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Thematic Analysis: Renewable Energy for Residential Use

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1. METHODS

Sources of data.

The data was collected based on four semi-structured interviews specifically conducted for the purpose of this research. The interviews focused on regular users of solar panels (either through ownership or profession) and smart home systems who were familiar with the topic of the discussion, which confirmed the suitability of the selected sample (Martínez-Mesa et al., 2016). The respondents were three males and one female, aged between 35–56 years. The interviews were carried out in the participants' homes or online.

Transcription of data.

Each interview was transcribed verbatim which reflected what the speakers have said. The data was then entered into NVivo 11 (version 1.7.1, QSR International) software programme (see: Roberts et al., 2019), which assisted with data management and systematic coding (see Appendix 1 for Transcribed Interviews with Codes). In place of real names, we also used participant numbers to comply with the ethical requirements related to participant anonymity (Allmark et al., 2009).

Procedures for Analysis and Interpretation.

First, following a deductive approach the thematic codes were developed based on the raw data, as opposed to being driven by a theory. The analysis was conducted in accordance to the principles of rigour and replicability of thematic analysis (Roberts et al., 2019), and followed five stage approach consisting of: (1) data familiarisation, (2) preliminary coding, (3) pattern searching, (4) theme review, and (5) codebook creation (Clarke et al., 2015; DeCuir-Gunby et al., 2011; Roberts et al., 2019). First, we familiarise ourselves with the data (e.g., through repeated interview playbacks). This was followed by the initial code creation where we assigned preliminary codes to relevant excerpts in the data (see Fig. 1, Affinity Map). We then began to refine the initial codes which helped to identify patterns in the data across all four interviews (see Fig. 2, Affinity Diagram). This provided foundations for the main themes. At this stage, to ascertain the validity of the codes, we also conducted an intercoder reliability check, to ensure that the same approaches were implemented by the coders and that similar observations were made. This also helped to resolve some of the initial associated with potentially ambiguous codes. During this process, two sub-themes were removed and merged with existing ones, which improved accuracy with which themes were differentiated. This

confirmed reliability of the coding protocol, which is known to also help control for the researcher subjectivity (Roberts et al., 2019). At this point, we also began to reach saturation in our data because we reported no new patterns or details provided by the participants. After reviewing the codes , we developed a codebook outlining and defining the main themes (see: DeCuir-Gunby et al., 2011)

Focusing on the three areas of interest, namely, solar panels (SP), smart home (SH), and energy consumption, five main themes and corresponding subthemes were identified. Each theme included a definition and supporting examples from the raw data. Leaning on procedure outlined by Roberts et al. (2019) we once again reviewed the themes against the raw data to ensure that all relevant examples were included.

2. CODEBOOK

Table 1. Analytical codebook outlining the main themes with corresponding definitions, subthemes, number of references, and examples of supporting statements.

Main themes and definition	Subthemes	References	Example statements
Diminished usability of SP		**41**	
Comments that describe negative experiences of SP including issues, limitations, and challenges	*Energy waste*	14	P1: "without the battery, you are going to have a lot of energy running off now it is going back to the grid" P2: "So if we ran a heater, for example, during the night, we wouldn't be able to run off the solar panel, because we can't store it" P4: "if you go to work in the day, you abandon a lot of clean energy"
	Information	12	P1: "To be absolutely honest. It's still kind of an abstract concept. Like, we know how they work, but we don't know 100%" P2: "I don't know if they are producing more energy at some times and other times whether there's more energy on a sunny day than a cloudy day" P2: "So I can't actually look and see what my energy consumption is."
	Manual monitoring	15	P1: "make sure that we run, we run the dishwasher during the day. We do the washing during the day. So everything would be a drain on the power during the day we tend to use when we know that the solar panel will be feeding energy. " P2: "And so the energy we use in the evening isn't from our solar panels, it's from from the grid. So to make the most of them, you've got to be thinking, okay, when do I need to consume energy, and make sure that you're doing it in the hours of daylight?" P2: "So on a cloudy day, you might find yourself having to go and stand in your cupboard and stare at a box to find out if your solar panels have enough light to actually be producing solar energy at that time"
Mindful energy consumption		**38**	
Comments that describe considerations and strategies that impact reduced energy consumption	*Convenience*	6	P1: "But yeah, I mean, realistically, I consider them in that. I won't switch them all on at once. If one comes on by accident." P1: "Having to run everything during the day is a little bit of a faff to be honest" P2: "I've got to remember to put it on the right time. If I get to the end of my working day, in the winter, it's going to be dark. So then it's a case of deciding, do I wait till tomorrow?"
	Cost	10	P2: "So we've definitely had a shift now to thinking much more consciously about energy prices and energy consumption. Just because the prices have gotten so much higher."

