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# The 3Ps: Protection, Productivity & Pleasure

for Australian smart home early  
adopters

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# 1. Introduction

Intel Corporation is an American multinational technology company, and one of the world's largest semiconductor chip makers. Over a number of decades the company has drawn on social science and ethnographic research to inform product direction and innovation. This project is an academic-industry partnership between Intel and RMIT University to provide insight into the lived experiences of the smart home.

RMIT University is a global university of technology, design and enterprise located in Australia, south-east Asia and Europe. The Beyond Behaviour Change (BBC) research program at the Centre for Urban Research (CUR) specialises in ethnographic research on household consumption practices. The group provides expert social analysis to inform development of new technologies and related policies. The BBC research program collaborates closely with RMIT's Digital Ethnography Research Centre (DERC), which investigates how people experience the digital in everyday life.

Over the past 3 years (2015-18) RMIT researchers have conducted a sociological study on the expectations for, and adoption of, smart home technologies in Australian households, funded by the Australian Research Council (ARC).

The 'Automating the Smart Home' ARC project involved:

- A qualitative content analysis of over 200 international smart home articles and marketing materials to explore industry visions for the smart home.
- Household ethnography including interviews, home tours and photography with 31 households who have adopted smart home and home automation technologies.
- In-depth interviews with 14 smart home industry professionals.

Based on this research, Intel commissioned RMIT to conduct an analysis of the household ethnographic dataset on the three concepts that are central to their ambient computing vision for the home: protection, productivity and pleasure (the 3Ps). The intention was to explore these concepts in different regional settings (e.g. Australia) and technology ecosystems.

## The project objectives were to:

- Conduct a targeted analysis of the existing ARC 'Automating the Smart Home' household dataset to understand how the themes of protection, productivity, and pleasure are understood and experienced by Australian smart home early adopters.
- Prepare and communicate Intel-relevant ethnographic insights from this analysis to the corporation and its designers, developers and marketers.

The remainder of this report is organised as follows. **Section 2** outlines relevant background information, including more detail on the Australian household research, information on the research participants, and relevant information on Australian housing and households.

**Section 3** provides an overview of the themes that emerged from this research in relation to each of the 3Ps and 12 household case studies drawn from the research to provide contrasting insights on how Australian households understand, experience and desire protection, productivity and pleasure in the smart home. These are provided in three sections, each representing a different 'P'.

**Section 4** summarises key insights and future opportunities for Intel Corporation in relation to its 3P vision.

# 2. Background

## 2.1 Methodology

Digital ethnography is a research methodology that provides in-depth insights into how people experience the digital in their everyday lives. It typically involves in situ research with participants, through observations, conversations and reflections. It also commonly involves digital methods to explore and gather insights in collaboration with participants (Nansen et al. 2016; Pink et al. 2016). It is not meant to be representative, but rather to provide complexity and richness on a particular issue or research question that would otherwise be difficult to gain through other approaches.

In this study, digital ethnography enabled the research team to explore how Australian householders are incorporating smart home technologies into their everyday lives and practices.

Given there is continuing fluidity about what a smart home constitutes (Darby 2017; Gram-Hanssen & Darby 2018), the research team also adopted a broad definition of this term, inviting anyone living with automation technologies and smart appliances, or self-identifying as living in a 'smart home', to participate in the study. Our only other selection criterion was that the household include at least one adult (over 18 years of age).

Households were recruited to the project through technology forums and events, a project website, social media, radio and print articles, advertisements, referrals from smart home industry professionals, and personal and professional networks.

Households were offered an AU\$50 supermarket gift voucher to participate in the research and thank them for their involvement.

The household ethnography involved three methods undertaken in participants' homes where possible:

1. Semi-structured, conversational interviews with all available members of the household, supplemented by observations;
2. Participant-directed home technology tours (following Blythe & Monk 2002); and
3. Digital photographs (taken by researchers) during the home tours.

Site visits took 1–2.5 hours and were conducted by one or two researchers (Yolande Strengers and/or Larissa Nicholls), audio recorded and professionally transcribed for analysis. The total dataset consists of 31 households and the interviews involved 42 people.

This project has ethics approval from RMIT University's Human Ethics Committee and all analysis and communication of results are provided in accordance with RMIT's ethical policies and procedures. Specifically, only analysed and de-identified data are reported here.

## 2.2 Analysis

The research team thematically analysed the dataset in NVivo qualitative software to identify:

- Householders' understandings and experiences of protection, productivity, and pleasure in relation to their smart home or specific smart home technologies;
- Other relevant understandings and experiences about the smart home that are not captured by the 3Ps;
- How the 3Ps relate to households who are using a voice-activated digital home assistant (e.g. Google Home and/or Amazon Echo 'Alexa').

Following this analysis, the research team identified contrasting perspectives or variations on the 3Ps in order to select

exemplary case studies as presented in this report. In some instances these cases reflect broader trends in the sample; however others are more isolated examples selected for their unique perspective on each of the Ps.

While the findings cannot be generalised, they do present opportunities for new and emerging desires for smart home technologies in Australian and other similar advanced economies. They also point towards ways in which householders are incorporating smart home technologies into their everyday practices that are likely to resonate more widely.

## 2.3 About the households

Most participants lived as a heterosexual couple (23 households had children living with them). In eleven of these households, children contributed to the interviews and tours on occasion. Two sole adult households also participated, as well as three single parent household and two men living together in a share house/ flat.

Most households lived in Melbourne (14), with the remainder from Sydney (7), Adelaide (5), Canberra (3), Darwin (1) and regional Victoria (1). Participants were mostly aged between 45–54 years (20) or 35–44 years (15), which likely reflects the demographic interested in and able to afford smart home technologies.

The sample was skewed towards male (25) versus female (17) participants, which is similar to other research on the smart home. Furthermore, it was mostly men who volunteered to participate in the research and instigated bringing smart home technologies into their households.

Where disclosed (24), most households had high incomes of AU\$104,100–\$156,000<sup>1</sup> (9) or more than AU\$156,000<sup>2</sup> (12). Nearly all were highly educated (Bachelor's degree or higher), most identified their cultural background as Australian or European, and most owned their own home.

Participants' houses were typically detached dwellings and located in suburban areas. Some were substantially larger than the Australian average, others were average or small-sized homes. About one half of dwellings were built with smart technologies integrated during construction, while the other half had smart technologies retrofitted or introduced at a later stage.

The number and type of smart devices in participant households was diverse (see Table 1) ranging from one smart device (e.g. robotic vacuum cleaner) through to fully integrated and professionally installed smart homes with a range of connected devices and appliances providing lighting, entertainment, security, comfort, energy management and garden irrigation. Ten households also had solar panels for hot water or electricity generation.

A full audit of smart home products and brands was not undertaken by the research team for each household. This was because the intention was to consider householders' expectations for smart home technologies and their experiences with integrating a wide range of potential devices into their everyday practices, rather than assessing or evaluating particular products and brands.

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<sup>1</sup> Approximately US\$77,500–\$116,000

<sup>2</sup> More than approximately US\$116,000

**Table 1: Summary of participant households**

#	Name (gender)	Adults (children)	Occupation	Age	Smart products & devices
H1	Tony (M)	1	Academic	45-54	Philips Hue lights, entertainment system, automated security camera, windows
H2	Floyd (M)	2 (2)	IT	45-54	Google Home, Google Mini, air conditioning, heating, beer fridge, one light
H3	Kirra (F)	2 (3)	Carer	45-54	C-Bus, Clipsal Wiser™, Aquatrip, temperature monitors, movement sensors, light sensors, door alerts, lighting, video security entrance
H4	Angela (F)	1 (2)	Community manager	35-44	Google Home, LIFX smart lights, solar power monitor, locks, robot vacuum cleaner, digital assistant bot, electric car
H5	Lindy (F), Johnno (M)	2 (2)	Education support / electrician	35-54	Weather station, sensors (temperature, water & motion), monitors, windows, fans, alarm system
H6	Rachel (F)	1	Unable to work; disability advocate	35-44	Philips Hue lighting, Belkin WeMo® switch, keypad door entry & intercom, remote air conditioning, assistive technologies
H7	Ken (M), April (F)	2 (2)	Marketing / Sales (IT)	35-44	Amazon Echo 'Alexa', Google Home, VERA™, Nanoleaf lights, Clipsal lights, Z-Wave lamps and door locks, entertainmen
H8	Kristi (F), Bill (M)	2 (1)	Feng Shui & teaching / Management	45-54	Amazon Echo 'Alexa', Control 4 system, Samsung robot vacuum cleaner, lighting, blinds, doors, windows, pool, fans, wall, home cinema, entertainment, security system
H9	Scott (M), Lauren (F)	2 (3)	Engineer / Radiographer	45-54	Amazon Echo 'Alexa', KNX system, air conditioning, lighting, heating, weather station
H10	David (M)	2 (2)	Project manager	45-54	C-Bus, lights, security, blinds, water features, Sonos music, CCTV, PBX phone system, home theatre, distributed thermostats
H11	Gabriel (M)	2 (3)	Systems architect	35-44	Google Home (x2), Node-RED (openHAB) & MQTT software, Z-Wave network, Arduino pool heating & PH, sensors (movement, temperature & humidity), LIFX & Clipsal lights, air conditioners, heating, proximity entry cards, garage door, home theatre
H12	Kurt (M), Graham (M)	2	Economist / Planner (technical)	25-34	LIFX coloured lights, music, Apple TV, WiFi enabled scales
H13	Kahlil (M)	2	IT (software)	35-44	LG Roboking vacuum cleaner
H14	Jerry (M)	2	Electronics/ management/finance	55-64	VERA, lights, doors, TV, music, solar PV monitoring, internal temperature sensors and external sensors linked to sound system (can notify of cool change), phone - integrated with TV sound, security cameras (Paradox system), LED strip lighting for caller ID, thermal camera
H15	Cara	2 (2)	Homemaker	45-54	Keypad entry, security cameras, blinds, music, heating & cooling, lighting, windows, pool
H16	Kate (F), Gavin (M)	2 (2)	Homemaker / Teacher	45-54	Control4, Dynalite lighting system & temperature monitors, doors, security cameras, Actron air conditioners, skylights, blinds, fans, TV, music, Mobotix keypad entry (security & safety for care access), media station integrated with lights & blinds, assistive technologies - hoist for bed access, switches & panels set at wheelchair height, pool access, heating & cover
H17	Darren	2 (1)	Business owner (arcade games)	45-54	KNX system, lights, front door, garage door, security cameras, heating, air conditioning, temperature & motion sensors, home theatre

