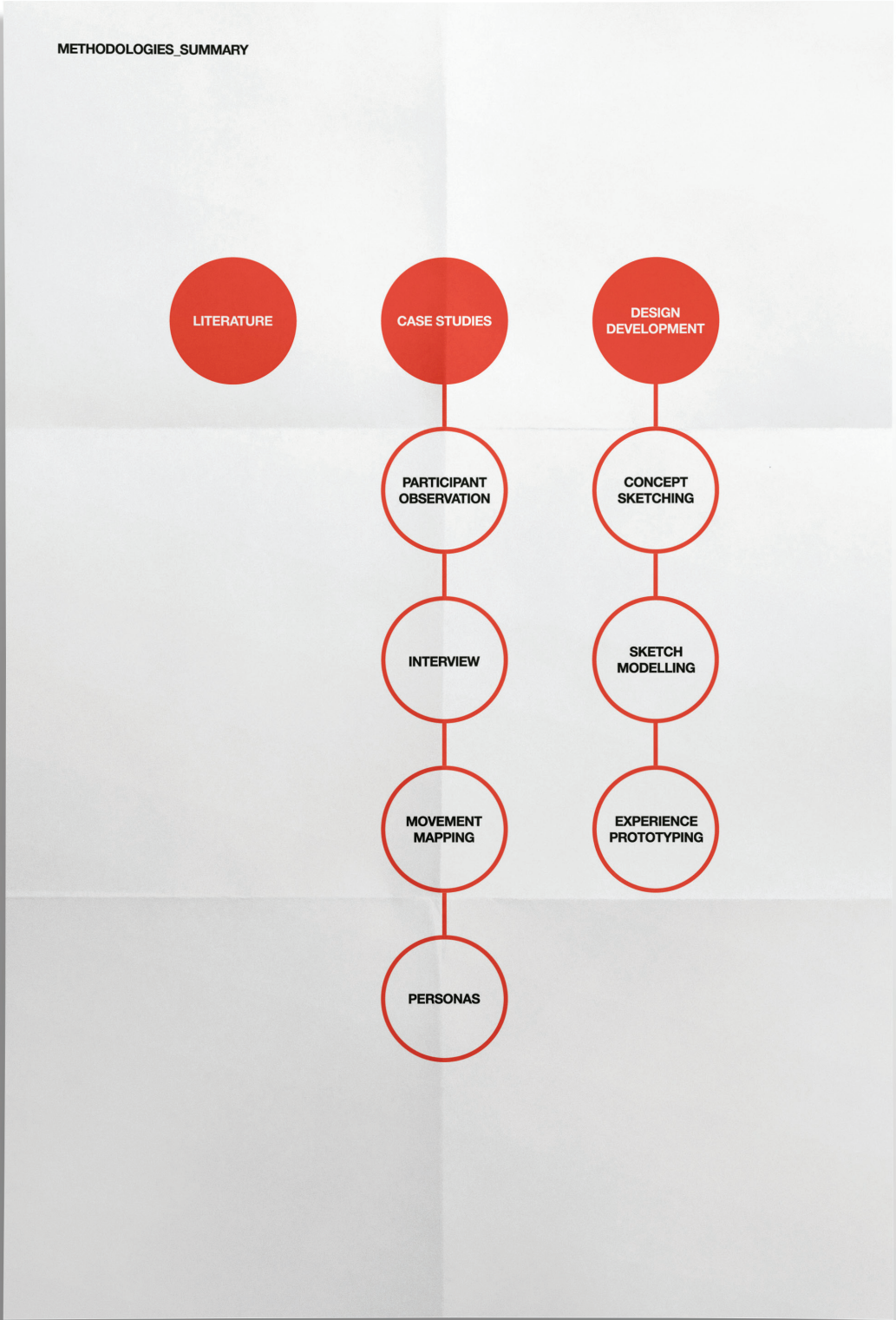
ABOVE: Figure 22. Methodologies summary breaking down research methods used.

CASE STUDY

As indicated in the section titled 'Research Methodologies', four personas were defined as a means to structure the case studies: Millennial Generation Household, Generation X Household, Baby Boomers Household, and Silent Generation Household. These personas each represent their respective generation-based demographic in regards to meal preparation, dining, and interaction with technology. The case studies that follow are sequentially representative of these personas. The Millennial Generation is therefore presented first, with the Silent Generation household concluding the case studies. It is important to recognise that independent, adult New Zealand residents collectively form the general target demographic for this research.

CS1

Case Study One

MILLENNIAL GENERATION

1980 - 2000

CASE STUDY ONE
1900s
3 BEDROOM HOME

PARTICIPANT ONE
19
BARISTA

PARTICIPANT TWO
21
STUDENT

1. DINING SPACE
2. KITCHEN
3. LIVING ROOM

4. TV
5. PORTABLE SPEAKER

ABOVE: Figure 23. Participant movement map within dining space of
the Millennial Generation household.

The term Millennial Generation in most academic circles refers to those born from the early 1980s to the early 2000s (Strauss & Howe, 2000). This generation is credited to be the first to grow up with the Internet, being the most exposed to digital technologies since birth. They are also thought to generically contain a strong sense of community, both local and global (Strauss & Howe, 2000).

The Millennial Generation household case study took place in a rented villa in the Wellington suburb of Newtown. Built in the early 1900s the three-bed is home to Participant One (P1) and Participant Two (P2). P1 is a nineteen-year-old female currently working as a Barista and partner P2 is a twenty-one-year-old male student.

Kitchen

Collectively P1 and P2 admitted their kitchen is part of a stereotypically dated student flat, however they embrace the space as a central hub to their living. P1 reflected on a space of social congregation and a lot of laughter as "everything 'together' happens here." A round dining table takes pride of place in the kitchens centre, used every night as cooking and eating takes place in the same space. I observed an incredibly functional kitchen where strong emphasis was placed on the traditional use of the dining table – being seated for a meal together and delving into free flowing conversation. An interesting observation came from both P1 and P2's desire to eat from warm plates as an important aspect to their evening meals.

Dining

When patterns of behaviour around dining are concerned P2 affirmed, "we don't fluff round – we normally just eat a main dish and that's it." They both identified a culinary tradition of white or red meat and vegetables, cooking American and British inspired dishes while exploring Mediterranean and Asian foods too. They purchase fresh foods on a daily basis, expressing their desire to eat fresh as often as possible. This then flows on to the lack of storage required and dependence on the fridge as an essential appliance in keeping their foods fresh. Because they cook their own meals they feel a responsibility to sit down formally and enjoy them together, where they reflect takeaway meals would often result in being eaten on the couch as a more casual meal - having not been prepared by either of them. Underneath the traditional use of a dining table I observed a fairly relaxed and adaptable dining culture, where passion for good food, and intimate bonding and conversation was evident. In this instance there was also complete integration of kitchen and dining space, which seemed to streamline common interactions while involving the dining space in the complete cooking and meal preparation process.
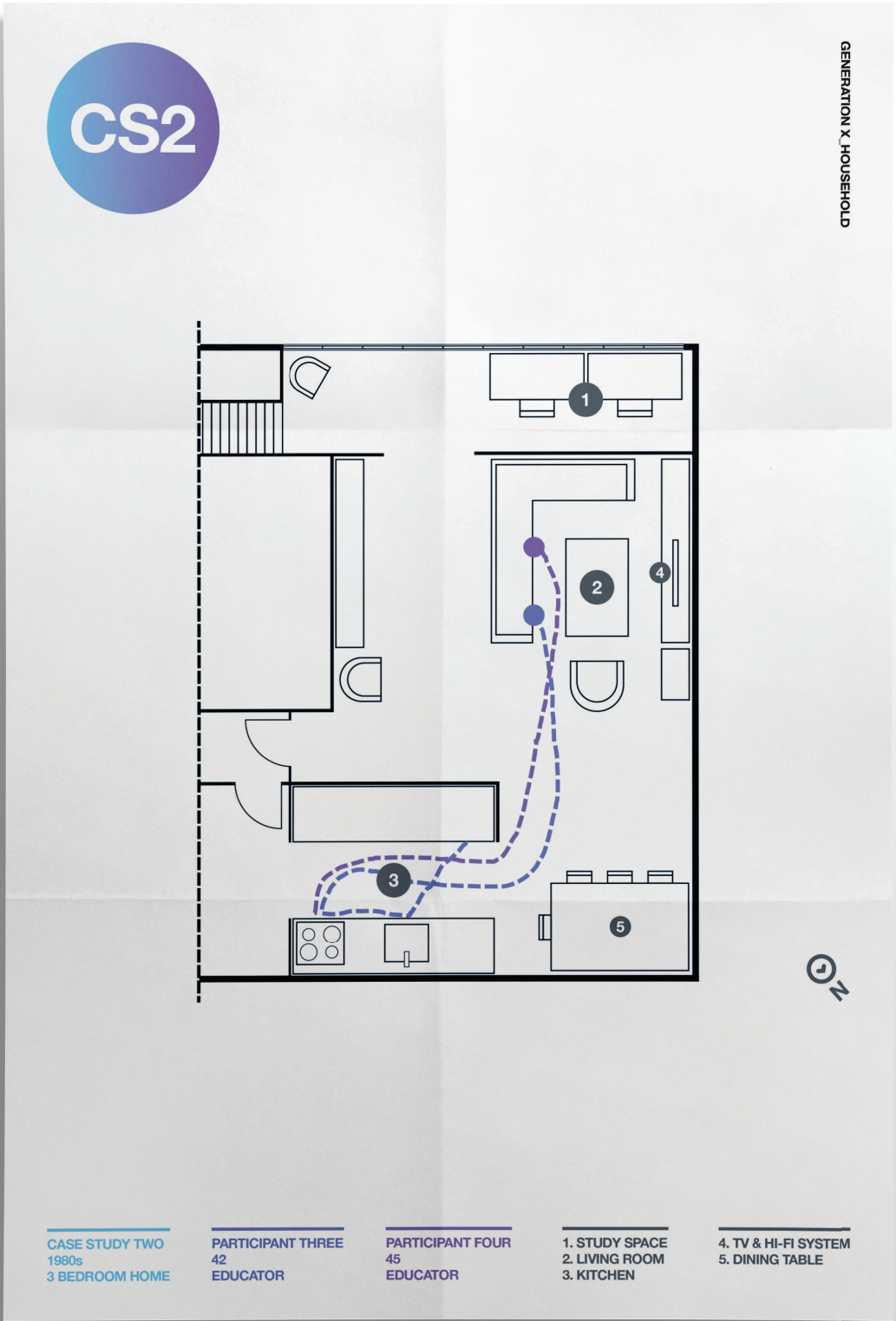
Tech Etiquette

Joining P1 and P2 for dinner I observed P2 interact frequently throughout the night with a Bluetooth speaker system connected wirelessly to his smartphone. This provided a ubiquitously ambient soundtrack, something he believed was enjoyable in creating a warm, easy-going experience when sitting down for their evening meal. This seemed to subdue the formalities of eating at the dining table as well as prolonging the overall mealtime period as background music made pauses in conversation feel more like intermissions rather than signs to end the conversation and thus the meal. Although both participants were raised in traditional settings that shunned external elements making their way on to the dining table while eating P1 admitted, "occasionally I find myself reaching for my phone to check it." This explicitly presented both participants acknowledgment of their use of digital tech and its value to enhance a setting, whilst also recognising the need for minimal interactions with it during essential intimate moments such as dinner.

TOP: Figure 25. CS1 often serve a singular dish in producing a meal as part of their culinary tradition.
BOTTOM: Figure 1. P1 admitted to casual interaction with her smart phone despite preferring not to.

TOP: Figure 26. CS1 dining behaviours reflect a casual interpretation of traditional dining at a dining table.
BOTTOM: Figure 1. Passionate about food CS1 enjoy dining as an intimate, relaxed experience.

CS2

Case Study Two

GENERATION X

1960 - 1980

CASE STUDY TWO
1980s
3 BEDROOM HOME

PARTICIPANT THREE
42
EDUCATOR

PARTICIPANT FOUR
45
EDUCATOR

1. STUDY SPACE
2. LIVING ROOM
3. KITCHEN

4. TV & HI-FI SYSTEM
5. DINING TABLE

ABOVE: Figure 27. Participant movement map within dining space of the Generation X household.

TOP: Figure 28. CS2 embrace an open tech etiquette where multiple devices were observed, and interacted with throughout the study.
BOTTOM: Figure 29. CS2 enjoy fresh foods prepared from scratch, where formal place settings reflect this passion for good food.

Generation X commonly refers to the birth years ranging from the early 1960s to the early 1980s (Strauss & Howe, 1991). This generation, compared with the generation it precedes represents a more heterogeneous generation, embracing social diversity of characteristics that include race, class, religion, ethnicity, gender identity, and sexual orientation (Generation X, 2008).

Placed on the slops of Wellington's Island Bay, framing views of the Cook Strait, the Generation X household case study took place within a 1980s Lockwood home. Its occupants, both tertiary educators, are Participant Three (P3), a forty-two-year-old female, and Participant Four (P4), a forty-five-year-old male.