			P3: "if you're on a budget, you probably would consider you would think about how long because you're showering"
			P3: "If the weather's good outside, then you wouldn't use tumble dryer because it uses quite a lot of electricity as well"
	Environment	8	P2: "And they make me feel also there is that feeling of you know, I'm doing something for the environment"
			P2: "To replace everything with them, one in terms of the ecological efficiency and environmental efficiency, you would be getting rid of perfectly good appliances, that's wasteful"
			P4: "Oh, yes, actually solar panels are very good, can provide very clear energy compared with fossil fuels"
	Strategies	14	P1: "regularly reminds me to turn off appliances and things when I'm leaving."
			P2: "we actively try to use the bulk of electricity in the in the daytime, so mid morning through to mid to late afternoon and minimise it in the evening."
			P3: "I'd rather use the gas heater rather than using electricity heater because it's more energy efficient"
SH capabilities		**49**	
Statements that outline existing features and further applicability of SH	*Autonomy*	20	P1: "anticipates the humidity"
			P1: "what happens with that is that if it goes over 55%, the small dehumidifier clicks on. And then when it lowers below 54 clicks back off again."
			P2: "I also have the smart control which controls the temperature in the house, which means my well the heating my house is not running constantly"
	Energy control	14	P1: "It is the same as our heating. Our heating will click on when it drops below a certain temperature. So if it drops below 18 degrees, it will click itself on and heat the house straight back up"
			P2: "being able to monitor things remotely like that. It's pretty useful. But it also allows me to monitor our power usage"
			P3: " smart home will allow you to maintain the temperature which works out cheaper in a way because it doesn't have to constantly work"
	Insight	5	P1: "And I can also check at the end of the day, there's a readout on my phone, which will show me when the height when the humidity spiked when the temperature drops to a certain level."
			P1: "it will literally show us exactly when that is and I can also switch the light on"
			P2: "So one of them is connected to that system. So sat here with you right now, I could technically go in there. Turn on and off the fan".
	Remote control	10	P1: "I've got something called Eve sensor. And that sensor, I can monitor from my phone."
			P2: "it's things like the light bulbs that you can turn on and off from your phone"
			P3: "And say like if you've if you left home and you forgot to turn the turn off the lights, you can still turn them off by using your phone which is pretty good I think."
SP attitude drivers		**26**	
Statements that reference participants' positive and	*Convenience*	8	P1: "Having to run everything during the day is a little bit of a faff to be honest"
			P2: "So in order to use that, to have that discretionary usage, we would need to be home."
			P4: "You need to consider the energy fluctuation."