#	Name (gender)	Adults (children)	Occupation	Age	Smart products & devices
H18	Trent	2 (1 -adult)	Bricklayer/builder	45-54	C-Bus, Wiser control system, coloured lights, heating, air conditioners, video security system, front gate, entry door, pool, theatre room, music, solar PV monitor, outdoor water feature
H19	Ted (M), Jess (F)	2	Software developer / PhD student	34-44	iRobot Roomba, WiFi enabled scales, WiFi connected speakers, smart meter monitor
H20	Tara (F), Matt (M)	2 (2)	PhD student / Academic	45-54	iRobot Roomba, WiFi connected speakers
H21	Larry	2 (1 -adult)	Real estate agent	55-64	Lights, air conditioners, heating, garage doors, security system, sprinklers, weather station, music
H22	Romy (F)	1 (1)	Physiotherapist	25-34	Eve phone interface, lights, air-conditioners, heating, blinds, home theatre, garage doors, front & back gates, front door, music, video security/entry system, motion activated lights, Z-Wave temperature sensors
H23	Demi (F)	2 (2)	Teacher	25-34	Lights, air conditioners, heating, blinds, garage doors, music, irrigation system, motion activated lights, video security system
H24	Valerie (F)	2 (2)	PhD student	45-54	Samsung Navibot vacuum cleaner
H25	Adam (M)	2	IT	35-44	Philips Hue lighting, video security system, music system (Sonos), video entry door, occupation activated lights, theatre room, energy monitor
H26	Morris	1 (2)	IT	35-44	Logitech hub, Google Home, Amazon Echo Dot (x2), geofenced outdoor lighting, Belkin WeMo lights, garage door, blinds, air conditioning, music, TV, Chromecast, iRobot Roomba
H27	Pablo (M), Noni (F)	2 (2)	Ethical investment research / Public servant (water delivery)	35-44	Heating & cooling (through SkyFi), solar PV monitor (Sunny Portal), Samsung robot vacuum cleaner
H28	Saul (M)	2 (2)	IT (education)	25-34	LAN control system, temperature sensors, security camera, IP camera, heating, air conditioning, power meters & data monitoring (Node-RED & Grafana), solar PV monitor, energy management (Rainforest Automation)
H29	Marliyn (F), Eli (M)	2 (1)	Clinical psychologist / Engineer	45-54	Temperature sensors, pool temperature monitor, solar PV monitor, energy meter
H30	Mahesh (M), Manju (F)	2 (2)	Urban designer / Academic	35-44	VERA, Z-Wave system, Amazon Echo 'Alexa', Synology digital management system (or NAS - Network-attached storage), lighting, music, motion activated lights, security door sensors, geofence activated security system, six-in-one sensor (motion, temperature, light, lux levels, humidity, UV)
H31	Lung (M)	2 (2)	Sales (supplements)	45-54	Lights, air conditioning, TV, music, security cameras, front door (fingerprint, keypad, card or key), home theatre, robot vacuum cleaner, High-Key lighting control, Sonos audio control

*Shading is used to highlight households selected as case studies for this report. All household names are pseudonyms.*



## 2.4 Pathways to adoption

The participating households were mostly early adopters of smart home technologies or self-identified technology enthusiasts. Most households had a least one adult who worked in a related technology or engineering field, and were passionate about smart devices and emerging technologies. A few households were directly employed in the smart home technology sector.

Self-initiating early adopters of smart homes wanted to be at the cutting edge of new technology, often buying products from the US in advance of their release in Australia. Some men in particular considered smart home technology a hobby, and commonly identified as being 'gadget people' (Strengers & Nicholls 2018). Others commented that they had installed smart home systems when building a new house in order to 'modernise' their home.

Several households had installed smart home technologies specifically to assist household members with disability. A small number of households were also primarily interested in adopting smart home technologies to improve their house's energy performance.

Those who had acquired an individual smart home appliance or device (e.g. Google Home or robotic vacuum cleaner) talked about being persuaded by their social networks or through marketing and media. They were typically keen to try and make everyday household chores easier and more convenient.

## 2.5 Background to Australian housing and households

These insights are drawn from a variety of industry sources, media reports, and the research team's own extensive knowledge of housing and technology adoption in Australia.

### Housing

- Detached homes are the main form of housing in Australia: out of ~ 8 million dwellings, ~73% are detached houses.
- Australian homes are the second biggest in the world (behind the US): average 233m<sup>2</sup> for detached homes; 190m<sup>2</sup> overall (including apartments).<sup>3</sup>
- The average household has 2.6 occupants.
- Apartments are growing in popularity and comprise almost half of new homes constructed.
- 65% of homes are privately owned.
- Housing is expensive (average home costs ~US\$520,000), frequent upgrading/ renovation to increase value is common.
- Minimal furnishing style is widely popular (Scandinavian-influence).
- High levels of foreign investment in housing, particularly from China.
- Due to the high costs of housing in major cities, many younger people anticipate renting throughout their lives.
- Renters' ability to make changes to the home are very restricted but younger, high-income renters likely to be interested in self-installable and transportable smart home technologies (e.g. 'off-the-shelf' or 'plug-and-play' devices).

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<sup>3</sup>Approximately 765 square feet for detached homes, and 620 square feet overall (including apartments)

## Wealth and diversity

- Household wealth is typically high: 16% of households earn over US\$2,200 per week (average is ~US\$1,100 per week).
- High levels of university-educated households, but significant household wealth has also been generated through the housing market and mining – people working in construction and trades (including traditional ‘working class’) are likely to be significant users of smart home technology in the future.
- Economic and lifestyle opportunities in Australia attract immigration: a third of the population was born overseas – England, China, New Zealand, and India most commonly.
- Languages other than English are spoken in >20% of homes: Mandarin, Arabic, Cantonese, Vietnamese, and Italian are most common.
- The population is ageing; the number of people aged 65 and over is projected to more than double by 2057. The majority of people over 65 live in their own home.

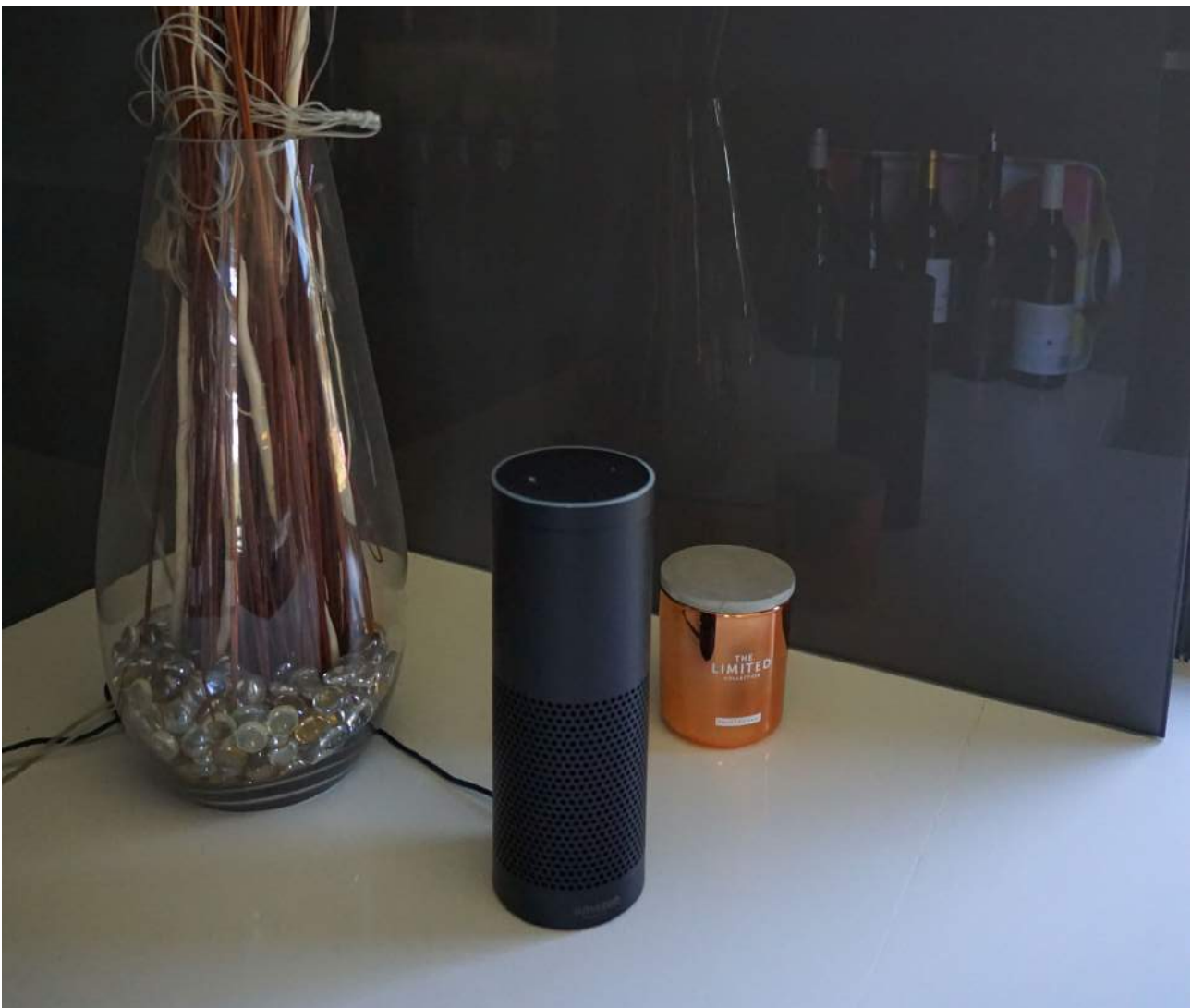
## Technology adoption

- A high proportion of Australians embrace and experiment with new digital technologies, including wearables and smart home technologies.
- Australia has poor internet speeds (55th fastest in world) and reliability; internet services are expensive compared to most other countries.
- Older people (over ~55) are less likely to use smart home technologies or have an internet connection at home.
- Some technologies reach the Australian market later than other countries, or overseas versions are purchased by keen early adopters (before adapted to local time zone, weather, etc.).
- On-demand or same-day delivery shopping is non-viable for many households due to the country’s geographically dispersed population.
- Amazon is not yet dominant in Australia and recent government taxation developments led to Amazon’s decision not to ship overseas purchases to Australia.