Kitchen

Similar to the Millennial household P3 and P4 currently rent while in the process of building their own home. For this reason they both feel they are in a period of tolerance with P3 describing the kitchen as "definitely not the heart of the home […] regardless of its size I feel the kitchen isn't a place to hang out or socialise." P3 and P4 actively cook together when preparing dinner most nights, and alluded to their adaptive use of a small kitchen simultaneously. Both choice and dietary requirements dictate the dominant purchasing of fresh foods on a daily basis, depending on the fridge to keep foods fresh.

Dining

Interestingly P3 believed culinary traditions "are becoming more singular thanks to international media" influenced by western foods especially fresh salads and fish. All meals are relatively simple, speaking to their daily patterns where dining, P4 believes, is completely convenience and comfort based. Dinner is mostly eaten on the couch in front of TV and an emphasis is placed on dining together. Even if this results in no talking where an intimate experience takes place through the simple pleasure of enjoying each other's, or a guests company. Admittedly P3 and P4 do not like the idea of eating at the dining table as it is not comfortable in their view, feeling too formal embracing what P3 believes is total honesty as "what we really want to be doing is sitting on the sofa watching a (TV) show. In actual fact I observed the dining table being used as more of a kitchen space utility, perhaps a role of the future?

Tech Etiquette

In extending on the adoption of the sofa and living space as the place of preferred dining P4 revealed it commonly centres on the "streaming of TV shows or a movie while eating as it is not scheduled and remains entirely in our control, fitting with when we feel like eating." This was an interesting observation where digital tech devices such as a TV, hi-fi system, smartphone and tablet were all in reach yet interaction with them centred purely on conversation. At no point did the digital tech interfere. Similar to the first case study I was exposed to a soft soundtrack throughout the night. Although played through a more substantial hi-fi system again I observed the utilisation of wireless Bluetooth control as P6 seamlessly changed tracks while mid conversation. However P3 and P4 outlined a general rule around the exemption of calls or online conversation with those not present during this casual, yet ritualised mealtime of pervasive tech integration.

TOP: Figure 30. Dining in front of TV enjoying streamed TV shows reflects CS2's emphasis on convenience and comfort.
BOTTOM: Figure 31. CS2's cluttered dining place setting visually communicates opportunity to better integrate dining and digital technology artefacts.

TOP: Figure 32. Observation of both P3 & P4 interaction with tablet and smart phone devices for entertainment and information purposes.
BOTTOM: Figure 33. CS2 enjoy a casual dining experience where digital technology is integrated in enhancing the experience.

Case Study Three

BABY BOOMERS

1940 - 1960

CASE STUDY THREE
1970s
3 BEDROOM HOME

PARTICIPANT FIVE
52
BUSINESS OWNER

PARTICIPANT SIX
51
BUSINESS OWNER

1. DINING SPACE
2. OUTDOOR AREA
3. LIVING ROOM

4. KITCHEN
5. TV
6. COMPUTER DESK

ABOVE: Figure 34. Participant movement map within dining space of the Baby Boomers household.

The Baby Boomers generation represents those born within the early 1940s and 1960s during the post-World War Two birth spike. They are commonly associated with the redefinition of traditional values, growing up in a time of widespread government subsidies in post-war housing and education (Werner, 2011).

Participant Five (P5), a fifty-two-year-old female, and Participant Six (P6), a fifty-one-year-old male, are a self-employed married couple running their own business. They share a three-bed home in the Normandale hills of western Lower Hutt, an estimated build of the 1970s.

Kitchen

P5 and P6 believe their kitchen is a logical space acting as a practical thoroughfare in connecting living spaces with other parts of the home. For this reason both participants see the living space, which they feel includes the kitchen, as the heart of the home. Only one person uses the kitchen at any one time despite its comfortable size as P5 revealed, "we generally split roles each night for dinner - one person will do the cooking while the second does the washing up." Due to their busy schedules food tends to be purchased on a weekly or half-weekly basis. For this reason they depend heavily on the freezing of their meat, vegetables and bread in particular – compensating slightly on freshness for convenience. It is interesting to note that out of all four household case studies the Baby Boomer's relied most heavily on their pantry and fridge-freezer storage space.

Dining

P6 describes their culinary tradition as "typically western-kiwi. We have pretty traditional meals that most Americans and Brits would recognise while also being partial to pasta, curry and stir fry dishes." They also revealed the meals are very commercialised, coming from popular culture outlets such as magazine's and TV cooking shows. P5 also interestingly admitted to their ritualised "tea with the six o'clock news" as an important structuring to their day, acting as an "indicator that the working day is done where it is time to enjoy a meal and have a casual conversation or heated debate in front of the TV."

Tech Etiquette

Although P6 described both participants as not the most "tech savvy" they do not see a major problem with digital technologies integration within the home and around dining. "We watch TV most dinners, so I find tech around meals being ethically fine" concluded P5. Throughout the meal I observed constant interaction between the TV remote and P6 while both shared a constant focus on the TV and each other during conversation. P6 also believes taking a phone call is fine as mealtime is a casual occasion and being connected to the rest of the world seems normal stating, "dinner together is relaxed enough that if an important call needs to be made or received then so be it, it is just the world we live in now. The same way I would interrupt dinner for the bathroom or pull the curtains for example."

TOP: Figure 35. CS3 outline open tech etiquette embracing digital connection as an essential element of modern society.
BOTTOM: Figure 36. P6 was observed interacting with a smart phone during meal connecting to social media platforms.

TOP: Figure 37. CS3 dinner strucutre centred on dining in front of the TV watching the 6pm news.
BOTTOM: Figure 38. P5 dining on lap infront of TV reflects casual dining behaviour of CS3.

TOP: Figure 39. Dining in front of TV provokes various streams for conversation where a social experience was observed.
BOTTOM: Figure 40. The TV and living space of the home provides a central hub for the CS3 culinary tradition.

CS4

Case Study Four

SILENT GENERATION

1920 - 1940

PARTICIPANT SEVEN
83
RETIRED NURSE

PARTICIPANT EIGHT
86
RETIRED ENGINEER

1. DINING SPACE
2. KITCHEN
3. LIVING ROOM

4. TV

ABOVE: Figure 41. Participant movement map within dining space of the Silent Generation household.

The Silent Generation commonly represents those born between the early 1920s and 1940s, having been born within a period of relative economical insecurity causing low birth rates, reflected in the ultimate action of two World Wars either side of the generation's timeframe (Carlson, 2008).

The fourth and final case study took place in Aotea with Silent Generation participants, eighty-three-year-old female Participant Seven (P7), and eighty-six-year-old male Participant Eight (P8). Both retirees now enjoy stunning views of Tithai Bay and Mana Island in a three-bedroom home built in the early 2000s.

Kitchen

Boasting the youngest home throughout this case study research I observed a relatively modern and incredibly well maintained kitchen and adjacent open-planned living space. While P7 does all cooking bar breakfast P8 takes care of the cleaning up as P7 explains, "I love to cook and enjoy preparing almost everything from scratch. I rely on regular visits to the shops to provide fresh food to cook and the fridge is essential in keeping things fresh." The kitchen is an incredibly spacious size where assorted kitchen utensils and books indicated the kitchens, and cookings significance to both P7 and P8.

Dining

P7 indicated that their collective culinary traditions both reflect the foods they were served as kids by their parents. In both cases this included Irish, Scottish and English elements. P8 described that most meals are fairly traditional served on oven-warmed plates mostly incorporating meats, vegetables and breads. Dinner at the dining table is a must as both participants explained its necessity in practicing politeness and good standards. With multiple people it also allows everyone to feel involved. Similar to the Baby Boomers participants P7 and P8 always structure their dinner around the six o'clock news with a small TV placed strategically next to the dining table. P7 explained, "I'll start cooking at 5:30pm with the intention of serving dinner just as the news begins." This also indicated the fact they both never eat separately as they feel togetherness is crucial aspect to their lives. P8 revealed, "despite using a dining table watching the news reflects the casual nature of our meals. This is not to say we don't communicate, rather in fact the opposite as it provides countless reason for conversation and even debate while more importantly giving us the sense we're still connected to the world."

Tech Etiquette

P7 and P8 appear to live a simple life with regards to their tech etiquette as they choose to limit its use to the TV, radio, phone line, and sporadically brief interactions with email and the Internet. Considering the integration of tech and dining they both affirmed the TV's exclusive use, promptly denying any suggestion of using the phone or Internet while dining.for the bathroom or pull the curtains for example."

TOP: Figure 42. CS4 depend on the 6pm news with evening meal in structuring the meal, and keeping informed.
BOTTOM: Figure 43. A passion for traditional cooking and good food is expressed in P7's meticulous food preparation and serving.

TOP: Figure 44. Dining together P7 & P8 embrace a traditional dining experience and utlisation of a dining table and formal place setting.
BOTTOM: Figure 45. Dining in front of a TV CS4 embrace an informed evening meal that provides opportunity for intimate conversation and debate.
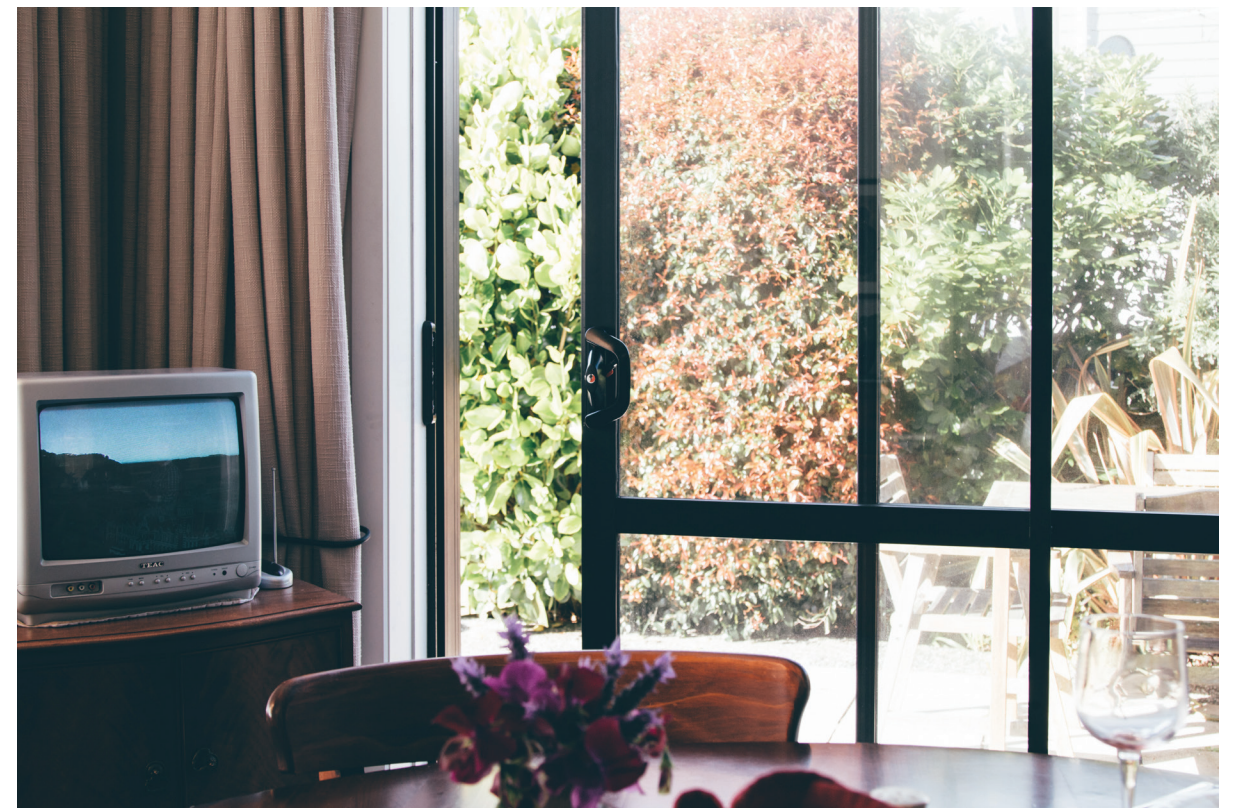
TOP: Figure 46. P7 & P8 both believe the dining table maintains appropriate social connection and politeness whether together casually or in a formal setting.
BOTTOM: Figure 47. A small TV expresses the value CS4 place on basic interaction with digital tech, without being obtrusive.