negative considerations that shape their attitudes	*Cost*	13	P1: "I feel that electricity going back into the grid is great, but we get paid a negligible amount for it, and it's gonna cost us 1000s of pounds to store the power ourselves" P2: "It would be so much better if there was a more reasonable consideration where we could look to use that energy ourselves as opposed to feeding it back to energy companies who then sell it back to us for twice the price during the night" P2: "The lack of affordable storage options, I understand why the batteries are pricey. But at the same time without the battery, you are going to have a lot of energy running off now it is going back to the grid"
	Environment	5	P1: "And they make me feel also there is that feeling of you know, I'm doing something for the environment, because I'm using the solar energy as much as I can rather than taking it off the grid from you know, fossil fuel production." P3: "the requirement is to have the solar panels …would bring the UK or any other nation who got those requirements into more like a energy efficient world, which means people will be using less electricity and moving towards self-producing, obviously electricity" P4: "actually solar panels are very good, can provide very clear energy compared with fossil fuels"
SP Future directions		**31**	
Statements that describe features of solar panels that are wanted but are missing from the existing system	*Autonomy*	10	P2: "So for me, it would really be it being in sync with that solar panel piece and be able to say, hey, the solar panels are working. We'll turn this device on, or we'll optimise it, optimise the energy consumption, toggle this to turn itself down or whatever, you know, you'd have to pre load the dishwasher or the washing machine." P2: "I say schedule things, so that they automatically go on either a set time or more usefully when there is the energy available from the solar pane" P3: "by setting up the temperature, the temperature in the house obviously keeps the temperature it doesn't require the doesn't require you to obviously turn on the heating"
	Energy preservation	14	P1: "Especially in a country where sunlight is such a precious resource anyway, it would be nice to be able to store it for things like winter or times times when we would like to use it a lot more" P2: "It would be so much better if there was a more reasonable consideration where we could look to use that energy ourselves" P3: "I think if you really want to use solar panels, I would suggest to you to instal also some batteries and compose them into a system"
	Insight	7	P2: "So it'd be nice to have a smart metre type setup, but that that would say, your solar panels are producing this much energy, and you are using X percentage of that, because that might then trigger me to go, oh, hang on, I need to charge my Kindle" P2: "More access to the information about what, what, what energy I'm producing, and how much of it I'm using" P3: "Maybe, maybe you can use some artificial intelligence to control the energy and energy costs. Yeah, energy flow and energy cost, anyway."

3. AFFINITY MAPPING AND DIAGRAM
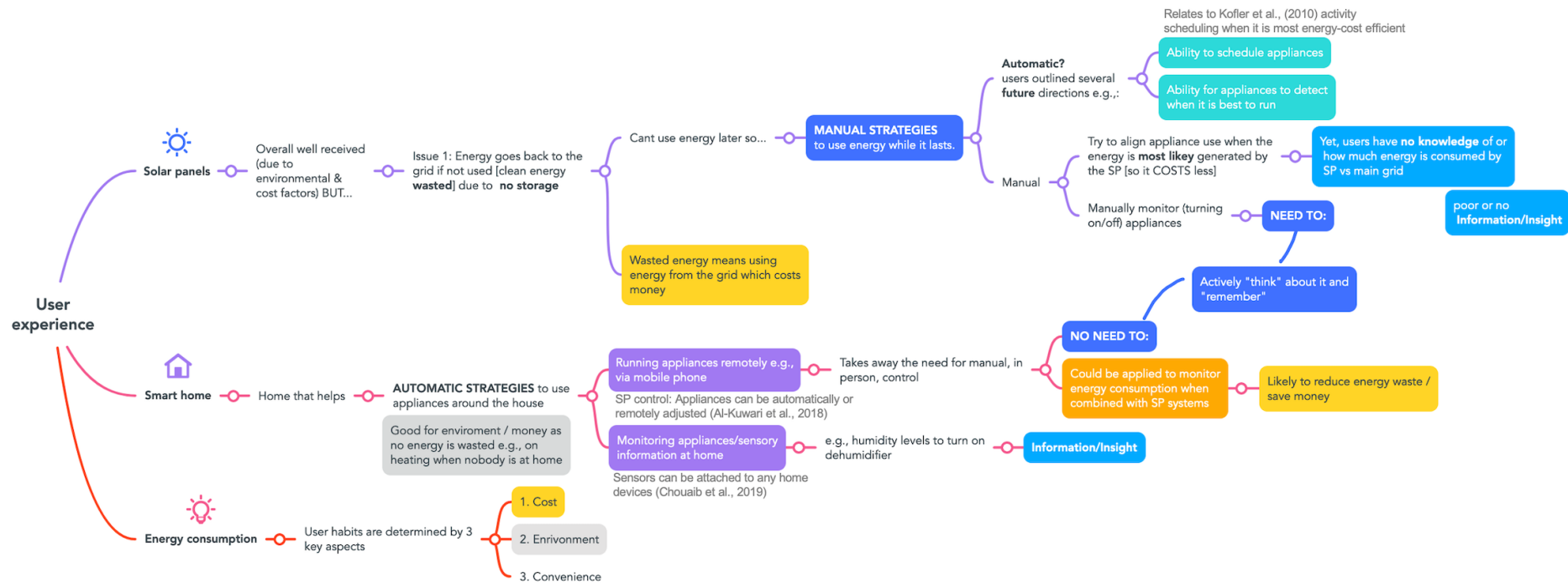
Figure 1. **Affinity map**. A breakdown of participants views and emerging patterns. Each element of relevance is colour-coded and related to a specific theme or sub-theme in the affinity diagram (see Fig. 2). The arrows show and explain relationships between the codes/themes and to previous literature (Al-Kuwari et al., 2018; Chouaib et al., 2019; Kofler et al., 2011).