## Culture, comfort and energy

- Many households still follow traditional gender roles with women mainly responsible for home duties and men predominantly responsible for longer term financial planning/ investment for the household.
- Australia's large land mass crosses multiple climate zones. Households experience a wide variety of weather patterns depending on where they live.
- Heat and cold (thermal comfort) are both major housing issues due to diverse climates.
- Households in the southern states tend to use heating and air conditioning sporadically. Full climate control is uncommon, which explains the relative low market for smart thermostats.
- Australia's energy prices have risen sharply over the last decade, and now exceed those in comparable advanced economies.
- Energy costs are a key concern for households. Household defaults on bill debts, hardship program reliance, and involuntary disconnections are increasing as a result of high prices.



# 3. The 3Ps

In this section we identify how Australian households in this study understood and experienced the 3Ps (protection, productivity and pleasure). We provide the following for each P:

- Word clouds from the interview transcripts, which give a snapshot of the key terms and concepts participants used when discussing each P;
- A brief summary of the key themes that emerged from the analysis concerning each P; and
- Four case studies selected from the household dataset to exemplify contrasting and complementary perspectives of each P (see Table 2). While each case study emphasises each households' perspective on one P, there is considerable overlap and discussion between the 3Ps amongst these cases.

Participant quotes are verbatim and may contain small typographical errors. Ellipsis points (...) within quotes indicate breaks in the conversation. Square brackets inside quotations provide clarifying text where the meaning is unclear. Pseudonyms are used throughout.

Case study photographs were taken by the research team at the participating households' homes. Identifying features (e.g. faces) are not shown unless explicitly permitted by participants.

**Table 2: Case studies of the 3Ps**


<b>Protection</b>		
1	Tony	'Peace of mind'
2	Floyd & partner (not interviewed)	'Security is a dead-set real problem'
3	Kirra & partner (not interviewed)	'Real OH&S issues'
4	David & partner (not interviewed)	'I've been known to spy on the children'
<b>Productivity</b>		
5	Angela	'A better way to keep organised'
6	Lindy & Johnno	'It's a common sense house'
7	Rachel	'For people with disabilities, smart home stuff is absolutely brilliant'
8	Gabriel & partner (not interviewed)	'It's largely set and forget'
<b>Pleasure</b>		
9	Ken & April	'Show-off factor'
10	Kristi & Bill	'The resort'
11	Lauren & Scott	'He's addicted'
12	Kurt & Graham	'The house welcomes you'



# Tony

## 'Peace of mind'


### Household

-  Academic
-  45-54
-  Melbourne
-  AU\$104,100-156,000

**FF**

If someone does burgle it, you've got the guy on video and you can show it to the police, that's one thing, but the most important thing was the peace of mind.

— Tony




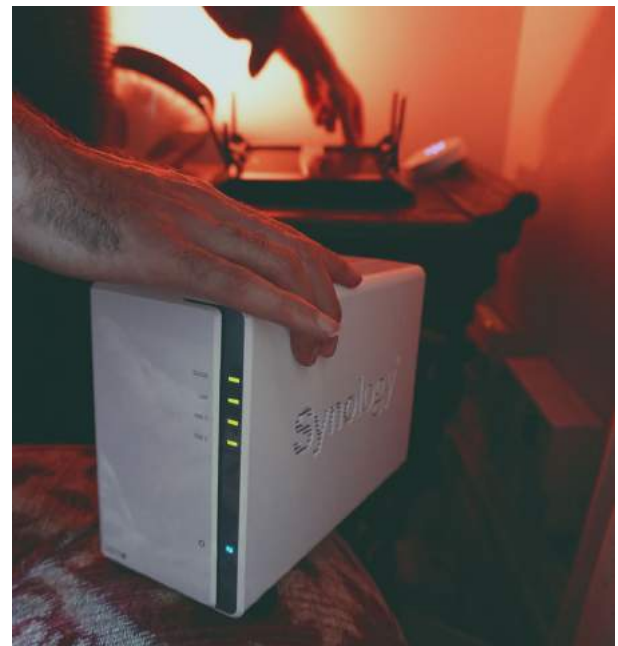

### Products & Devices

- Philips Hue lighting
- Media server (Synology) plus Plex
- Apple Smart Home protocols
- Front security camera – networked to a phone/computer app (brand unknown)

**FF**

The key benefit of [the lighting system] was when I set up or activated...but very easily, it's a one-minute program to set up...for when I go away.

— Tony

### Protection Priorities

- Security camera reduces risk of the home being targeted by burglars when travelling
- Notification and video capture of any unusual disturbance around the property provides peace of mind
- Mature technology that is 'stable' and has been on the market for a few years provides 'a bit of trust', even if it's not the cheapest product available

## Household Description

Tony lives alone in an affluent inner-city Melbourne suburb and travels a lot for work. Security of his property is therefore his main priority. A camera by the front door alerts him via text message and email when it detects any movement. A minute or two of video is also uploaded to the Cloud, which he can access from anywhere. He says, 'for me, being away...that's one of the few apps on that phone that I allow notifications to come through', but only if he is going away overnight or for a longer trip. Automated lighting is also part of Tony's security system. He has Hue lights set to come on regularly in the evening when he's away, and also varies the days and randomises the times by plus or minus 20 minutes. He feels this allows him to more closely mimic an occupied house, although he's not sure whether that acts as a deterrent. He says, 'a smart burglar would also know that this is what people are doing, so it's just reducing risk'. Tony acknowledges that being away a lot means he's 'always going to be vulnerable' but the notifications at least give him 'peace of mind'.

## Pressure Points

- Tony finds repeated iterations of software upgrades 'just frustrating to go through'.
- Cost is an important consideration for Tony in implementing further security features, such as automated blinds or curtains that can be randomised while he's away (similar to his lighting).
- Tony has smart 'stuff' sitting unused in cupboards because 'it's just too difficult to use'.
- Inflexibility in moving bulbs to different lamps/rooms without having to 'break the system down again, and then set it all back up again' is very 'irritating' for Tony. He says, 'it kind of screws it up. ... Bloody inconvenient house! That's what drives you mad about some of this'.
- Tony would prefer to 'hardwire everything ... even though we've supposedly gone beyond that ... just to get the most reliable system'.



**There were considerations for smart locks...[but] because of WiFi hacks...just keep it simple, standard, conventional locks and key...that's a definite stopping point for me.**





— Tony



# Floyd & partner

'Security is a dead-set real problem'


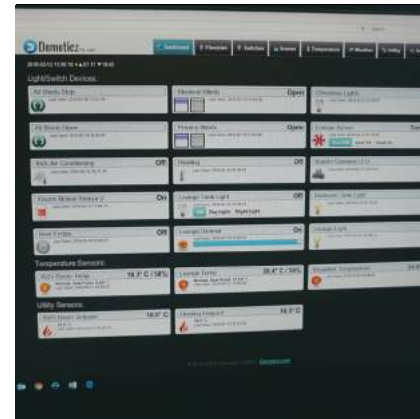
## Household

-  Information Technology
-  45-54
-  Melbourne
-  Undisclosed

**FF**

I think security is a dead-set real problem and it can't be stressed enough I think, to be honest.

— Floyd


## Products & Devices

- Google Home, Home Mini
- Air conditioners, beer fridge and one light connected to voice activation (Google Home)
- Automated (smart phone controlled) thermostat (Honeywell T6 Pro)

**FF**

That's probably the biggest danger...that someone could find a loophole in your kettle and use it to attack someone or just turn your kettle on when it's dry...the possibility is there to burn your house down by using a kettle or something.

— Floyd




## Protection Priorities

- Programming lighting to make the house appear occupied reduces risk of burglary
- Using independent software and avoiding using Cloud based systems reduces or eliminates the risk of devices being hacked
- Having back-up systems in place that aren't power/internet dependent (e.g. battery operation, manual switches), and being able to (re)program devices independently, reduces system vulnerabilities (e.g. getting locked out of the house)



## Household Description

Floyd is married with two children and makes use of smart technology to increase his home's security. He programs the main light to switch on/off at set times during weekends, weekdays or across the whole week to make the house appear constantly occupied. He also randomly adds or deducts 30 minutes to these light schedules to make it look more variable. However, it is the security of the devices themselves that most concerns Floyd, who identifies Cloud based systems as the main point of vulnerability for devices to be hacked and used in a single or coordinated 'denial of service attack'. Floyd has 'completely wiped' his devices and they are now 'running my software' in order to reduce this perceived vulnerability. However, he highlights that manufacturers of cheap mass appliances are 'not interested in internet security' and the people installing them are unlikely to be aware of the implications. Floyd is also concerned about smart devices being used as part of domestic abuse, and about being locked out of his home or specific devices. For example, speaking of smart locks, he explains 'I'd rather a lock on the front door, a fingerprint reader or something like that. But...you need to look at how they function when there's no power and is it a security risk both ways? If there was a fire and the power went out...can you even get out?' For that reason, he would prefer systems with battery-back up.