HOUSEHOLD_SUMMARY

|	KITCHEN	DINING	TECH ETIQUETTE
CS1	Kitchen acts as central hub to their living. Passionate about fresh foods and cooking meals from scratch every night. Oven-warm plates before a meal routinely.	American and British inspired culinary tradition often based on a one dish meal structure. Traditional use of the dining table as key element to dining behaviours.	Integration of digital tech in dining for entertainment purposes, and not for digital communication. Digital tech subdues formal use of dining table during dining.
CS2	Most commonly cook meals from scratch together using fresh foods. Dependence on fridge to keep foods fresh instead of storing foods longterm in pantry.	Relatively simple, healthy meals that speak to their busy lifestyle and dietry needs. Most commonly dine together in front of TV on the sofa built on convenience and comfort.	Openly integrate digital tech for entertainment and information purposes during dining. Prefer not to interact with digital tech for communication purposes while dining as a time to disconnect.
CS3	Kitchen acts as central hub to their living, connecting the home. Split roles within the kitchen with regards to cooking and cleaning. Busy schedules result in storage of food, compensating on freshness for convenience.	Traditional meal structure of American and British influence, consuming commercialised meals found in magazines or TV as part of popular culture. Dinner together with the 6pm news in front of TV is a strong ritual, and key element in the days structure.	Completely open to the integration of digital tech in the home and around dining. Mainly for entertainment and infromation purposes digital tech is also interacted with on a communication basis as need be.
CS4	Kitchen plays vital role within open plan layout. Split roles for cooking and cleaning within kitchen. Meals prepared from scratch due to passion for cooking and desire to invest time in cooking on a daily basis.	Strong culinary tradition based on upbringing. Traditional meal structures originating from British society - multi dish dinners particularly. Dining table is fundamental to their dining experience. Dinner is served around the 6pm news on TV, ritualised every night together.	Minimal interactions with digital tech due to traditional values. Only tech interacted with regularly would be the TV, and telephone outside of dining.

ABOVE: Figure 48. Household case study summary breaking down key kitchen, dining, and tech etiquette elements of each generation.

PRELIMINARY DESIGN

The preliminary design stage acknowledges aforementioned literature and case study research in pursuing an iterative design process. This stage aims to produce research-led conceptual thinking that ultimately produces the final design solution for this research project. The design experiments outlined in the following section explore a variety of research methods in ensuring the final design output accurately addresses the research aims as best possible.
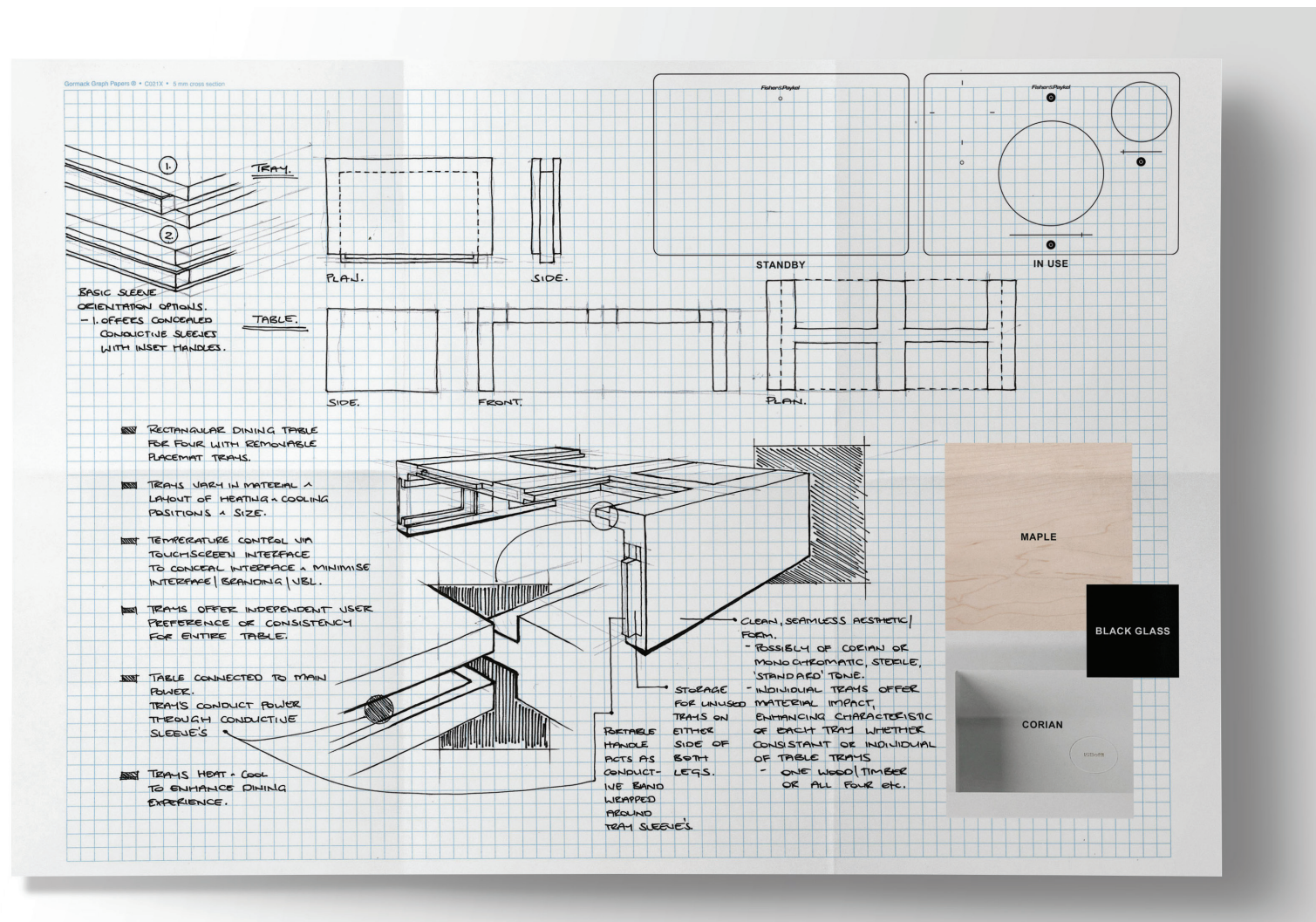
Experiment One

PLACEMAT TABLE CONCEPT

This design experiment aimed to explore pervasive technologies integration with both appliance design, and the dining table, maintaining the fundamental practicality of a table while merging it with a speculative appliance device. The concept explores four removable placemats within a rectangular table with double-sided adaptability. The first side incorporates a working surface, while the second houses the appliance device that integrates induction-heating technology.

There exist two predominant purposes for the modular appliance device. First, heating and cooling capabilities on the induction surface enhance the dining experience of the user having complete control in heating and cooling elements of their meal to their own preference. Secondly, to provide a portable, adaptive placemat-tray again allows the user complete control in where they choose to dine when outside of the dining table context. The reasoning for an appliance device centres on the continual development of open plan living spaces,

furnishings and products, in this case linking functionalities of the kitchen with the basic ergonomic practicality and cultural hierarchy of the dining table. The concept also seeks to address the significance that the majority of the participants placed on the dining table as an important and valued utility to dining. Despite the fact that all four household case studies described their patterns of dining without the dining table as frequent and even, in some cases, preferred, the dining table serves as an enduring artefact that symbolises the dining experience.

The placemat table concept (experiment one) had both successful and unsuccessful elements. The identification of a portable, adaptive placemat-tray was most successful in proposing a personal device as opposed to a collective table-based device. The limitations on user functionality were not successful, however this shortcoming and other missed opportunities assisted the development of the next iteration.
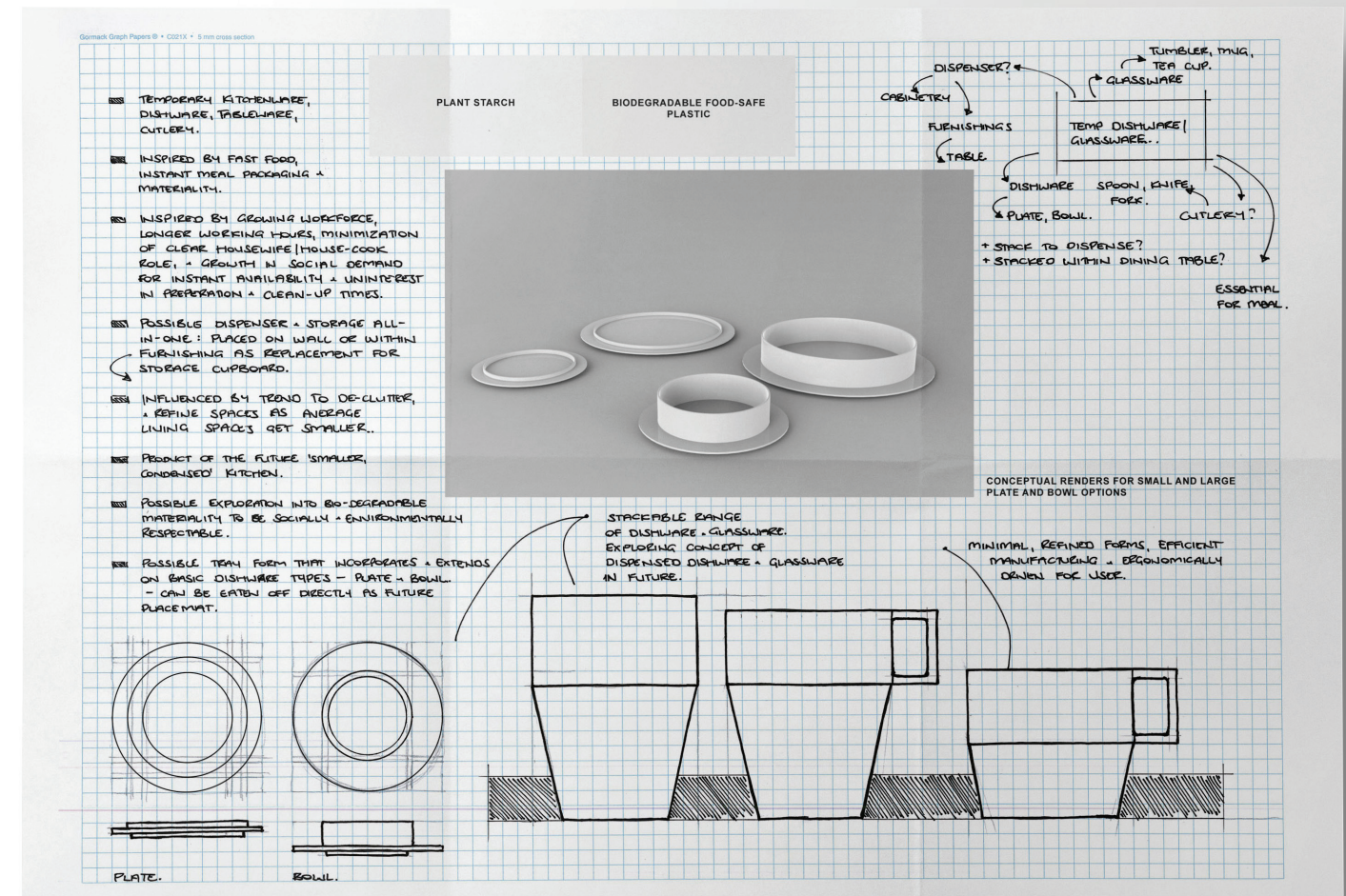
Experiment Two

SMART TRAY CONCEPT
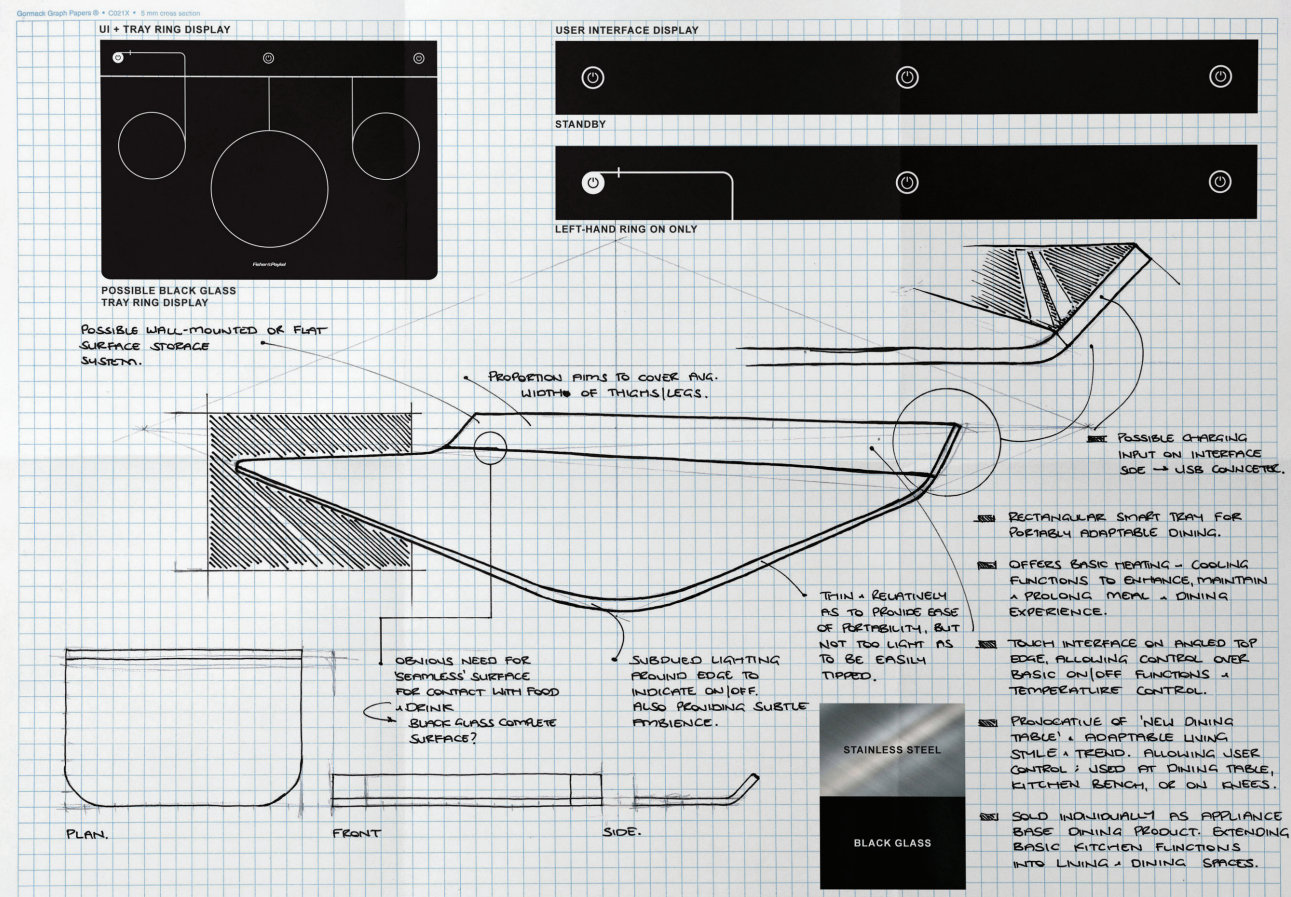
The second design experiment was an iteration on the first experiment but with particular focus on designing an appliance-based device for the individual user. The aim was to explore the possibilities of providing a device that supports basic utilities and enhances the daily patterns and behaviours of its user. The Smart Tray concept effectively sought to utilise the fundamental, everyday act of dining to bridge and integrate digital technology within the scope of home appliance design. This aspect also aims to consider pre-existing relationships between dining and digital technology as all case study households interacted with digital technology while dining for entertainment purposes, with two of the four routinely watching the 6pm news on TV with dinner. While the form expresses a sleek and minimal aesthetic, its primary functions centre on an induction appliance device identical to that developed in the initial design experiment. The other, more provocative function provides the user with a device that enables pervasive technology. This design, essentially the convergence of an appliance-inspired dining tray and pervasive technology, envisions the user connecting to online applications and devices in close proximity wirelessly through a seamless user interface touch screen system.