Figure 2. Affinity diagram. The findings represent 5 main themes with corresponding subthemes. Arrows depict links and relationship between the codes across the different subthemes.

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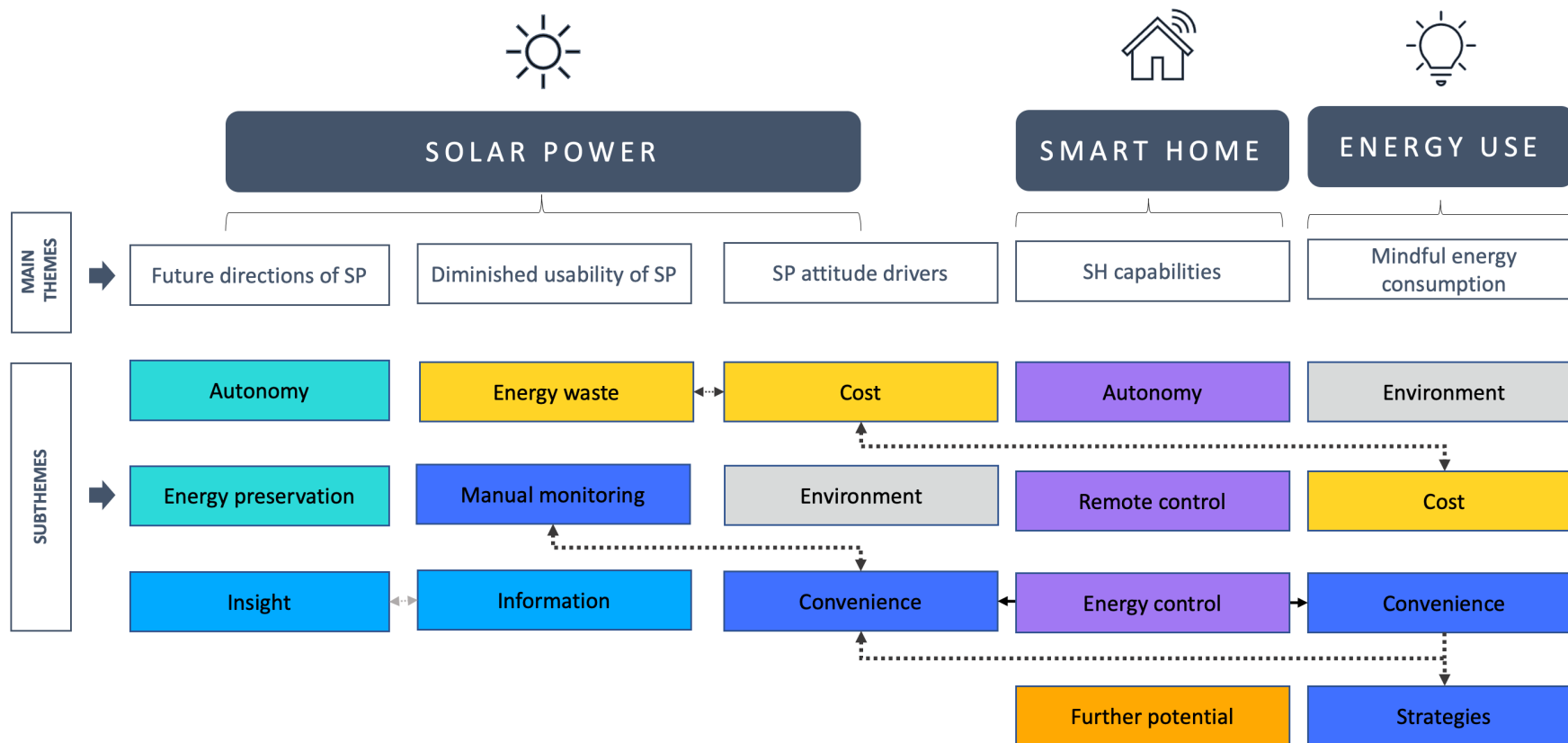
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Appendix 1. Transcribed Interviews with Codes