**Why I hate Philips Hue etc., all of these other systems that lock you into using their servers. They're all Cloud based...when you have a problem you've got no control over it.**

— Floyd



## Pressure Points

- Floyd is reluctant to install upgrades whenever the notifications come through, 'in case they've changed something that stops me doing it the way I'm doing it'. He first searches for information about the particular upgrade and what it does.
- Floyd uses open source software and reprogrammable devices. He can't see the advantage of devices that lock you into one system with no control – 'I wouldn't put up with that sort of thing. I would actually disconnect it'.
- Floyd believes appliance manufacturers aren't interested in internet security, or updating software, and don't address issues when loopholes are discovered.



**Someone else could...take over 20,000 of these devices around the world and get them at a given time to attack another server or website or whatever.**

— Floyd



# Kirra & partner

## 'Real OH&S Issues'

### Household


-  Full-time carer (former engineer)
-  45-54
-  3 (ages undisclosed)
-  Melbourne
-  AU\$104,100-156,000



**FF**

We want to maintain control of things that may present a risk, or we want to know are happening... we may need different responses in different situations because we don't necessarily know how our children have responded or what the issue is.

— Kirra



### Products & Devices

- C-Bus home control system
- Motion activated and light sensitive lighting
- Clipsal Wiser™ home control system
- Aquatrip to regulate water flow
- Temperature monitors in bedrooms with threshold alerts (flashing lights)
- Fermvision video intercom entry with keypad including open door alerts for front, back and garage doors (flashing lights); code locks on bedroom doors


### Protection Priorities

- Smart technology used to keep special needs children physically safe while allowing them freedom to learn
- Ensuring the health and safety of the whole family and the home itself
- Protecting the family's privacy by avoiding use of some systems, including voice-activated digital home assistants (e.g. Google Home)

**FF**

I'm not really interested in Google knowing about our lives. Maybe that would change but I can't really see it being a big value-add for us. ... We want to have less information about our family online. ... I think information online never goes away, and to a certain extent it's uncertainty, I don't know how that information will be used.

— Kirra



## Household Description

Two of Kirra's three children have a health condition involving significant intellectual, physical and emotional challenges. The home's smart technology is focused on making it a safe and nurturing environment for them. Her two children are unable to regulate their body temperatures, which can lead to a range of issues, so Kirra has temperature monitors in their bedrooms linked to an alert system of flashing lights when the temperature moves outside a certain threshold. In preference to thermostatic control, the alert allows Kirra to assess the situation and respond accordingly. Flash-lighting indicates if the back, front or garage doors are open – another safety feature for her children who 'don't necessarily understand safety'. Kirra also uses lighting to create a calming visual environment in the playroom, which helps her children with sensory regulation. Other smart features protect Kirra's health and the home in general. A wave-operated shower system prevents the children turning on the water themselves and also assists her with their showering. Water flow is regulated by an Aquatrip system to prevent flooding. Before installing these devices, all bathrooms had to be locked which impacted on a 'whole range of different things'. Kirra and her husband wanted the home's technology, especially 'the really important safety aspect', to be hard-wired as much as possible and not dependent on WiFi connection. The changes she has made have given her 'huge peace of mind' and allowed her children to have more freedom and independence.

## Pressure Points

- Sensory features of any smart tech, such as noise, lights, movement etc., have to be considered in relation to Kirra's children's potential reactions and wellbeing.
- Kirra is always thinking about 'future-proofing for future unknown children's needs'. As such, she has over-catered compared to their current needs, creating redundancies and options for additional features to be installed later.
- Kirra is not keen on voice activated devices. She is wary of their lives being online, perceiving this a risk in relation to her children's intellectual disabilities and therefore their vulnerability.
- Installers and suppliers were not very helpful in assisting Kirra to understand the systems she installed, despite her detailed questions and relatively high level of technical expertise.



**There were real OH&S [occupational health and safety] issues for showering, because they were once little but now they're big and heavy.**

— Kirra




# David & partner

## 'I've been known to spy on the children'


### Household

-  Project manager (utility company)
-  45-54
-  2 (ages 15 & 19) and 2 dogs
-  Melbourne
-  Undisclosed




In the laundry, where the dogs are during the day when we're out, if they want to watch TV well that TV was only installed when the dogs came along... just to have a bit of noise and whatever during the day... help relieve the loneliness.

— David





### Products & Devices

- C-Bus system including lighting, security, blinds and water features
- Distributed, integrated music system (Sonos)
- CCTV inside and outside the home (streamed to smart phone)
- Door camera and gate integrated with a PABX smart phone system
- Home theatre with automated blinds and projector
- Light-responsive external lighting (sensors)
- Distributed Siemens thermostats connected to outdoor temperature sensors




One of the dogs...got a toy stuck in the doggy door and they couldn't get in or out... could have ended up being a bit messy... So I popped home and fixed the issue.

— David

If we're away on holidays and the house is empty you can just check that there's nothing going on ... nothing amiss.

— David



### Protection Priorities

- Cameras and security systems provide protection for the home from anywhere in the world
- Internal cameras streamed to smart phone allow monitoring of children and pets to fulfil care and parenting responsibilities
- Flexibility of the C-Bus system allows frequent programme changes
- Hard wiring for all the network connections 'because it's robust'
- C-Bus system has low voltage switches and is 'super-safe' for children

## Household Description

David and his wife both work full-time and lead busy lives. They designed and built their ‘moderately smart’ single-level three-bedroom home to suit their needs as they get older – providing somewhere they can live for a long time without having to worry about ‘the stair factor’. David wants his smart home to provide functionality, convenience and comfort along with ease of use; eliminating ‘some of the button pushing’ and being able to ‘monitor what’s going on at home’. While security is a key reason for installing the CCTV system, providing a ‘certain level of comfort’ and allowing David to alert the security company to false alarms, he also makes additional, often covert, use of its monitoring capabilities. David has a camera and television installed in the laundry room where his ‘four-legged children’ (2 dogs) stay when no-one is home so he can check on them and provide care if needed. He says this is his main monitoring activity; however, he also remotely monitors his children when he and his wife are out. If they claim to be home studying, he says ‘I can see “Oh, he’s watching TV”’. David says his children are not currently aware he can do this, although they are aware the camera records their activities in the home. Often he’ll ask them what they’ve been doing when he already knows. He tells them, ‘I can always go back and check’ and says they will then ‘generally come clean’. He hasn’t given them access to this app because ‘they’d realise what functionality it has’. David says their home theatre has improved their family’s quality time. He says it’s now the dogs’ ‘favourite room...because they come in there with us...it gives us quality time together’.

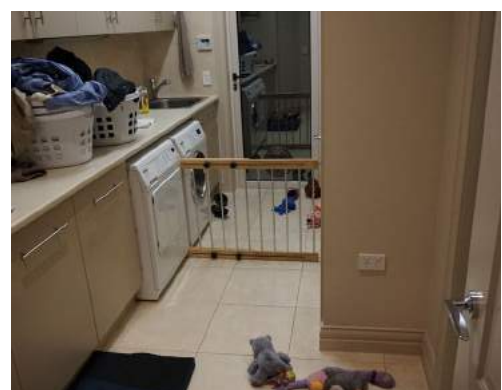
## Pressure Points

- David acknowledges that some of the software updates he performs would present a challenge for ‘the average person’. Being an engineer, he can figure it out himself and also quite enjoys it.
- David would like to integrate his air conditioning with the C-Bus system and also control the whole system remotely. He knows this technology exists; however, the cost and effort involved have been a deterrent up to now.
- Being able to assess how much energy various appliances are using in real-time, and control his usage based on that information, is something David is interested in but hasn’t explored much yet.
- David stores and backs up all his data locally and doesn’t trust the Cloud to store personal information securely. He is also wary of having connected devices in the home that people could somehow access and ‘mess with’.



**There’s nothing [i.e. cameras] in the bedrooms or anything, it’s only in the living areas. ... I’m not that controlling.**

– David





# Angela

## 'A better way to keep organised'

### Household

-  CEO (Online community company) part-time
-  35-44
-  2 (ages 7 & 10)
-  Sydney
-  More than AU\$156,000

### Products & Devices

- Google Home
- LIFX WiFi-enabled, coloured smart lights,
- Smappee solar power monitor
- Smart locks
- Robotic vacuum cleaner (brand unknown)
- Digital assistant bot for work (brand unknown)


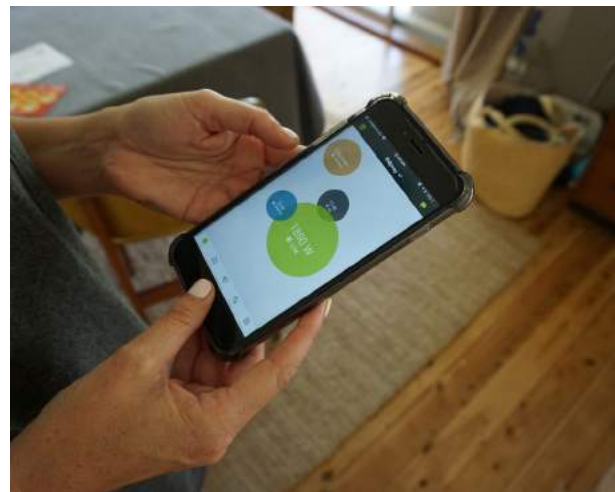
### Productivity Priorities

- Google Home's scheduling, voice calendar entries and timers enable multi-tasking and scheduling
- Digital voice assistants with male voices/ names (Siri, Google Home, and work assistant bot) challenge gender stereotypes
- Voice assistants and other smart devices enable improved time management and coordination around parenting, housekeeping and business roles

**FF**

I can say in the morning like 'what's my day look like', and it [Google Home] will tell me the weather and tell me what's in my calendar.