In addition to the Smart Tray, this design conceptualisation extended to the initial development of glassware and plateware accessories in communicating the opportunity for a product family. The expanded conceptualisation of this speculative product sought to position the tray and associate glassware and plateware as a singular entity: the user require utensils when engaging with the tray, so it seems appropriate to supply utensil accessories that fit to the trays exact requirements. The glassware and plateware options are proposed to incorporate a conductive materiality that takes advantage of the performance of the trays induction capabilities. In considering ergonomic portability as an essential element, a secondary function explores a magnetic relationship between the tray and accessory range. Whether permanent or via a magnetic off/on base this would improve the portability of the tray and its contents. This speaks to the dining behaviours of our Kiwi culinary tradition as two of the four household case studies enjoyed their dinner while sitting or kneeling at a coffee table.

The applicability of these functions relates to literature research on the smart home and the argument for the ubiquitous integration of digital technology within the home through such

conceptual thinking. As a concept driven by future forecasting and a speculative design approach, this concept seeks to propose and provoke questions regarding how digital technology and appliance design elements are integrated and utilised in the home of the future.

The Smart Tray developed within the second experiment provided a strong basis for further development, not only for the simplicity of form but inclusion of a touch interface system enabling the seamless application of technology. At this stage it was determined that the further development of glassware and plateware should be avoided for the sake of focussing on the user interface of the Smart Tray and in presenting a more concise and refined design solution.
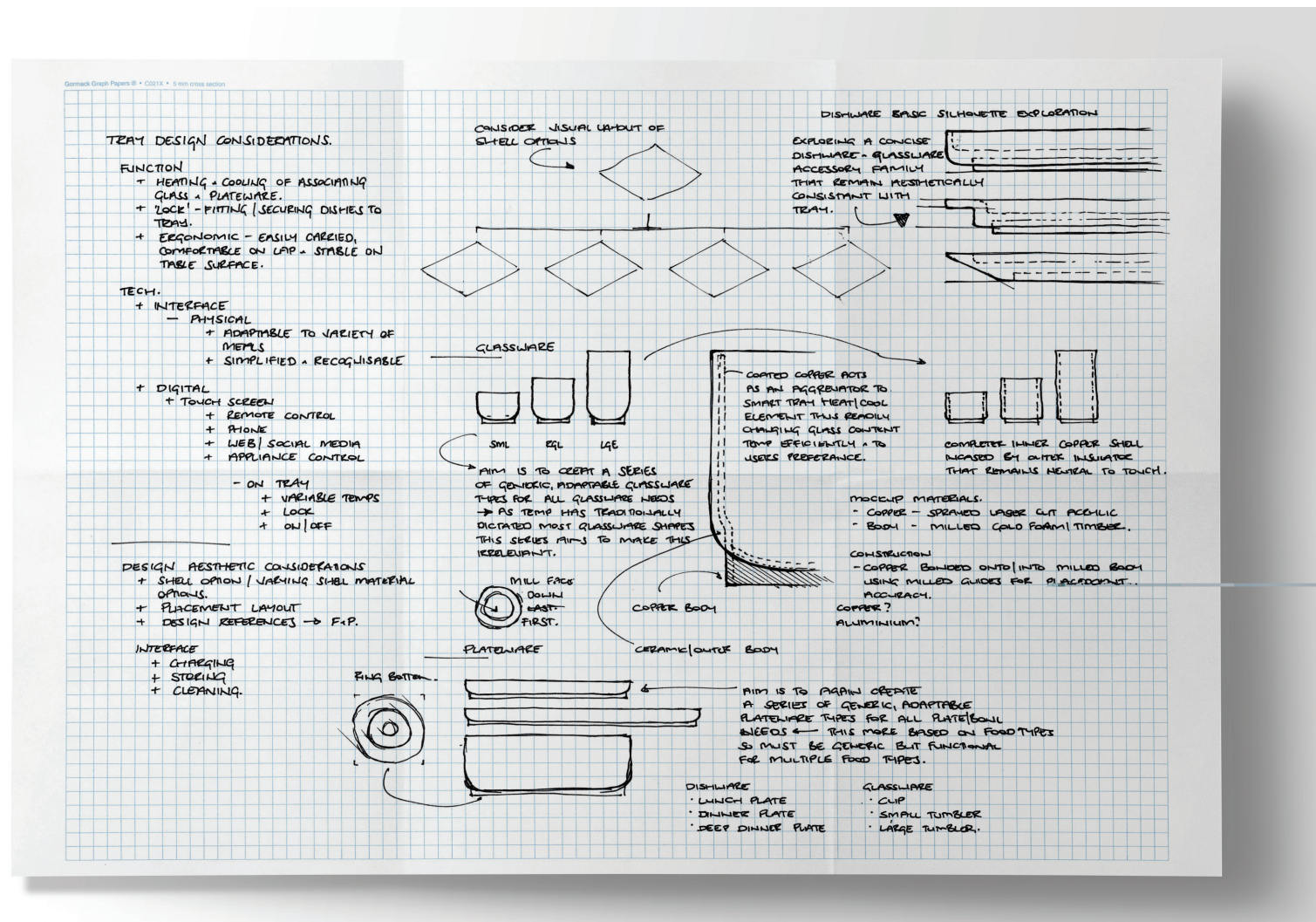
TOP: Figure 53. Generic Cup Glassware concept; sketch 005.
BOTTOM: Figure 54. Generic Tumbler Glassware concept;
sketch 006.

Experiment Three

SMART TRAY ITERATIONS
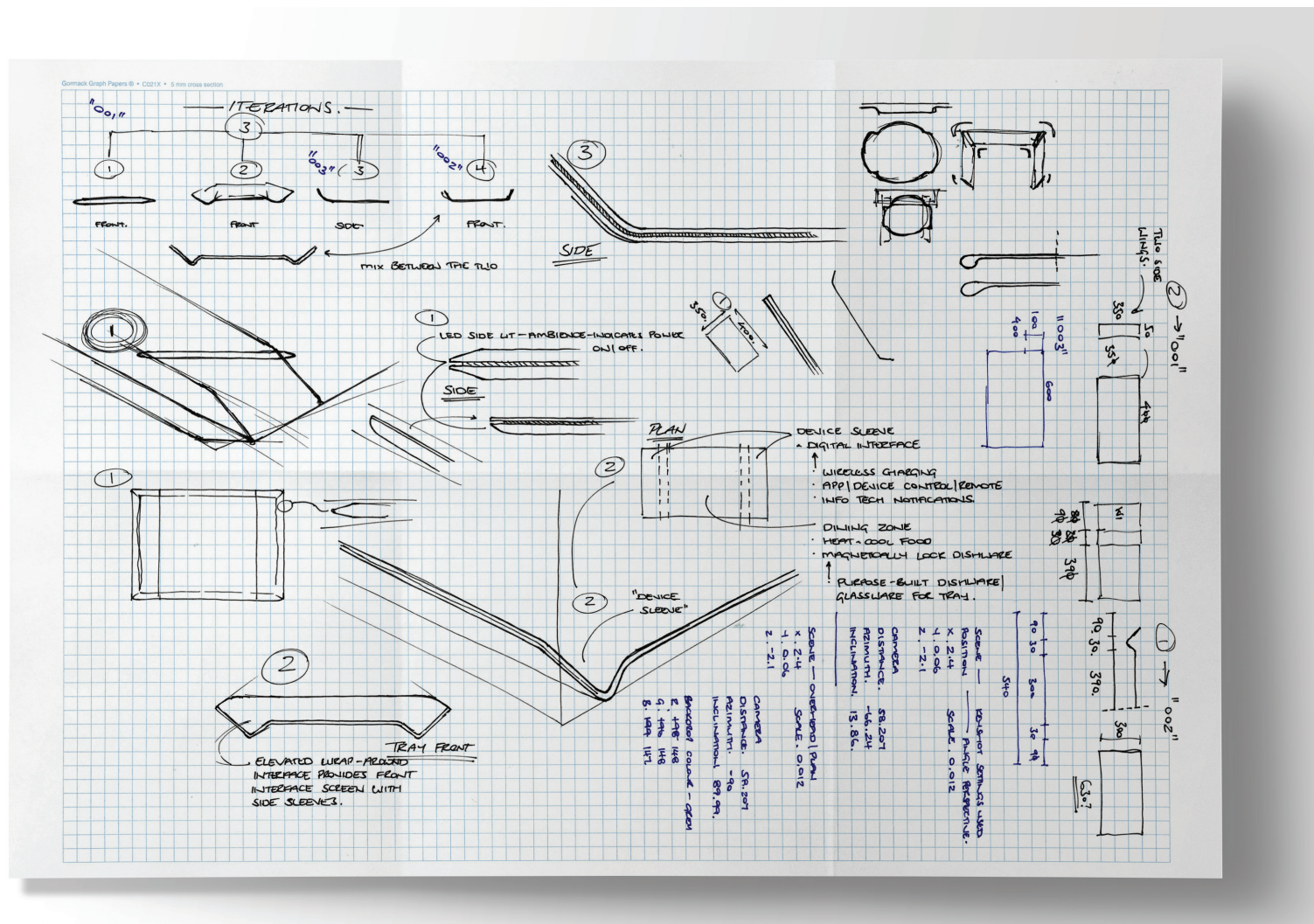
Culminating the previous design experiments, this experiment aimed to further apply the findings from the household case studies in developing three iterative design solutions. Utilising concept sketching, sketch modelling, and experience prototyping methods the three iterations explored various approaches to the design of the form that effectively integrated digital and physical interfaces while maintaining a minimal aesthetic.

After sketching and rendering CAD representations, iterations '002' and '003' were selected for their contrast in form and interface orientation. Iterations 002 and 003 were then mocked up through laser-cut acrylic sheet and bent to to produce the experience prototypes that would support the development of the next stage of the iterative process. These basic prototypes quickly exposed the failures and successes of these forms: While both iterations were too small in scale to fit a dinner plateware piece, 002 had positive ergonomic qualities. Iteration 003 was more difficult to hold in-hand and impeded the arms when used on a surface or lap due to the digital interface paddles on both left and right-hand sides of the tray. The Smart Tray iterations ultimately resulted in 002 being selected as the final concept in which iterative developments would continue.

It was concluded 002 provided the most opportunity in presenting a practical form integrating both digital and physical interfaces. The form was also the most intuitive in providing the user an angled touchscreen interface above the plateware. The touchscreen interface is seamlessly integrated within the form with a smooth twenty-degree bend up from the dining zone surface.