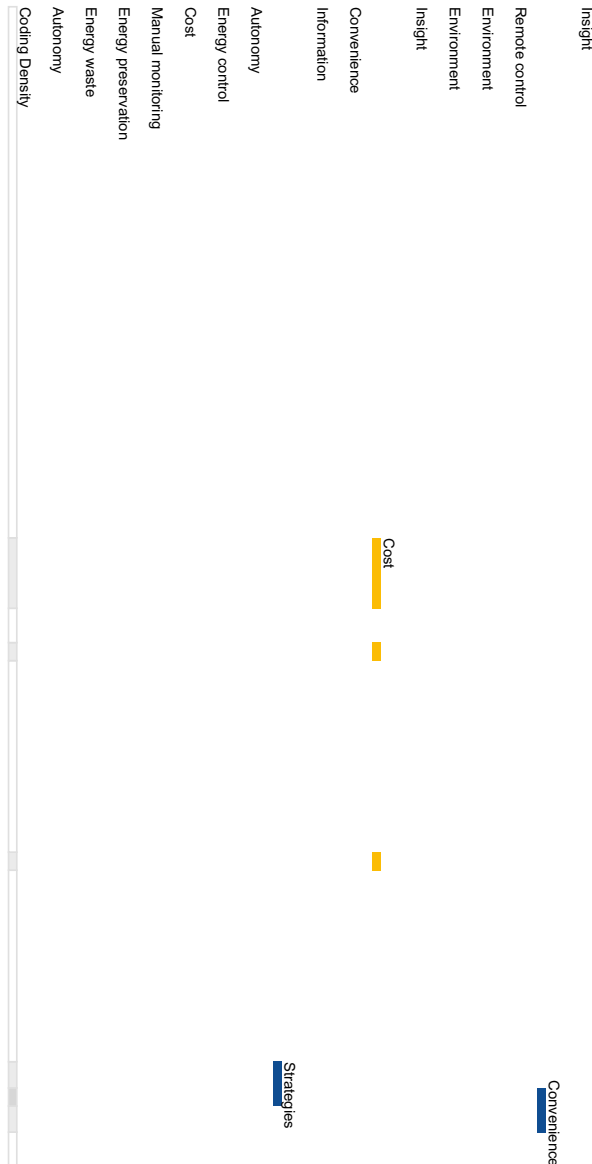|		
1		**INTERVIEW 1, PARTICIPANT 1**
2		
3	Interviewer:	Okay, all right, I was recording. So I'm G. So I need to get verbal consent
4		from you to be able to record the interview.
5	Participant1:	Yep. Cool.
6	Interviewer:	If actually if you hold it because you get your answers as it as soon as like it's
7		recording. Okay. So, the purpose of this is just to look at renewable energy for
8		residential use, and just have some questions along those lines. So, if you
9		could identify like your age bracket, are you between like 18 to 24-25 to 34-
10		35, to 40-44
11	Participant 1:	35 to 44
12	Interviewer:	35 to 44, age bracket, okay,
13	Participant 1:	Brutal
14	Interviewer:	You've given verbal consent. This is face to face. Alright, so, are you ready for
15		question one?
16	Participant 1:	Absolutely.
17	Interviewer:	Okay. All right. So question one. What appliances do you think will carry the
18		most energy in your home?
19	Participant 1:	The video games consoles for the game consoles.
20	Interviewer:	Really?
21	Participant 1:	Absolutely. They are like energy vampires, because I can't switch them off.
22		So the PlayStation five and the series X have to sit in standby, which means
23		they're constantly consuming energy.
24	Interviewer:	Is that is that even worse than like your dishwasher?
25	Participant 1:	Yeah, absolutely. Yeah, crazy power, because they are on 24/7, So the
26		dishwasher will only run for 20 minutes at the max. Yeah. Whereas the
27		consoles will be on all of the time. Okay.
28	Interviewer:	Okay. Yeah. I mean, that makes sense.
29	Participant 1:	Now with the steam deck, I guess the battery that gets recharged every 20
30		minutes.
31	Interviewer:	Okay, cool. And so I guess , you know, the question is, when do you use
32		them? When do you use these?
33	Participant 1:	So, as they're always on standby, I tend to use them in the evenings. So
34		probably between sort of six, six and 10.
35	Interviewer:	Okay. And do you think like your, the energy consumption changes when you
36		use the console?
37	Participant 1:	Absolutely. Yes.
38	Interviewer:	Okay. Thank you. Question three. So how much do you consider the
39		electricity costs when you run these appliances?
40	Participant 1:	Not as much as Emma. Okay, not, not so much. Not, not really as much as I
41		should do. Because [partner] regularly reminds me to turn off appliances and
42		things when I'm leaving. But yeah, I mean, realistically, I consider them in
43		that. I won't switch them all on at once. If one comes on by accident. I'll