— Angela

**FF**

I rent the house out over summer... helps pay for Christmas and holidays and things. ... The lock's great... it integrates with Airbnb and... sends the person access to the lock for the period of their booking. ... I don't have to do anything.

— Angela



## Household Description

Angela is a busy single Mum and CEO of her own company who starts each day with weather updates, news, and a schedule rundown from Google Home. She thinks ‘voice search is where it’s going...that’s going to make it so much more relevant’. Her smart home devices encourage her two sons to be more independent, by taking responsibility for some household chores and asking for assistance from Google Home rather than her. Angela particularly likes the Google Home shopping list feature, which her boys can add to when they want her to buy something. She orders online using the shopping list from her Google Home app as her guide. She also frequently uses the time feature on Google Home, to notify her when the washing machine has finished its cycle, and also for cooking. Angela mostly works from home and uses a digital assistant bot called ‘Andrew’ to help set up her meetings. As a self-identified feminist, Angela has deliberately changed the default voices of her Google Home, work assistant bot and Apple smart phone (Siri) to male because she wants to challenge gender stereotypes about women being better suited to administrative and housekeeping roles. While enjoying the efficiencies she has put in place, Angela is also aware that technology tends to ‘give us [e.g. women] more time to go to work’. Comparing it to household appliances which ‘just crammed more into our lives’ she thinks automation ‘is just going to give us more time to do more’.

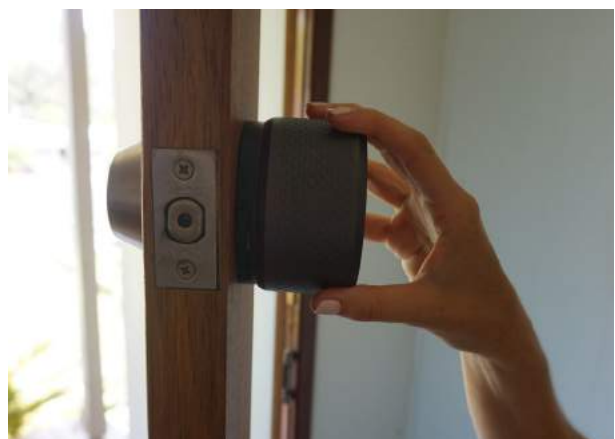
## Pressure Points

- Angela finds time spent on upgrades and troubleshooting ‘a pain’ and ‘unexciting’ but she accepts that there will be a ‘level of technical frustration’ with smart devices, ‘there always is’. Every one of her devices has required time spent on support forums.
- Angela is distrustful of and worried about low battery alerts for her smart locks: ‘I don’t want to get locked out because the battery has run out’. But she also wants to make sure the battery is fully used, ‘because they’re expensive’.
- She would like to do more around efficient energy use and storage, but finds that when she tries to investigate online, ‘it gets too technical...a bit confusing’ and she gets ‘a bit put off by those types of forums’, particularly because there are more men than women commenting.



**He [Andrew the work assistant bot] knows my calendar... arranges different times... knows where I’ll want to have my coffee in Sydney. ... He’ll send the address and he’ll make it at that place... so he knows what my preferences are.**

— Angela





# Lindy & Johnno

'It's a common sense house'


## Household

 Electrician/ Education support

 35-54

 2 (ages 10 & 12)

 Melbourne



 AU\$104,100-156,000



## Products & Devices



- Aosong temperature and humidity sensors
- Digitech wireless weather station
- Water temperature monitors and sensors (brand unknown)
- Automated windows and fans (brands unknown)
- Clipsal cent-a-meter™ energy monitoring device
- Allen-Bradley integrated control system

## Productivity Priorities

- Monitors and sensors measure water temperature, air temperature, wind, and humidity, and are integrated with windows and fans to maximise energy efficiency
- Real-time energy use monitoring enables immediate response to spikes in consumption
- Sensors and automated functions used to reduce needless energy use, e.g. standby power
- Motion sensors switch off the hydronic heater if they don't detect any movement

  
**Why would you use electricity to open and close your blinds? I don't think that's smart.**  
 — Johnno  


  
**We don't have any dark hallways where you need to turn the light on or anything like that.**  
 — Lindy  
**We don't have to turn our lights on until very late in the evening.**  
 — Johnno  


  
**There was a decision there made early on that you let the environment work for you.**  
 — Johnno  




## Household Description

Lindy and Johnno's 8.5-star sustainable home is a 'common-sense house' focused on maximizing energy efficiency. Productivity is referenced to getting the most out of the house, with minimal energy input. Via an indoor control station, Johnno monitors indoor temperatures, water temperatures and the weather through wireless connection to a weather station mounted on the roof. Windows and fans are integrated with sensors and open/close or switch on/off accordingly. Johnno downloads sensor information regularly to his computer for ongoing reference. The technology allows the couple to monitor energy use in real-time, so, as Lindy says, 'if it goes up you think, "something's on. What's on?" ... and you can scout around and have a look'. Most of the home's interfaces are custom designed by Johnno because he found off-the-shelf devices '[didn't] offer the same degree of flexibility'. Standby energy use is particularly annoying to him, and 'remote control...that's just using energy', so he uses built-in equipment which switches on in response to signals from connected sensors. Johnno values efficiency over automation. He's not interested in automated blinds or electronic entrance systems, 'because they use power'. Instead of using the gas-boostered solar hot water, Johnno will turn on the hydronic panels and draw hot water from them to do the dishes in the evening, 'so at the same time I'm doing the dishes I'm heating the house'. The couple's sustainable house design has reduced their need for heating, cooling and even lighting 'above and beyond' what they had imagined.

## Pressure Points

- Johnno wants to have his WiFi router sense when no one is home and switch itself off, because 'why would you run a WiFi network if you're not home?'
- The family have a valve on their kitchen tap that automatically diverts cold water to their water tank, including from the hot water tap, until it's reached temperature. Johnno wishes he had installed it on all of their water utilities.
- Johnno and Lindy identify a tension between energy efficiency and control as the 'difference between an automated house and a sustainable house' (Lindy).



**If you let something else do the work for you, therein lies the energy cost. ... You want to save energy, cut back on what you want to control.**

— Johnno



**Our electricity bill at the moment is in credit \$600.**





— Lindy



# Rachel

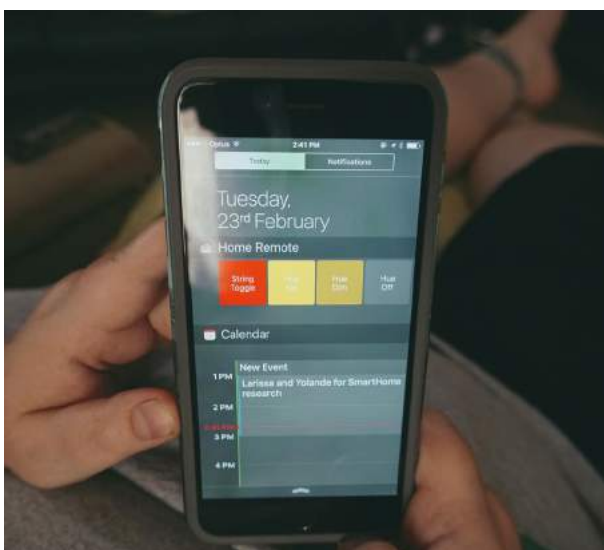
**'For people with disabilities smart home stuff is absolutely brilliant'**

## Household

-  Unable to work, online disability advocate
-  35-44
-  Melbourne
-  AU\$13,000-\$20,800

## Products & Devices

- Modified assistive technology devices (large computer screen, specialised keyboard, trackpad and input system)
- Automated Philips Hue lighting connected to a Belkin WeMo® switch
- Remote controlled air conditioning (brand unknown)
- Technical Systems Australia intercom and Presco key pad entry



**For people with disabilities smart home stuff is absolutely brilliant and invaluable, literally invaluable. ... You can let people live independently in their own homes for so many more years...by having quite a minimal amount of technology.**

— Rachel

**One of the things you get when you're severely disabled is people hover over you all the time... you don't get any privacy or peace and quiet. ...If there was technology that could mean that we felt less invaded, that would just be awesome.**

— Rachel

## Productivity Priorities

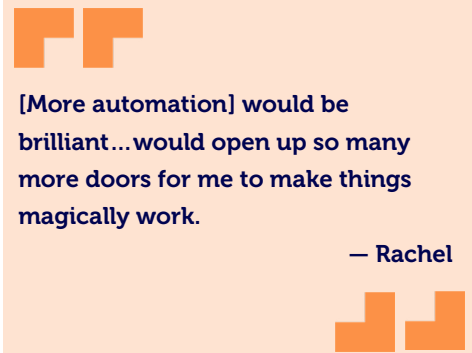
- Smart home control and automation enables management and efficient allocation of limited physical energy/mobility
- Maintenance of existing independence and desire to increase this where possible enhanced through automation and smart control
- Intercom front door access provides privacy and security for Rachel and her home

## Household Description

For Rachel, productivity means being able to accomplish as much as possible in her home independently of her carers. Due to a debilitating disability, she has a limited amount of physical energy and mobility available in the day, so being able to automate activities and tasks means she can allocate more energy to things she wants (rather than needs) to do. Rachel has designed and installed all of her home's smart technology systems (some by proxy). She has her lighting programmed for specific times but can also override this through her phone. Being able to retain manual operations is important so her carers can still use everything. Rachel highlights that automation 'gives [people with disabilities] stuff that can't be got any other way'. Living in social housing and on welfare support means Rachel manages her money closely. Being able to remotely control her air conditioning and lights affords Rachel some capacity to minimise electricity use. However, she does not monitor her electricity consumption because she needs air conditioning for her physical health and cannot reduce her lighting further or be left in the dark (where she could fall and injure herself). Remote, intercom door access means Rachel can receive visitors and services, including her carers twice a day, without having to get up. Before she had the intercom installed, Rachel had to sleep with her front door unlocked for eighteen months so her carers could gain access. She would like to install more smart home technology in her home, but is unable to afford it.