001

002

003

ABOVE: Figure 56. Smart Tray iterations; sketch 008.
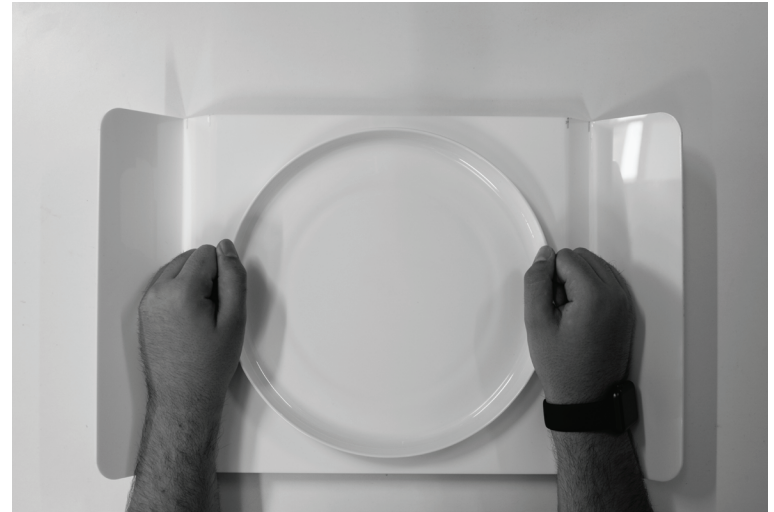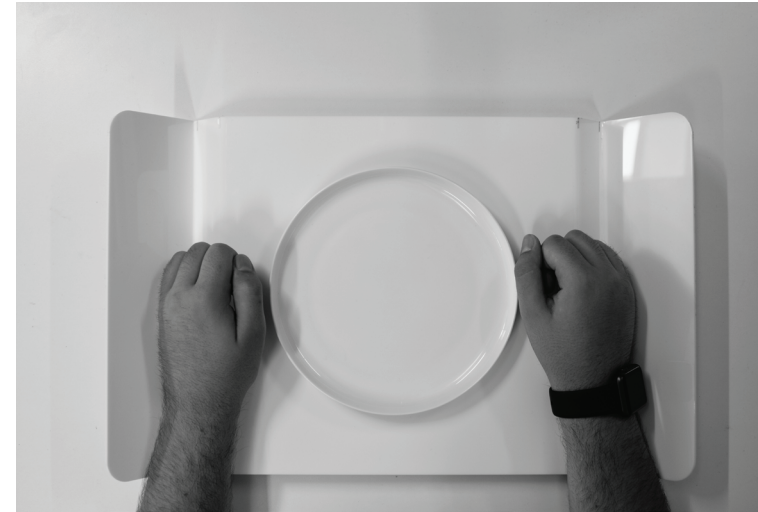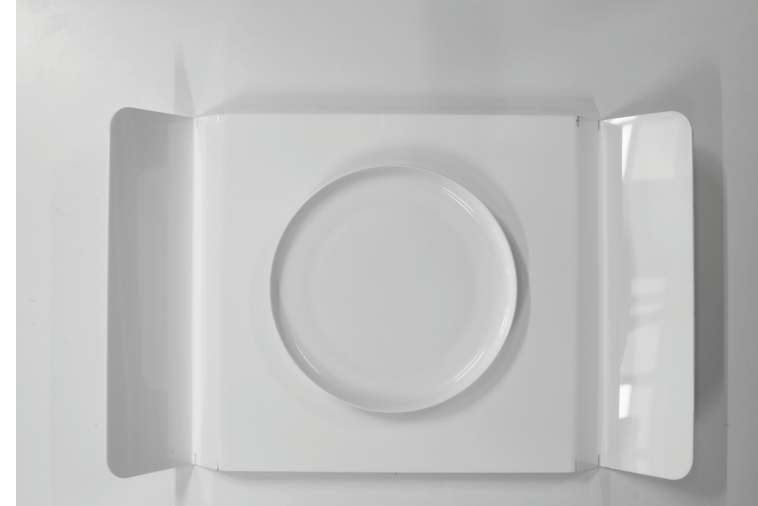
ABOVE: Figure 57. Prototypes 002 during scale testing.

ABOVE: Figure 58. Prototypes 003 during scale testing.

Experiment Four

DINING ZONE

Experiment four, Dining Zone, explored the possibilities for framing the most ergonomic scale and proportion for the continued development of the Smart Tray concept. As iterative prototypes 002 and 003 were too small to fit the appropriate utensils, the experiment primarily centred on using a plateware piece centrally within the dining zone, while having room for a glassware piece on either left or right-hand side of the plateware in acknowledging both left and right-handed users. Using masking tape a dining zone was measured and recorded through photography. This experience prototyping exercise utilised common dinner plateware and tumbler glassware utensils in determining the minimum space required for the most effective ergonomic interaction.

Through this exercise the dimensions of the dining zone, originally identified as 500x350mm, was refined down to 462x337mm for the final Smart Tray dining zone. This dimension was implemented in Experiment Five, which will be concluded on in its own subsequent section to follow.

Experiment Five

SMART TRAY PROTOTYPE

Experiment Five was the penultimate stage of the iterative preliminary design process for the Smart Tray concept form. The experiment aimed to produce a full scale, detailed prototype in order to engage in participant based experience prototyping to ensure the designed output considers the impacts of technology on the domestic New Zealand dining experience. The intention of observing participant's interaction with the concept offers another iterative stage of informed development centred on overall scale and detail proportions of the Smart Tray's physical interface. It also acted as a final opportunity to interact with household participant types to ensure the concept reflects considerations brought to light in the initial case studies and to gauge its imagined usability in the future.

The experiment applied a number of methods including sketching of the form and design details. These sketches led to three iterative solutions via CAD renders before constructing a prototype from extruded polystyrene based on the most practical, ergonomic solution. It is worth noting that these iterative solutions all communicate a singular overall form while the iterations varied in the exploration of details in the treatment of the edge and surface finishing, as well as the form of the underside leg and fillet radius.