Coding column headers: Coding Density, Autonomy, Energy waste, Energy preservation, Manual monitoring, Cost, Energy control, Autonomy, Information, Convenience, Insight, Environment, Environment, Remote control, Insight

Codes marked: Cost, Strategies, Convenience

| 44 | | switch to that console and switch it off. Okay. I won't leave everything |
45		running at once. But yeah, as I said, not not as much as I should do really.
46	Interviewer:	Okay. Thank you. Question Four. How would you describe your attitude
47		towards solar panels?
48	Participant 1:	They could be better. Yeah, I think they're really useful. But problem with us
49		having to use everything during the day means it doesn't really take into
50		account things like cold nights. So if we ran a heater, for example, during the
51		night, we wouldn't be able to run off the solar panel, because we can't store it.
52		Right. But yeah, yeah, I think it's a good step in the right direction. But I do
53		feel that there's, there's a lot that can be adjusted. Like what types of things
54		like, like, as we discussed, like having a storage unit. I feel that electricity
55		going back into the grid is great, but we get paid a negligible amount for it,
56		and it's gonna cost us 1000s of pounds to store the power ourselves. I think
57		that that is a I think it's a good step in the right direction that the government
58		ensures that all new new build homes have to have a solar panel. But they
59		don't really take into account the storage and the maintenance costs of such.
60	Interviewer:	So you wished they like, better off as a way to better optimise
61	Participant 1:	Absolutely, that's an issue. Especially in a country where sunlight is such a
62		precious resource anyway, it would be nice to be able to store it for things like
63		winter or times times when we would like to use it a lot more. Okay. Imagine
64		if you could store it all the way through summer for when you want to have
65		heaters in the winter, that'd be far better off.
66	Interviewer:	So, do you have solar panels? If so, why? If not, why not?
67	Participant 1:	We do and because it's a government initiative that all new build homes have
68		solar panels?
69	Interviewer:	Oh, is it? ,
70	Participant 1:	Yeah.
71	Interviewer:	So on all new builds have to have solar panels?
72	Participant 1:	Yep.
73	Interviewer:	Alright. See, were there any types of considerations or benefits to thinking
74		about before? You got them? This isn't like you're looking forward to this kind
75		of house?
76	Participant 1:	Oh, yeah, it was kind of just as part of the house really? To be absolutely
77		honest. It's still kind of an abstract concept. Like, we know how they work, but
78		we don't know 100%. What, what they do? Okay. We had to call a man into
79		sort of have a look and see how the energy consumption was doing. Because
80		there's a there's a switch in the loft, that I have absolutely no idea how it
81		works.
82	Interviewer:	Let's kind of see what let me make sure it's recording. I think it is. Let me just
83		double check. Yeah, that's all good. Okay. Yes, thank you. So, there's a switch
84		that is switching?
85	Participant 1:	Yes. There's like a junction box that feeds the power from the solar panel
86		converts the power from the solar panels into the house.
87	Interviewer:	So, so there's like a power switch?