## Pressure Points






- Money permitting, there are other things Rachel would like to automate that she currently relies on her carers for, including operating the unit's main lights, bathroom fan, heating, and opening/ closing the curtains and blinds.
- Rachel highlights that having appliances like an oven, fridge, and washing machine with 'just a little bit of smarts in them' would allow her to manage her own laundry and decide for herself what, when and how she eats.
- Rachel's unit does not have enough power outlets for her needs and, being a rental property, she can't make any major alterations and even minor modifications require permission.
- The angle of the infrared on her remote-controlled air conditioner often makes it difficult for Rachel to turn on and off, and she would rather control it through her phone. However, modifying it would take an excessive proportion of her limited income.
- Rachel notes that most of what her carers do for her could be done by automation, making these services less of a drain on the government and providing greater independence for people with disabilities – 'I don't need four-and-a-half hours of people being friendly to me when they're paid every day'.



# Gabriel and partner

## 'It's largely set and forget'

### Household

-  Systems architect / Textile designer
-  35-44
-  3 (ages 12, 12 & 14)
-  Sydney
-  More than AU\$156,000

### Products & Devices

- Google Home (x2)
- VERA smart home control
- Node-RED (openHAB), MQTT, SkyFi & MySensors software/interfaces
- Z-Wave network
- Movement, temperature & humidity sensors (Arduino)
- Integrated pool heating (synced with clock and calendar) and pH control system (Arduino)
- Remote garage door control
- Circuit energy sensors & monitors (Open Energy Monitor)
- Lights, air conditioning and heating – all network connected
- LIFX & Clipsal lighting connected with light dependent resistor sensors
- Backup power using a UPS server (Uninterruptible Power Supply)
- Entrance door controlled with proximity cards
- Google's AIY Projects (Do-it-yourself artificial intelligence) home assistant using Raspberry Pi
- Home theatre with automated blinds
- Roomba robotic vacuum cleaner



**I can see who came in, when and where. Is it Big Brother? I don't think so. I don't use it for spying on people's comings and goings. ... Just interest... and [then] forget about it.**

— Gabriel



### Productivity Priorities

- Automation and scheduling on devices ensures many household functions occur with minimal manual input
- Google Home allows for easy multi-tasking regarding everyday household tasks and functions
- Phone alerts provide notification when something has been left on or open, allowing for quick attention to any issues or inefficiencies
- Monitoring the energy consumption of home technologies provides data on the cost of certain appliances at specific times, such as the hot water or pool pump
- Manual functionality provides backup in the event of connectivity failures

## Household Description

Gabriel's home is brimming with 'an awful lot of' hardware and software, and he is responsible for all of it: 'when it doesn't work, it's me'. He enjoys being able to multitask using his two Google Home assistants which are integrated with all his smart devices. Using his voice (or his phone), he can open the garage door, turn the heating on, and soon he'll also be able check the temperature in his pool. He thinks voice interface is 'great...especially when you're washing up, you can say, 'turn the TV up'. You don't have to dry your hands...'. While he admits it's not a necessity, he values the increased functionality it provides: 'it's an additional interface to the house which is quite helpful'. Gabriel has automated his pool controller to send water to the roof for heating when the sun is out; it also checks and adjusts the pH levels automatically. He says this saves him time every day because 'it's largely set and forget'. Gabriel monitors his energy use 'on most of the house circuits' so he has a constant, real-time report of how much energy is being consumed at any point on the circuit. He describes this as 'probably one of the most important aspects for having a smart home, in that you can control, or you can do better or smarter automations through knowing when's the best time to run a device'. Gabriel receives phone alerts if something has been left on or open, such as his beer fridge, pool pump, lights or garage door. This provides him with greater control over his home, a 'hobby' that Gabriel 'burns' up to 12 hours of his time on every week. He spends a lot of time in his extensively equipped, multi-screen 'control room' where he does his 'tinkering', often in his 'free-time' while his wife and kids are asleep.

## Pressure Points

- Gabriel's automation takes 'way too much' of his time. He says, 'that's why I probably wouldn't say it's that smart, because... it needs a lot of control to get right, a lot of effort'.
- Technologies are currently too varied and incompatible for Gabriel to achieve smooth interoperability. He thinks we're 'miles' from being able to turn an oven on using Google Home.
- Gabriel believes everything should be able to be controlled manually 'the way it would have 20 years ago'.
- Despite all the monitoring and associated controllers and servers, Gabriel says 'I'm probably not in front' when it comes to electricity consumption.
- There are smart modifications that Gabriel has thought about doing, for instance to his laundry dryer, but he is aware they would invalidate his house's insurance.
- Gabriel thinks that smart home control software needs to become a lot more user friendly. He describes the current options as 'ridiculously difficult' for non-IT people to operate.



**When you walk into a room it should know that there's someone in here, [or if] it's now night time, it'll turn the lights on.**

— Gabriel



**Current sensors... are constantly reporting back how much electricity is being consumed at that point in time on that circuit. ... One of the most important aspects for having a smart home is that you can control ... when's the best time to run a device.**

— Gabriel



# Pleasure



- Households derived **considerable pleasures from using smart devices and living in a smart home**, although these were often partially offset by the frustrations and complexities involved in learning to use and maintain smart home technologies (Jensen et al. 2018a; Strengers & Nicholls 2018).
- Smart lighting was a main source of this pleasure, generating **new sensory experiences and opportunities for ambience and mood creation** in line with current smart home marketing (Strengers et al. 2016). Lighting and other sensory enhancements, such as automated water features, created aesthetic experiences in the home (e.g. coloured light scenes) which were commonly associated with pleasure (see Kurt & Graham, case study 12).
- Smart mood lighting was often part of a broader intention to create a relaxing and pleasurable home environment in an attempt to **replicate the experience of going on a holiday or living in ‘a resort’** (see Kristi & Bill, case study 10). Home cinemas, audio-visual systems, pools, and outdoor and indoor entertainment areas were commonly part of this expectation for vacation-style pleasure.
- Several affluent households with large and fully-integrated smart homes noted that **pleasure was derived from sharing these smart devices and experiences, or showing them off to others** (see Ken & April and Kristi & Bill, case studies 9 & 10).
- **Setting up, tinkering or playing with the devices was a significant source of pleasure – predominantly for male instigators of smart home technology adoption** (see Lauren & Scott, case study 11). In these households, smart home technology constituted a pleasurable hobby in and of itself (Strengers & Nicholls 2018).
- Several households also took pleasure in **the novelty or ‘cool’ factor** of controlling the home via smart phones, touchscreen panels or voice control. Google Home and Amazon Echo (Alexa) were commonly associated with fun and playful experiences (see Ken & April, case study 9).
- The energy consumption associated with new smart home pleasures could **offset or exceed any energy productivity benefits** enabled through automation, efficiency and monitoring, as noted by the research team and others (Hargreaves et al. 2018; Jensen et al. 2018a; Strengers & Nicholls 2017).

# Ken & April

## 'Show-off factor'

### Household

-  Sales/ Marketing (IT)
-  35-44
-  2 (ages 2 & 4)
-  Sydney
-  More than AU\$156,000

### Products & Devices

- Amazon Echo 'Alexa' (US version imported and modified to work in Australia) and Google Home
- VERA™ smart home control
- Nanoleaf lights
- Clipsal lights
- Luxaflex hub for motorised blinds
- Z-Wave lampshades controller and doorlocks

### Pleasure Priorities

- LED colour-enabled smart mood lighting provides convenience and entertainment
- 19 automated blinds that open and close in response to the weather and time of day, provide comfort, convenience and security
- Alexa (downstairs) and Google Home (upstairs) enhance pleasure through ease of direct voice interfacing



**FF**

Probably Alexa's our best friend. If I'm having a party on the deck we take Alexa out there and just stream music.

— Ken

**JJ**





## Household Description

Ken and April love the features of their current smart home and are keen to get more. They share the benefits of their smart devices with others, and are frequent entertainers. Ken in particular ‘loves gadgets’ and ‘he always has to have everything first – as soon as it hits the market, we get it and integrate it’. He recently used his connected projector screen to help him and a friend organise a European holiday – ‘had up here Google Maps...worked out...where we’re heading...booked our train tickets, plane tickets and everything else’. Both take pleasure from playing with new smart devices and implementing aesthetic, entertainment and mood enhancements from automated lighting and audio-visual features. When he’s working from home, Ken likes to have the National Geographic channel on mute in the background (on the wall-sized indoor projector), because he finds nature programs soothing and relaxing. The couple’s 19 automated blinds can be operated from anywhere, including bed. This kind of flexibility and convenience makes Ken and April’s busy executive and parenting roles less stressful. They also get a lot of fun from their two voice activated assistants. April likes to set music to play as she comes downstairs in the morning, so ‘we’re all dancing while we make brekkie’, and Ken likes to ‘play’ with Alexa’s shopping list feature, ‘but only to show off to people’.

## Pressure Points

- Ken and April are upgrading to a larger smart home that’s ‘as big as we could make it on the block’. Their new home will allow them to ‘holiday at our own home’ and will include a basement wine cellar, bar and lounge they call the ‘person cave’.
- Ken installed the latest Luxaflex hub for his automated blinds. However, it’s a beta version from the US and he hasn’t been able to get the voice integration working yet – ‘it’s a pain in the neck’.
- Ken and April have a lot of gadgets in storage that have either never been used or are ‘too difficult to work’. Ken describes situations where major systems have stopped working and says without an IT background, ‘you’d probably be screwed’.