Through experience prototyping the case study participants found the polystyrene prototype to be slightly oversized, and this was consistent with participant negative commentary on the tray's "square" appearance and concern that it was too big to place on a table. This commentary allowed for refinement to the Smart Tray's scale and proportion and it was determined that the tray needed to incorporate a smaller dining zone that expressed a more rectangular, ergonomic proportion. These refinements were considered and then implemented within the final Smart Tray form.
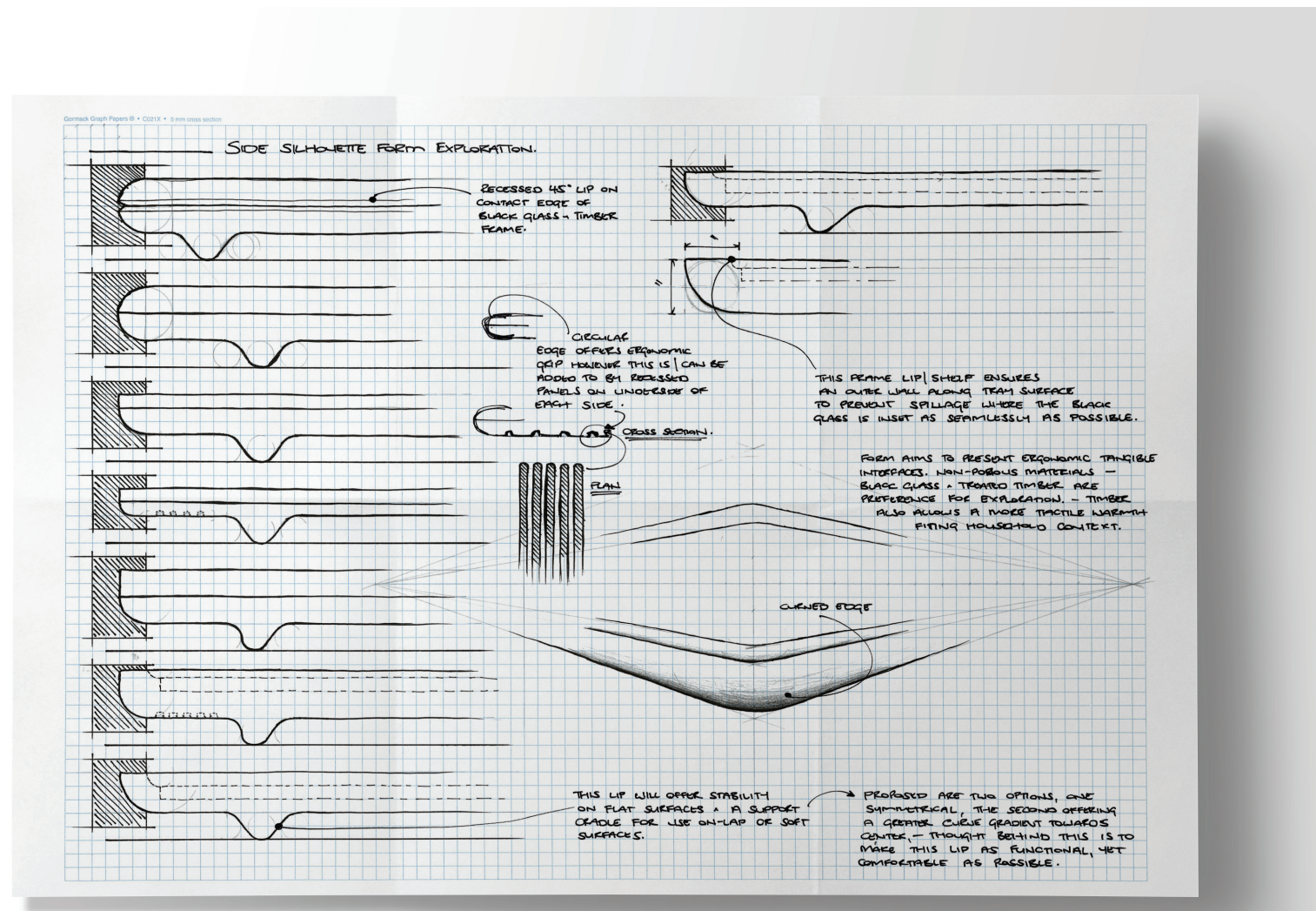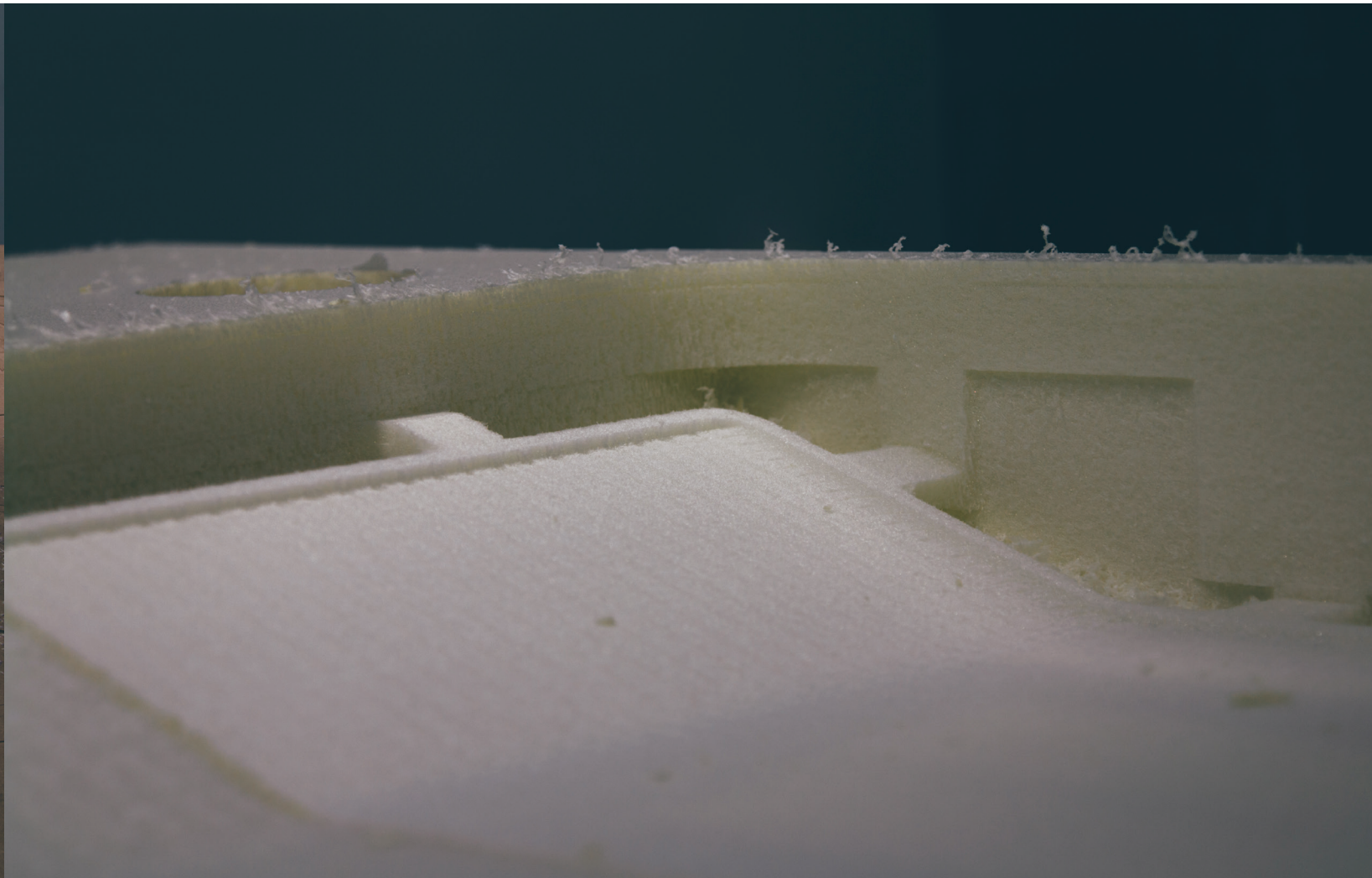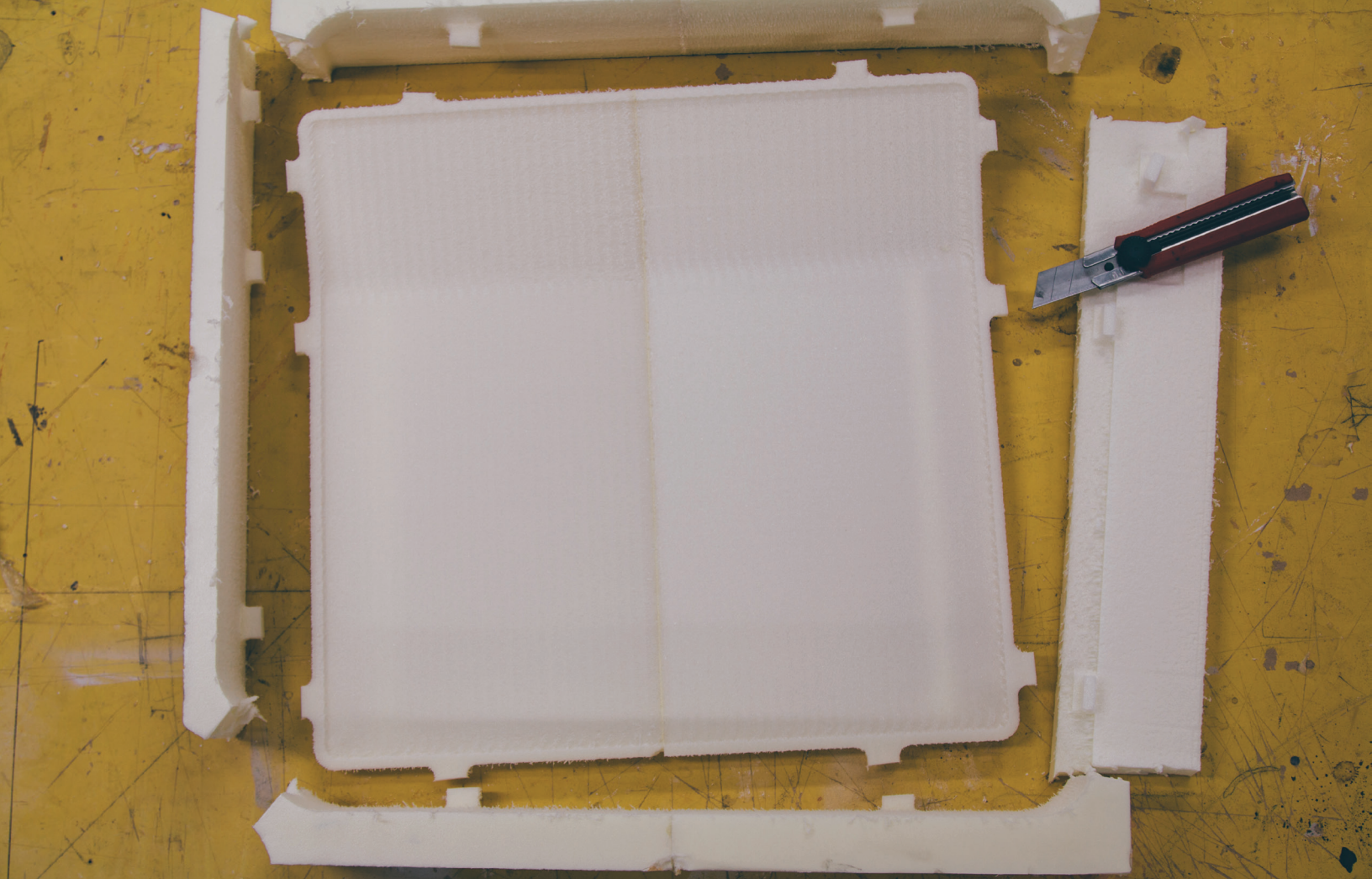
ABOVE: Figure 61. Final Smart Tray details; sketch 010.
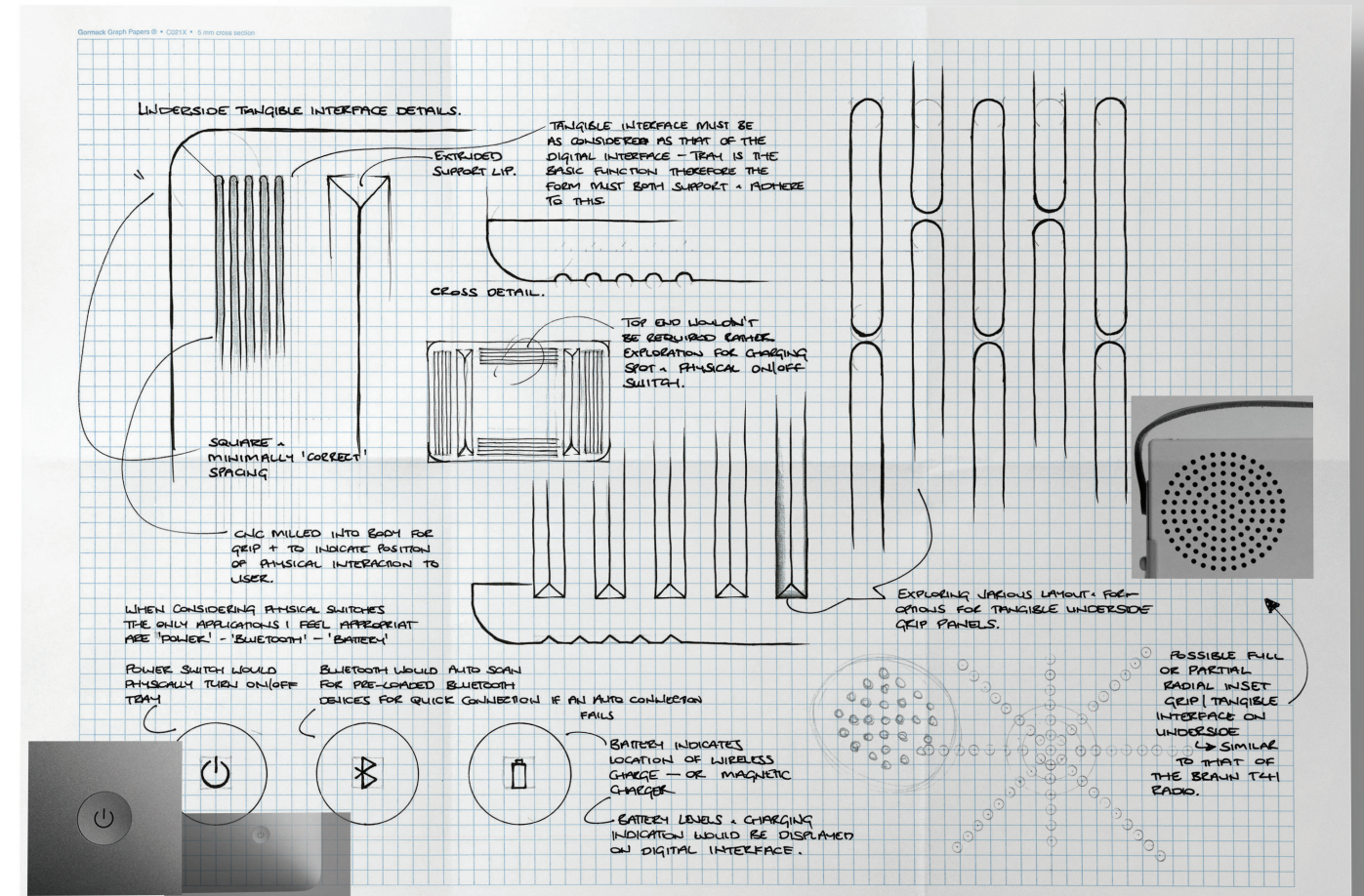
ABOVE: Figure 62. Final Smart Tray details; sketch 011.
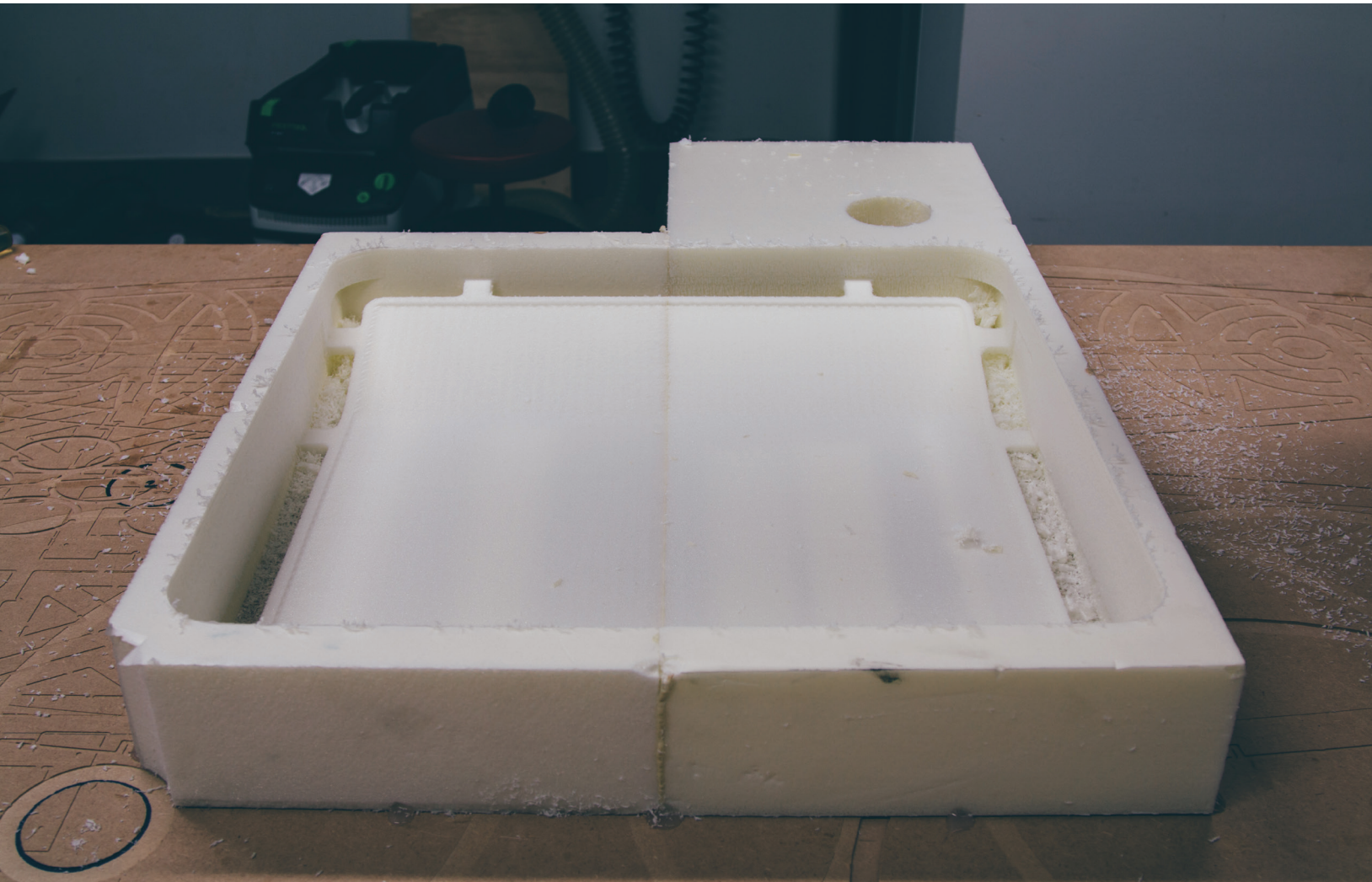
ABOVE: Figure 65. P001 being removed from tab body.

ABOVE: Figure 66. P001 underside physical interface detail.

ABOVE: Figure 67. P8 interacting with P001 during user testing.