88	Participant 1:	Yes. Because it has to convert the solar energy into, into power for the house.
89		Okay, so there's like, almost like a dynamo, I guess, that converts it and then
90		feeds it back to the grid. That's where the battery would go if you had five
91		grand to spare.
92	Interviewer:	Right.
93	Participant 1:	And they're about five grand. They are not cheap. We did look into them.
94		Because objectively, it will be a really good idea. But it was that we're getting
95		a lot boarded. Unfortunately, we have too much crap to not have that last
96		boarded.
97	Interviewer:	I think Tesla does as well. I think it was very expensive.
98	Participant 1:	They are ludicrously expensive.
99	Interviewer:	Pretty crazy. Okay. Question six. What are your thoughts on using solar panels
100		to supplement the energy in your home? So it's been kind of answered, but…
101	Participant 1:	Yeah, brilliant, absolutely fantastic. I mean, obviously supplements, our
102		energy when we use stuff during the day and make sure that we run, we run
103		the dishwasher during the day. We do the washing during the day. So
104		everything would be a drain on the power during the day we tend to use when
105		we know that the solar panel will be feeding energy. And so yeah, that's pretty
106		good, to be honest.
107	Interviewer:	Okay, so it is I guess like when you use appliances, it's kind of considered a
108		little bit because this whole…
109	Participant 1:	Yeah, absolutely. You think about it, yeah, definitely. Absolutely. Little bit.
110		Yeah. Well, as I said, Ms. [name] thinks she is the practical head of the two of
111		us.
112	Interviewer:	Okay, thank you.
113	Participant 1:	No worries.
114	Interviewer:	All right. So question seven, source seven out of 10. What challenges do you
115		think people face when using solar panels? This is also been covered.
116	Participant 1:	I was gonna say exactly. Storage. Yeah, at the moment we are paying, we are
117		sending our energy back to get a negligible amount of discount on our energy
118		bills, when in reality, it would be much more practical for the individuals to be
119		able to store the power that they are producing. It would be so much better if
120		there was a more reasonable consideration where we could look to use that
121		energy ourselves as opposed to feeding it back to energy companies who then
122		sell it back to us for twice the price during the night.
123	Interviewer:	So part of the problem is, you're not getting as much money from the from
124		selling energy as it's costing you to actually get it back
125	Participant 1:	Yeah, yeah. Yeah.
126	Interviewer:	So like being able to optimise?
127	Participant 1:	Yeah, yeah, like kind of important. Having to run everything during the day is
128		a little bit of a faff to be honest.
129	Interviewer:	Especially because like, I guess your usage of your consoles and sophists were
130	Participant 1:	Yes. The sun especially nowadays, it's kind of sick. That's true.