**I love it when you have people over and they can see all your gadgets and stuff.**

— April

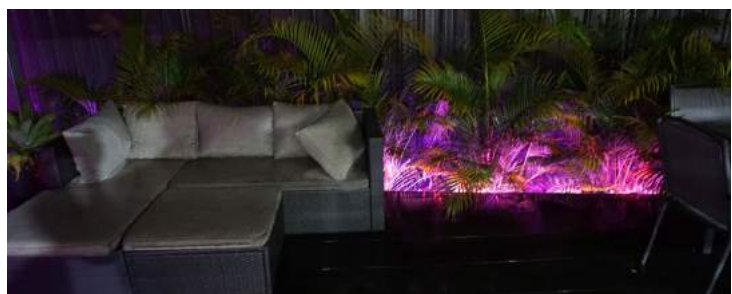
**It’s a show-off factor as well, I guess...it’s a conversation piece.**

— Ken



**I love my LED lighting, so the bar, out around the outside deck...all controlled off an app...the bathroom upstairs is all tricked out with LED lighting.**



— Ken



# Kristi & Bill


## 'The resort'

### Household

-  Feng Shui consultant, author, and teacher/ Management (security industry)
-  45-54
-  1 (age 6)
-  Sydney
-  Undisclosed


### Products & Devices

- Amazon Echo 'Alexa'
- Control4 smart home system (extensive automation of doors, windows, blinds, lights and pool area)
- Samsung robotic vacuum cleaner
- Smart washing machine and fridge (brand unknown)
- Fingerprint readers on doors (brand unknown)
- D-BOX cinema seats


**I press that button, it opens this door and open[s] the garage – How good is that?... It's brilliant.**

— Kristi





### Pleasure Priorities

- Motion sensing and coloured lighting throughout the home's interior and exterior provide ambience and entertainment
- Internal automated doors, windows and blinds provide comfort, convenience and natural light as the family move through the house
- 8-seat cinema room with motion synchronised seats, and automated pool pump, heating and lights for outdoor heated swimming pool, provide resort-like entertainment and relaxation opportunities
- Retracting wall in main bedroom and outdoor automated water features enhance the natural beauty of the property



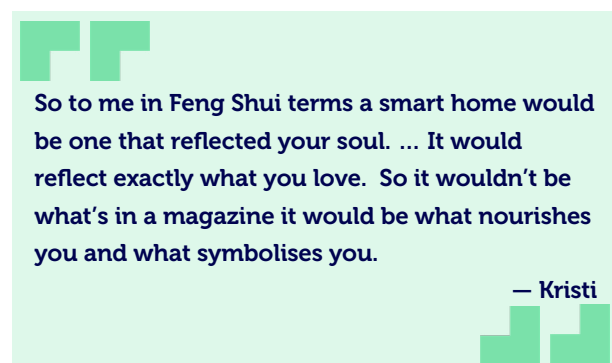
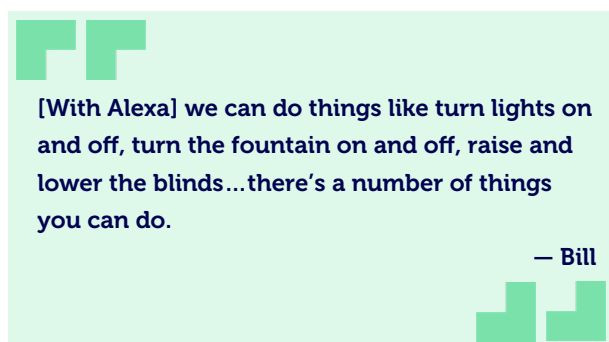
**Coming home is like going away for the weekend...it's nice to stay home.**

— Bill



## Household Description

Kristi and Bill's home is a new build—an 'upper scale premises' focused on providing comfort, which is 'a lot bigger than what I [Kristi] thought'. It includes a four-car garage, rotating window awnings that track the sun, swimming pool, spa, swim-up bar, indoor water features, outdoor fountain in the property's dam, seven televisions including a home cinema with surround sound ('better than Gold Class') with D-Box chairs that respond to the film's action, and an additional water feature yet to be installed outside. Kristi says that their smart home connects them closer to their natural environment: 'we've really got the yin and the yang because we're really getting into the automation ... but we still really love the nature that's around us as well'. Their smart home set-up requires a control room which is kept at 25 degrees (the rest of the house's temperature is more variable depending on seasonality). Kristi describes their home as 'a staycation' while their relatives and friends call it 'the resort', 'it's definitely a talking point'. Their home's aesthetics, achieved primarily through lighting, are also important to Bill. When he arrives home, 'the eave lights will turn on...that sort of creates a little bit of a nice ambience'. He also enjoys the reflective lights created by outside LEDs, which they use to enhance an outdoor fountain, adjacent pond and also their swimming pool. The couple describe their home as 'definitely fun' and even play practical jokes by remotely-controlling lighting and entertainment.



## Pressure Points

- Redundancy is a key consideration for Bill. Every system – alarm, lighting, blinds, pool, AV – works independently so 'if one fell over it's not going to take or compromise the whole set up'.
- The internet dropping out is an ongoing issue for Alexa's operation – it causes 'all sorts of drama'. Bill
- Bill wants to install an app that will allow them to start opening the garage door as they're coming down the road, 'so you can literally drive in the gate and not have to stop and push a remote or anything like that'.
- Bill expects electronics to fail now and again, and over time. He says 'it's just in their nature, they run warm because they're powered by electricity and then over time things can fail'.
- Despite trying to reduce their energy consumption with solar generation and automating 'certain banks of power to turn off' through their alarm system, the home is not as efficient as Bill would like it to be because of the large number of appliances and smart technology in operation.

# Lauren & Scott

## 'He's addicted'

### Household

 Ultrasound technician/ Engineer (computer programmer)

 45-54



 3 (ages 17, 17 & 13)

 Melbourne



 More than AU\$156,000



### Products & Devices

- Amazon Echo 'Alexa'
- European KNX system (equivalent to C-Bus)
- WiFi connected weather station
- Automated lighting, heating and air conditioning (brand unknown)
- Canex multi-zoned thermostat system
- V-Zug smart oven

  
**When he was over in, was it Indonesia, [he] actually just for the fun of it turned all the lights off.**  
 — Lauren 



  
**It's my job but it's also my hobby, electronics. ... I love tech, so I make sure [the novelty] doesn't [wear off]. I keep going.**  
 — Scott 

  
**I never played with valves, but... this is my low voltage box... so everything in here is mine to play with.**  
 — Scott 

### Pleasure Priorities

- Playing with smart home technology is a hobby and challenge that provides pleasure and entertainment for Scott
- Different temperature zones maintained throughout the home with 7-8 thermostats provide constant comfort
- Motion activated lighting provides convenient illumination as the family moves through the house
- Different lighting intensities and colours enhance indoor and outdoor ambience, and create unique settings and cosy spaces for different activities and rooms

## Household Description

Scott is passionate about smart technologies, and is the main instigator for bringing new technologies into the home. He gets pleasure from the technology itself. As his wife Lauren says, 'he loves it, he's addicted...it gives him a lot of pleasure'. Both agree that compared to their old house, 'it [smart home technology] makes the house more comfortable...it just feels pleasant to be in'. Scott likes to maintain their six-bedroom home at a set temperature, 'ready for when people come home', and sets the bathrooms slightly warmer than the main living areas and bedrooms, which he finds 'makes a real difference' in terms of comfort. Ambience is also a priority for Scott. He has programmed different illumination levels in specific areas depending on their main function, and also uses different lighting temperatures, from cool to warm light. He thinks it works really well – 'you think, oh yeah, that's a cosy corner'. Scott and Lauren have also enhanced cosiness in their living area with a gas log fire, which they say has increased quality family time with their three girls, and provides 'a pleasant thing to sit in front of and look at'. Much of the pleasure the couple derive from their automation is described as the convenience associated with app-controlled air conditioning and lighting, which the whole family are able to control from their phone – 'so [the girls] can climb into bed and then turn the lights off, rather than...having to talk across a dark room'.



**I can turn the air conditioning on half an hour before I arrive home... which is probably the most desired outcome of this whole system.**

– Scott



**I did a lot of research on all the systems that were possible, ... [the KNX system's] got a lot of quite serious engineering behind it, it's a commercial system.**

– Scott



## Pressure Points

- Scott is working towards having the heating linked to his alarm clock so it comes on half an hour before the alarm. Integration is often a challenge – but one he enjoys.
- Installing sensors to measure the energy used by different circuits in the house, and by specific devices, is something Scott wishes he'd done.
- Scott is unable to upgrade the software for the family's smart oven. He's 'disappointed at that'.

# Kurt & Graham

## 'The house welcomes you'

### Household

 Economist/ Retail (technical)

 25-34

 None

 Canberra


 AU\$83,200-AU\$104,000

### Products & Devices


- WiFi connected entertainment (Apple TV, music)
- LIFX smart coloured lights
- WiFi enabled scales


### Pleasure Priorities

- Controlling multiple lights independently without the use of a hub (e.g. Phillips Hue)
- Using coloured and ambient lighting to create a 'chilled', fun and homely atmosphere
- Technology that's functional, easy to program, and affordable


  
 I've got a strip light [LIFX] that sits underneath the bed and that comes on slowly at daybreak. ... It knows what time sunset it, so it fades over half an hour...then my room goes slowly redder throughout the evening. ... They say blue light is bad for sleep, so it's goes redder and redder by itself naturally.


— Kurt





  
 At the beginning with the lights, I was kind of like 'I don't know'. But after using it you feel like 'Oh...where I can play with MY lights and adjust the lights to what I want or what I'm looking for'. ...makes you feel unique in your own home.

— Graham



  
 Right now, running a smart home...takes a lot of effort, so it's not labour saving it's labour increasing... It's only going to start making a difference in labour saving when it's smart enough to actually figure it out..