ABOVE: Figure 68. P2 interacting with P001 during user testing.
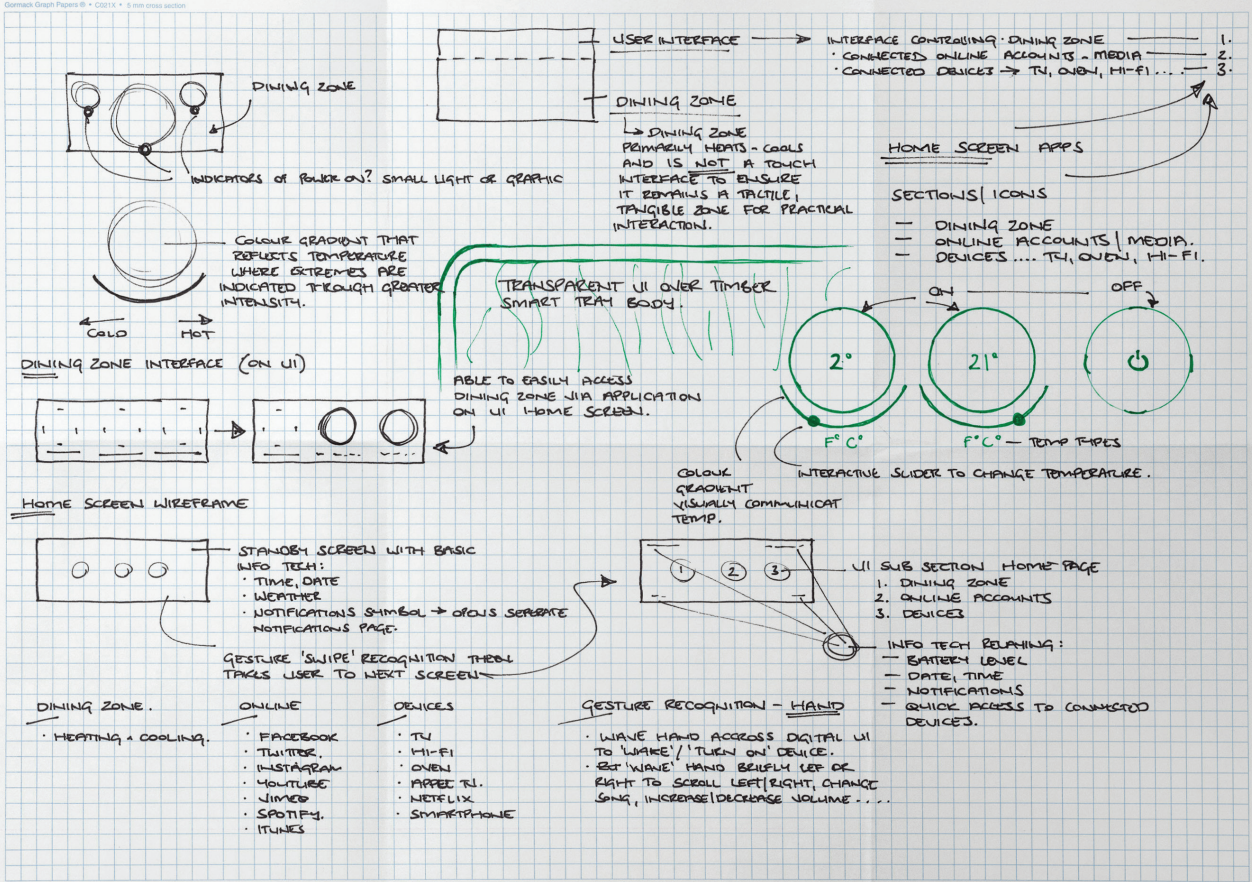
ABOVE: Figure 69. P2 interacting with P001 during user testing.

ABOVE: Figure 70. P2 interacting with P001 during user testing.
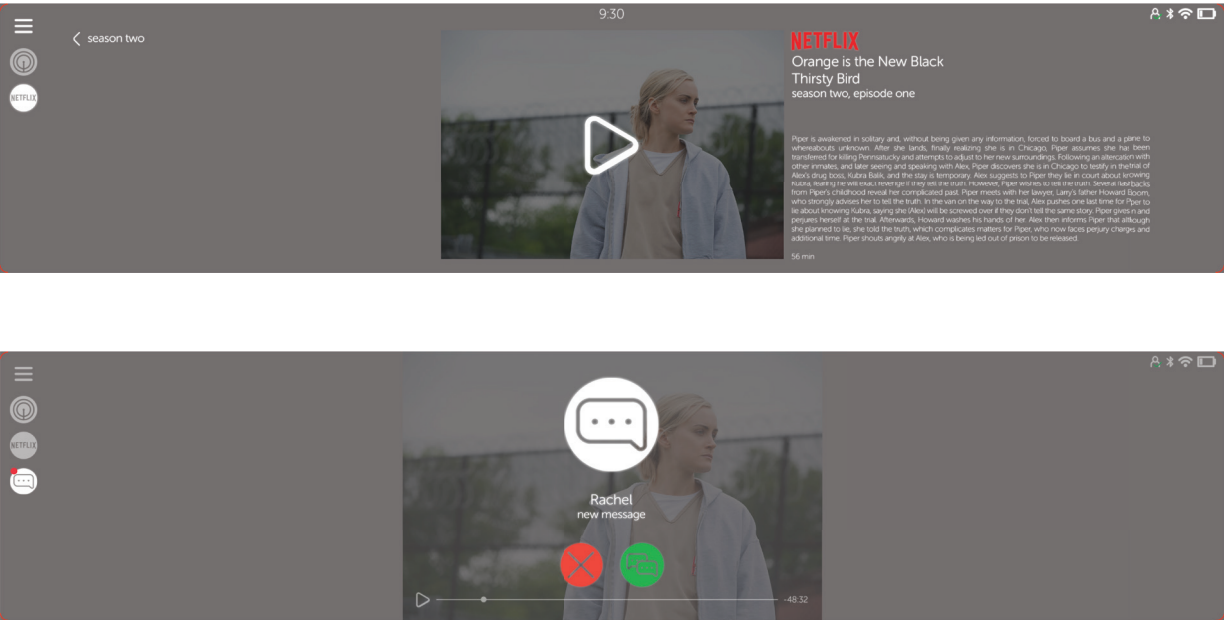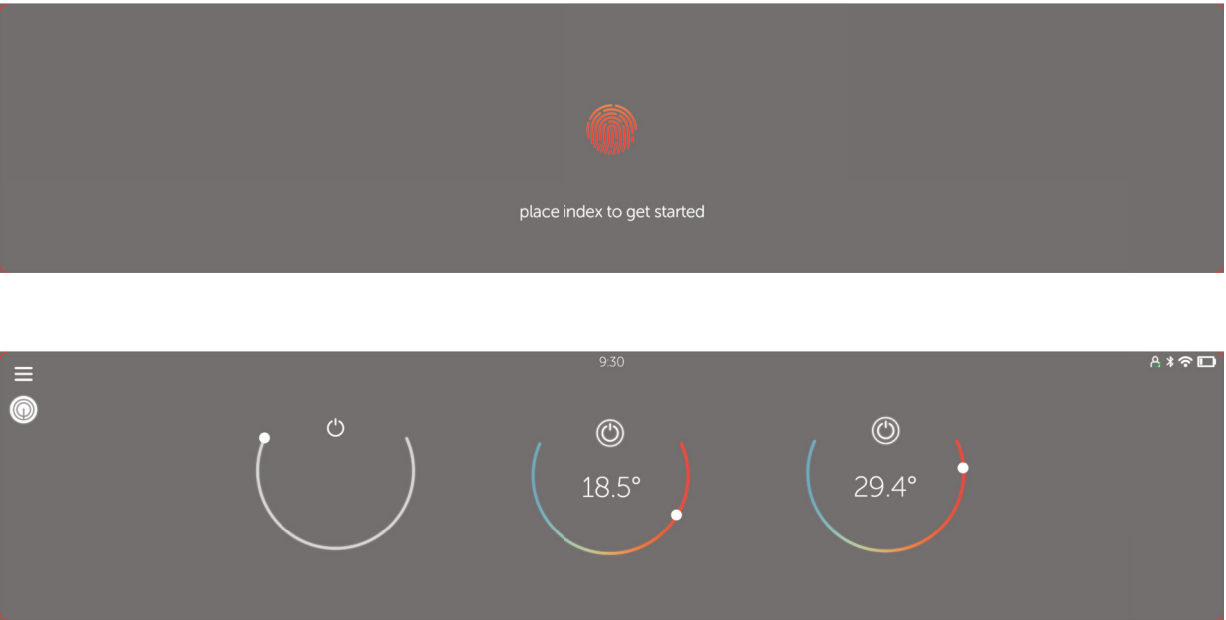
Experiment Six

DIGITAL USER INTERFACE

Experiment Six, although brief, began early in the conceptual stage before finalising the overall design experimentation explored within the research. This experiment utilised the concept sketching method in conceptualising the Smart Tray's digital interface. It was identified early in the research through literature and the case study series that digital technology was a critical element in producing designed solutions for the future dining experience. Therefore this experiment aimed to speculate the aesthetic qualities and basic function of a digital interface within a future dining design context.

Reflecting the research proposition in support of the ubiquitous application of digital technology within the future domestic dining experience, the conceptualisation explored seamless, minimal interface design emphasising the simplification of interaction to the degree that it is foreseeable in the not so distant future. The primary method engaged during this phase was concept sketching through which aesthetic treatments and wireframes were envisioned. The development of the interface design was directed to a large extent by literature and case study research, particularly in breaking down the various interface functions into three core 'zones': the first of these, the *dining zone*, collaborates (speculatively) with the Smart Tray's induction capability in allowing the user full temperature control of the tray's dining zone surface through the control panel on the digital interface. The second, the *onli3ne zone*, allows the user connectivity to their personal online accounts such as Facebook and Instagram, as well as online entertainment and news. The *device zone*, the last of these zones, allows a user wireless control of Bluetooth connected devices in the tray's proximity – from the oven in the kitchen, to the TV in the living space. The three core sections aim to collectively enhance the future Kiwi dining experience.

Experiment Six embodied an iterative design process resulting in the final iterations implementation within the final Smart Tray design solution. In devising a strategy to refine and present a speculative interface for the Smart Tray it was determined that experience prototyping would not take place at this stage for two reasons: to begin with, the design solution, while prototyped to full-scale, was unable to show a functional digital interface. Additionally, the digital interface aimed to provoke future possibilities for the application of digital technologies within the home, however user feedback on this point was not of substantial value to the development of the final design in relation to the research intentions.

place index to get started

18.5°

29.4°

season two

NETFLIX
Orange is the New Black
Thirsty Bird
season two, episode one

Rachel
new message

DESIGN SOLUTION

The Smart Tray represents the final design solution of this research in considering the impacts of technology on the New Zealand domestic dining experience. Seeking to meet the future needs and desires of Kiwi households the Smart Tray provides a portably adaptive appliance device utilising the fundamental human act of dining to speculatively bridge innovative kitchen appliance design, and digital technology design thinking as a means to advocate for greater ubiquitous application of pervasive technology within the future home.

1: Digital Interface Display
2: Dining Zone
3: Dining Zone Plates

ABOVE: Figure 80.

The Smart Tray presented in this thesis represents the final design solution of this research process. In seeking to meet the needs and desires of Kiwi households in the future, the design solution proposed here in the form of the Smart Tray provides a portable and adaptive appliance-device that is specifically suited to support New Zealander's increasingly technology-reliant lifestyles. The Smart Tray design satisfies a multitude of needs associated to the fundamental human act of contemporary dining in regards to digital connectivity, highly considered interaction design, and the application of pervasive technology. This design output speculates on ideas that capitalise on and perpetuate the use of pervasive technologies within the future home, and that have the potential to propel innovative kitchen appliance design today.

The literature reviews, case study findings, and user testing and feedback have guided the development of the Smart Tray and have provided substantial evidence that supports its validity as a potentially marketable product. In tying this final design back to the literature reviews conducted as part of this research, these elements acknowledge the kiwi culinary tradition and evolution of Kiwi domestic kitchen and living spaces from the early twentieth century. This design reflects a flexible dining opportunity affording the user complete control in where they choose to dine, whether on the sofa in front of TV or at a dining table.

The final Smart Tray expresses a minimal, elegant form that seamlessly integrates physical and digital interface elements. The physical interface encompasses the tray's side edges and underside elements, where filleted side edge details produce comfortable in-hand tactility for the user. The underside extruded cut details also act to enhance this tactility providing the user an edged surface with which to grasp the tray. In developing the tray's scale considerations have again been drawn from the research findings with particular emphasis on the evaluation of the extruded polystyrene Smart Tray prototype in Experiment Five. Feedback from this experiment centred on the tray's necessity to communicate a thin, light, rectangular proportion where the long edge runs parallel to the user allowing for the organisation of a traditional dining-ware layout; the dining zone is therefore defined by the space allocated to a central plateware position with two glassware positions slightly further from the user on both left and right-hand sides of the plateware. The final tray proportion is 480mm x 360mm

making the tray proportionally ergonomic for adaptive use, from its position on a user's lap to its placement on a dining table. Extruding 12mm from the bottom surface of the tray, two elongated 'feet' act to raise the tray slightly when placed on a flat surface in order to communicate and facilitate the tray's portability. The 'feet' also act as support guides when placed on a users lap, whereby the filleted surface edges allow a user's lap to nest with the bottom form of the tray. The far edge of the Smart Tray angles upwards by twenty degrees in order to provide the user a more ergonomic view of the digital interface display. This angled display surface visually acts to define the boundary between the dining zone and digital interface display zone.

In breaking down the compositional elements making up the Smart Tray, the materiality ascribed to the final design has been critical in emphasising the human-centred design attributes of this project. As an appliance-device it was evident that the Smart Tray would be required to express a sense of warmth and personal companionship in conjunction with qualities of functionality and durability. For this reason the Smart Tray's body is constructed from Beech, a timber commonly found in international furniture and kitchen utensil markets, as it is valued for its durability. This choice of material also acknowledges New Zealand's strong association to nature and agricultural wealth, with forestry representing one of the earliest industries in the nation's forming. The ability to merge technology with a traditional material such as wood was chosen intentionally as a way to integrate pervasive technologies within the future home while maintaining a connection to the familiar attributes found in traditional dining design.

The utilisation of future forecasting and a speculative design approach afforded the opportunity to push boundaries and suggest provocative treatments of the interactive display and components and pervasive technology applications. The proposal to introduce a transparent digital interface was an element incorporated in the Smart Tray's design relatively late in the final design process. This was ultimately applied because it was determined that the black glass interface introduced in a previous iteration appeared to emphasise a commonplace induction appliance product rather than a seamless digital interface-tray relationship. The transparent digital display also supports the intention of minimising the visual impact of digital interfaces through an effort to create seamless visual integration of all

components.

As stated in the section that explains the developments explored in *Experiment Six, Digital User Interface*, the speculative functionality of the digital interface can be split into three sub sections: dining zone, online zone, and device zone. The dining zone represents the heating and cooling areas on the tray's surface incorporating a centrally positioned area for single plateware, and two smaller glassware areas positioned slightly further from the user at both left and right-hand sides. This refined layout reflects contemporary Kiwi culinary traditions represented by all four case study households that embrace a singular dish meal structure. The only slight variation on this was observed in the Silent Generation household who admitted to sporadic use of a side dish associated with more traditional British meal structuring. The online connectivity zone utilises a wireless Bluetooth connection to the user's smart phone, in turn connecting the Smart Tray to their online accounts. As smart phones will inevitably continue to develop as a digital sidearm, the Smart Tray's online connectivity foresees acting as a digital utility device to enrich a user's dining experience. The device connectivity supported by the *device zone* will build on to the functionality offered by wireless Bluetooth connectivity as pervasive technology increasingly takes the form of tangible products and appliances. Pervasive technology is already found in many New Zealand homes, and in the foreseeable future all New Zealand homes will be able to control kitchen appliances such as the oven and fridge-freezer using this technology, as well as living space products that include the TV and hi-fi systems. The Smart Tray's wireless connection to a TV as part of the *device zone*, for example, would also allow the wireless connection to an online streaming platform such as Netflix, part of the *online zone*. In combining the three zones that make up the digital interface in this speculative product it is important to conclude

on the amalgamated reasoning that has shaped the interface aesthetic.

The Smart Tray's digital interface communicates its ubiquitous application through a minimal design approach. This approach presents a modernist, predominantly monochromatic colour scheme and layout in order to express elements of empathy and docility towards the user. Through this quiet aesthetic experience the Smart Tray seeks to incorporate pervasive technology within the dining experience, rather than vice versa. The interactional qualities of the Smart Tray have also been explored where gesture recognition and touch display elements have been incorporated into the final design solution. Gesture recognition can be considered a component of a perceptual user interface (PUI), effectively allowing a computing device to mathematically interpret human motion (Rouse, 2015). The Smart Tray proposes simple user gestures such as a full hand swipe across the digital interface display in order to turn the display off and on. The speculative application of perceptual user interface technology acts to enhance the tray's interactional qualities through non-touch navigation of the digital interface display. Alongside more common touchscreen capabilities, gesture recognition provides the user with an ergonomic digital interface display.

Photography has also been an important element in presenting the Smart Tray's physical and digital attributes alongside contextual use to emphasise a human-centred design solution. The contextual photography follows a model user throughout a typical day according to their dining experience. Presented in an overhead view to humanise the tray's interactive qualities, breakfast, lunch, and dinner contexts are explored through various physical and digital Smart Tray interactions in order to best convey the tray visually.

1: Tangible Interface Detailing
2: Leg Supports

ABOVE: Figure 79.

This context image, as the first of a contextual narrative, explores the Smart Tray's gesture recognition speculative capabilities where the user has woken, prepared breakfast and is now interacting with the tray. Gesturing through a full-hand wave across the interface display the user will unlock the display and its functional capabilities as the first stage of interaction.

LEFT: Figure 81. Smart Tray gesture recognition context.

Once the user has unlocked the device they have decided to touch the list button, part of the tray's touch screen digital display. When activated this button in displays all applications set horizontally in sub sections from bottom: dining zone, online zone, and device zone. Alternatively when touched again the list button will then conceal the applications and return to the previous standby screen.

RIGHT: Figure 82. Smart Tray home screen context.

Using the tray to eat breakfast in bed, the user has now opened the dining zone application, turning both centre and right dining zone plates on. The user has set the plates to the desired temperature, heating both their avocado toast and filtered coffee. In addition to the digital display graphics indicating a plate's activation and temperature set, the physical dining zone plate will also begin to illuminate softly.

LEFT: Figure 83. Smart Tray breakfast dining zone context.

Now that the dining zone plates are keeping the user's breakfast warm, they have decided to watch some TV in bed. The user has touched the list button and selected the Netflix application, bringing up a TV show of interest. The applications activation is evident via the sidebar situated directly below the list button where the dining zone application can be seen slightly dimmed to communicate its background use.
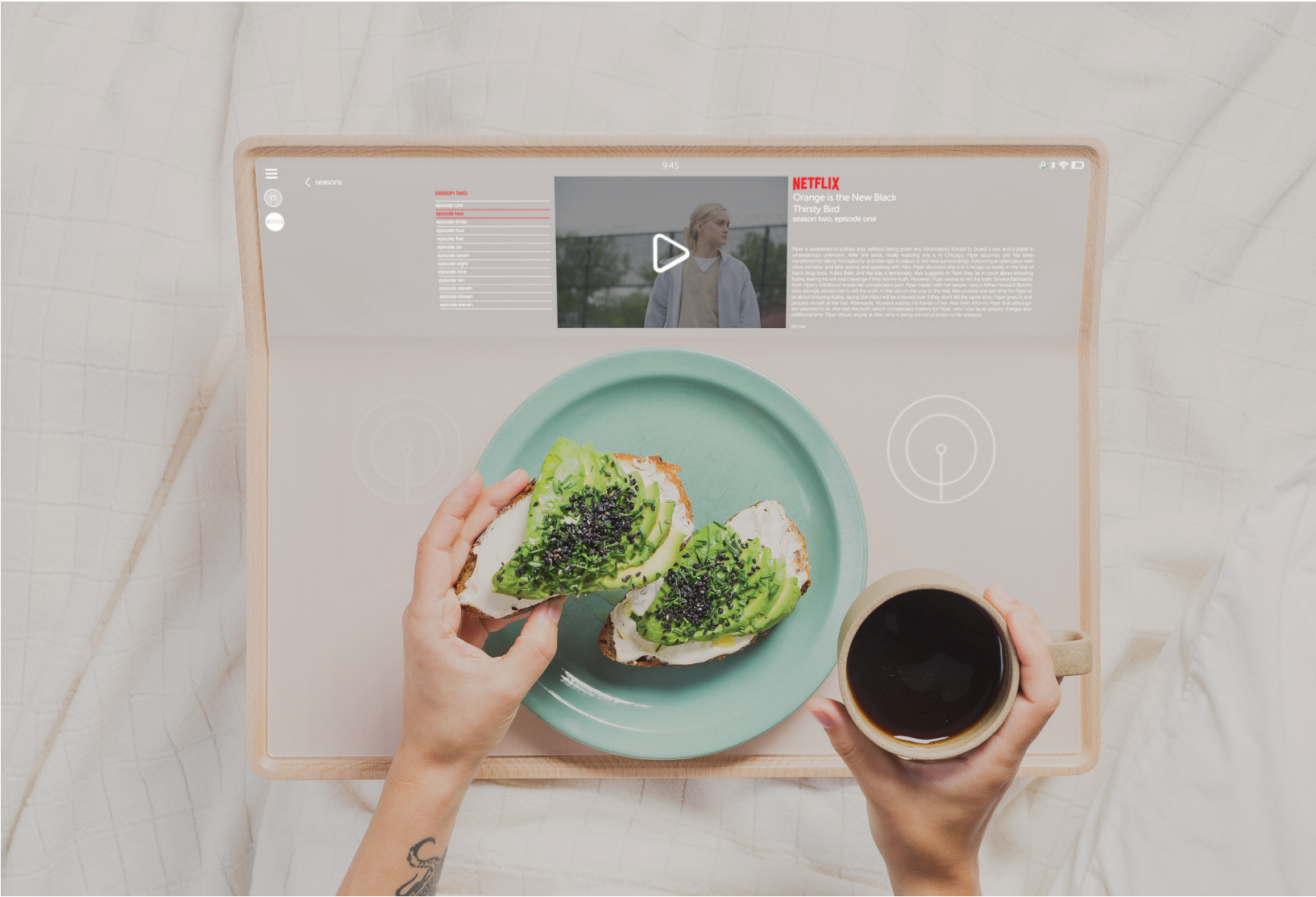
RIGHT: Figure 84. Smart Tray breakfast online zone context.

Because the user's smartphone is connected to the tray, a new message from a friend is promptly displayed on the tray's digital display, and overlaid over any other active application in allowing the user instant online connectivity. The message application can be seen in the sidebar with a small notification signal, which will continue to be displayed until the message is read.

LEFT: Figure 85. Smart Tray breakfast device zone context.

For lunch the user has prepared some mussels and a glass of beer. Eating from the tray the user has again opened the dining zone application and begun to set the applicable dining zone plates' temperature. In this case the user has preferred a cooler temperature set.

RIGHT: Figure 86. Smart Tray lunch dining zone context.

Now that the user can enjoy their meal at a regulated temperature, they have opened Instagram as part of the online applications connected to their smartphone. The sidebar indicates that applications from breakfast earlier that morning are still open and can also be instantly opened if needed, where pressing on any application for three seconds will prompt the option to close it, removing it from the sidebar.

LEFT: Figure 87. Smart Tray lunch online zone context.

While eating their lunch the user has opted to play some music, connecting to the music device application and selecting to link it to an online music streaming application, in this instance Spotify. The user has also selected their hi-fi system from a selection of available devices connected to the tray and the user's smartphone.

RIGHT: Figure 88. Smart Tray lunch device zone context.

For dinner the user has prepared a serving of lamb with a glass of red wine, again interacting with the dining zone application in order to regulate the temperature of their meal throughout the night. The active dining zone application can be seen in the sidebar with all other background applications dimmed below.

LEFT: Figure 89. Smart Tray dinner dining zone context.

The user has served their dinner around the viewing of a rugby game on TV, where they have opened the TV device application. Linking it to their SKY online application the user can select the applicable rugby game and watch it on their connected TV all from the Smart Tray.

RIGHT: Figure 90. Smart Tray dinner device zone context.

During dinner with the Smart Tray the user has received a Facebook Messenger chat from a friend. Through the connection to the user's smartphone and online accounts, including Facebook, the user has been able to open the application and reply, organising a coffee the next morning. Meanwhile, the connected TV and SKY applications continue to run in the background.

LEFT: Figure 91. Smart Tray dinner online zone context.

ABOVE: Figure 92. Smart Tray detail.

ABOVE: Figure 93. Smart Tray detail.

The Smart Tray is a design solution that meets the needs and desires of future Kiwi households. Although this research is contextualised within New Zealand, the general research outcomes are applicable to a wide market. The output produced as a result of this research, including the exegesis and design of the final Smart Tray, is intended to offer a valuable critical perspective and viable future design solution that will aid in furthering the professional field of dining design.

This research project has been completed to the highest level possible within the restraints of the resources and timeframe afforded. That being said, the opportunity to critically reflect on the entirety of the project has allowed the opportunity to consider possible ways to extend and further explore this research topic. While the case study research has provided numerous successful elements in the Smart Tray's development, the case study research would potentially benefit from the inclusion of more case study participants spread evenly across all four generations. The utilisation of a larger participant pool could have offered greater insight into contemporary elements of meal preparation as

well as dining and tech etiquette behaviours, and this would further validate the research finding and related design outputs.

The future forecasting and speculative approaches incorporated within this research-led design project have offered a unique perspective and point of departure in designing for the future within appliance design, dining design, and technology design sectors. In proposing the Smart Tray as a speculative design solution, the tray contributes to academic commentary within the fields of both design and sociology. It is particularly surprising, therefore, that the outputs developed in this research have such a great potential for product development within commercial design sectors. In the immediate sense this research hopes to engage the reader and to provoke thought about the future of design. The future forecasting and speculative design approaches utilised in proposing the Smart Tray aim to capture the imagination of the reader, allowing them a precedent with which to construct their own thoughts and conclusions for how the future Kiwi dining experience and integration of pervasive digital technologies may evolve.

ABOVE: Figure 94. Smart Tray detail.

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FIGURES

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