— Kurt

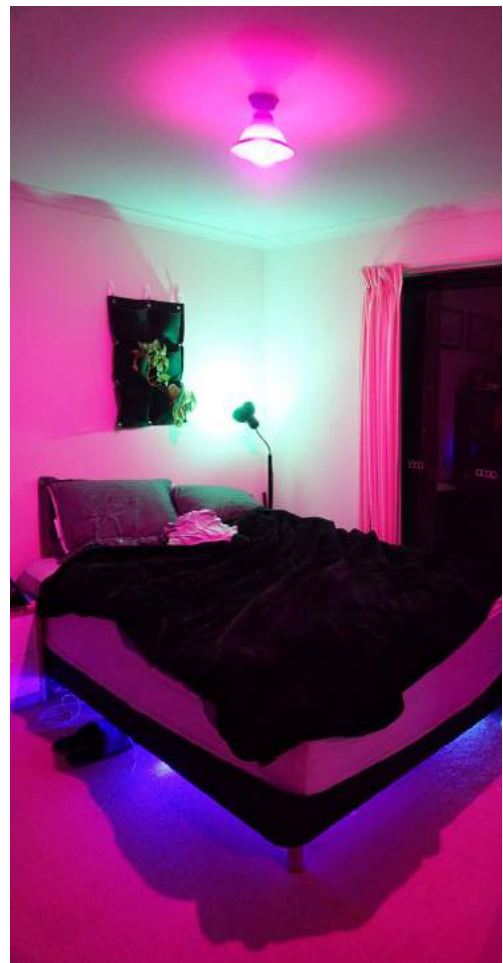


## Household Description

Kurt has lived in his two-bedroom rental townhouse for around eight years and has gradually done what retrofits and modifications he can so that it's now at a 'pretty happy point'. His housemate Graham works in retail for Apple, which he associates with them being 'pretty gadgeted-up' – 'above average, but not obsessed'. They find many smart technologies interesting but weigh them up against their cost and value. As Graham says, 'It's kind of like, do you really NEED...do you really WANT all of them?' They like to support new, exciting technologies on Kickstarter, like the LIFX bulbs and motorised blinds (yet to arrive). They are also waiting on the 'Knocki' to arrive through Kickstarter – a light controller that can be attached to surfaces, allowing them to turn lights on and off by knocking the surface. Both Kurt and Graham like arriving home to ambient, 'chilled' lighting – 'the house welcomes you', as Graham says. Graham particularly enjoys being able to play around with the lighting – 'one day with the blue colours...make it less bright...light plays with the music you're listening to...I enjoy that one', but admits he sometimes 'struggles' with the integration. Kurt also finds some of the programming difficult and identifies 'if-this-then-that' as the closest to what he would define as 'smart'. However, he thinks these systems are 'still really choppy...not fantastic ways to control things'. Nevertheless, Kurt and Graham both enjoy being able to customise and control their own lighting to the point that they 'miss [their] lights' when travelling overseas.

## Pressure Points

- Kurt describes their lighting technology as 'incomplete', like being able to turn lights on or off or change their colour when they arrive home late without having to 'play around with your phone'.
- The cumulative and ongoing cost of new smart technologies deters Kurt and Graham from investing in devices like a smart lock or Nest Learning Thermostat.
- Kurt's 'dream device' is a proper (affordable) espresso coffee machine that can be programmed to turn on when he wakes up. Graham agrees 'that would be a good feeling'.
- Graham finds voice-activated technologies 'tricky' because of his accent (Colombian). He says they don't always work, if they're programmed for English, but programming them for Spanish 'gets tricky as well'.
- Kurt and Graham have concerns around the security of smart devices, especially the potential for malicious attacks using ransomware.
- Graham is concerned about the environmental and social impacts of their production – where are they produced, how and by whom? - 'what is the backstory of that light?'



# Key insights and future opportunities

## **Insight #1: Householders understand protection as improving their home's security and providing care for family members**

- The term 'protection' is less significant to smart home householders than enabling security and care via smart technology.
- Those adopting smart home technologies for security have confidence in their own knowledge and skills of technology setups but hold concerns for the security or privacy of other less aware/capable households.
- Monitoring the home and its occupants (particularly children) can be understood as a form of 'careful [or care-full] surveillance' (Richardson et al. 2017), which is intended to provide care and concern for others.
- Remotely-accessible monitoring and security capabilities provide considerable peace-of-mind for busy and hyper-mobile households.

## **Future opportunities**

- Respond to the multiple and varied types of protection and surveillance desired by households.
- Consider possible privacy and security implications within the household, and the ways that smart technologies may unduly reduce control for some household members.
- Reframe discussions of protection around the provision of care and concern for others (e.g. ways of providing parental care).
- Ensure the security vulnerabilities of smart technologies are addressed in ways that do not rely on high skill and awareness levels within households.

## **Insight #2: Men are more interested (than women) in currently available smart home technologies**

- Male tech-enthusiasts often enjoy researching, setting up, maintaining, and 'tinkering' with smart devices, considering these activities a hobby or leisure activity.
- Both women and men may be less likely to take smart home technologies 'seriously' if they are considered a 'toy' or play-thing for men.

## **Future opportunities**

- Incorporate diverse understandings of what women want from smart home technologies into design and marketing.
- Ensure smart technologies are sufficiently useful (for households who do not derive pleasure from technology itself) and easy enough to install and use (for households without a highly capable tech-enthusiast).



### **Insight #3: For women, smart home productivity is commonly associated with managing work and home pressures**

- With women still performing most of the domestic duties in the home (cooking, cleaning, caring for others, etc.), regardless of employment status, technologies that assist with multi-tasking and coordination of daily activities are likely to appeal.

#### **Future opportunities**

- Better identify where the smart home technology market is/isn't catering to women.
- Develop smart home technologies that relieve the 'double bind' of home and work that women commonly face, without framing domestic tasks as gendered.
- Explore how smart home technologies can better promote and assist work-life balance, e.g. develop smart technologies which both simplify domestic duties and work towards greater gender balance in the home.

### **Insight #4: Productivity benefits can be undermined by the additional 'digital housekeeping' required to keep the technologies running.**

- A variety of issues with smart home technologies require considerable technical expertise and trouble-shooting skills which take time and energy.
- Men are more likely to perform smart home 'digital housekeeping', potentially taking them away from other chores or activities. While these activities may initially be perceived as fun, they may become more of a burden over time.
- Women can find smart home technology support networks and forums less appealing and useful, in part because they tend to be predominantly used by men, or focused on men's interests.
- Despite perceived multi-tasking and convenience benefits, most households do not think smart home technologies save sufficient time to offset what's involved in setting up and maintaining them.

#### **Future opportunities**

- Develop greater insights into the growing role of digital housekeeping in smart home households, its gendered distribution, and the issues it presents to women who are interested in incorporating more smart home technologies into their everyday lives.
- Create spaces and support networks for women interested in smart home technology.

### **Insight #5: Households want to integrate smart technologies into their home to increase its value and desirability to others**

- Home-buyers and owner-builders are increasingly interested in installing smart home technologies up front to modernise their home and increase its value.
- Renters' ability to make changes to the home are very restricted but younger, high-income renters are likely to be interested in self-installable and transportable smart home technologies (e.g. 'off-the-shelf' or 'plug-and-play' devices).

## Future opportunity

- Consider how households at different stages of household development, and at different points on the property ladder, may differ in how they adopt smart home technologies.

## Insight #6: Smart home technologies are used to care for non-humans, such as pets and other technologies

- Busy households with pets are attracted to smart technologies and entertainment options to help keep their animals occupied, safe and cared for (particularly cats and dogs).
- Smart climate control and lighting systems can improve (or be necessary) to maintain appropriate conditions for temperature-sensitive equipment (e.g. smart home networks/ hubs).
- Smart home technologies can introduce new and unexpected energy demands to the home via the routes noted above.

## Future opportunities

- Recognition of the health benefits of living with animals and increasing numbers of pets in homes in the US and Australia (combined with increasing willingness to spend money on pets) presents a considerable opportunity for the smart home market.
- Better understand how smart home technologies can be used for pet care and entertainment.
- Identify ways to minimise the energy consumption associated with smart home technologies that introduce new energy demands into the home.

## Insight #7: Smart home technologies have distinct benefits for people with disabilities or debilitating health conditions (including ageing)

- Improved independence and reduced reliance on human carers as a result of smart home capabilities are highly valued by people with disabilities or chronic health issues.
- Smart technology can provide safeguards against potential health and other vulnerabilities. These include being able to remotely unlock doors for visitors, or monitoring the room temperature and health of people with special needs.
- Touchscreen control and voice activation increases the independence and mobility of people with disability to perform everyday tasks like opening doors and turning lights on/off.
- The benefits of smart home technologies for people with disabilities are not adequately captured by the 3Ps.

## Future opportunity

- Further explore potential future markets/ clients for smart home technologies, e.g. disability and health care service providers and government agencies.
- Identify and examine current use of smart home technologies in public housing to understand how to meet people with disabilities' needs and decrease undesired reliance on human carers.

## Insight #8: The pursuit of pleasure in the smart home undermines possible energy consumption savings

- The promotion of smart homes can escalate comfort and pleasure expectations, and relegate energy (if present) to a lower level concern.
- Energy consumption is mostly increasing in smart home households because these devices are integrated into an expanded range of practices and places in and around the home, and often consume considerable power as a result of being constantly 'awake' and awaiting commands.
- Households can implement energy reduction with smart home technologies (and many are interested in doing so), but this is likely to require active rejection of other lifestyle and pleasure benefits currently being promoted in the smart home market.

## Future opportunities

- Rethink the kinds of desirable expectations that smart homes promote and enable in order to diversify the smart home market and capture a wider diversity of potential users.
- Take inspiration from 'slow' movements and popular contemporary lifestyle visions that prioritise simple pleasures and reconnecting with friends and family through meaningful experiences.
- For example, the Danish lifestyle concept of *hygge* (loosely translating to 'cosiness') is gaining popularity and currently 'on trend' in Australia, US, UK, and other advanced economies (Jeppe 2011; Wiking 2016). Early research conducted by the research team in collaboration with Aalborg University (Denmark) colleagues suggests that *hygge* represents a promising alternative design vision for the smart home and prioritises lower or minimal energy consumption (Jensen et al. 2018b).



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