Coding Density

Autonomy — Energy waste

Cost

Energy control

Autonomy

Information

Cost

Insight

Environment

Environment

Remote control

Insight

Manual monitoring

Strategies

Energy preservation

Convenience

Convenience
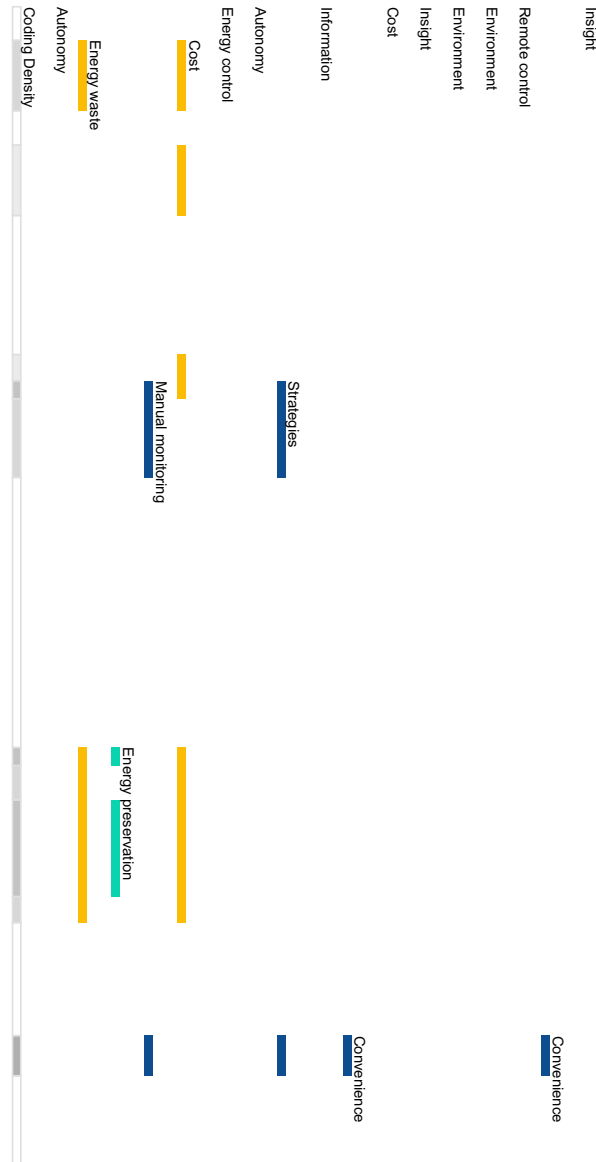
131	Interviewer:	Okay, question eight. Right. So what do you think you could do to improve
132		the energy consumption in your home?
133	Participant 1:	So, our home's pretty well insulated, because obviously, as a new building, it
134		comes as kind of a standard. So we're pretty conscious about that. I, I bought a
135		smart dehumidifier. Okay, specifically for that purpose. So we have a small
136		dehumidifier that runs on a smart circuit in the room that stores my comic
137		books, right? . And we have a large scale dehumidifier outside which purifies
138		the air, but the principle behind that is that it learns. So it basically it registers
139		the humidity at certain times. Okay, so when you first buy it, it will have to
140		learn when you are most likely to say, shower or hang your washing and then
141		it will switch itself onto a higher level at that period of time. . And then it will
142		go into overdrive and then it will switch back just based off the humidity it
143		serves to pre-emptively.
144	Interviewer:	Yeah?
145	Participant 1:	Yeah, anticipates the humidity. Yeah, it's really useful, actually. And in fact,
146		as Emma was deeply surprised, because the things pretty huge. She was
147		paranoid that it was gonna cost an arm and a leg and energy, but thankfully, it
148		hasn't. were burned. But what I will tell you the name of it, it's a British
149		company is really good. Really good. The only only expense we have is filters
150		for it. Okay, you have to buy air filters because they get banged up. But
151		realistically, it's whisper quiet. And yeah, clicks into clicks into overdrive
152		every now and again, but realistically, it doesn't really doesn't really cost that
153		much at all.
154	Interviewer:	It's interesting, because I have a British dehumidifier as well. So I was just
155		wondering, I forget the brand might be it might be the same thing, let me
156		check.
157	Participant 1:	Who is it? Is it's a big ask grey thing. Eback?
158	Interviewer:	eback? Even back? Okay. No, I don't have eback .
159	Participant 1:	So, it's 12 litre smart dehumidifier.
160	Interviewer:	Yeah, that's cool.
161	Participant 1:	That's now dead cheap. Actually.
162	Interviewer:	I've got I've got some as the reason why is because there's like 70% humidity
163		in the house.
164	Participant 1:	Yeah. And so as okay, this is too much not keeping up. 47 actually got to
165		yesterday. It's got a laundry function to speed LED display. And then basically
166		what happens , it specifically put it on at night hasn't been given away. So
167		yeah, basically, yeah, switches and so forth. But yeah, ours is the same, like
168		so. I've, I've got something called Eve sensor. And that sensor, I can monitor
169		from my phone. And it's set up on a circuit. So there's a small dehumidifier in
170		the study, which is where the comics are. And what happens with that is that if
171		it goes over 55%, the small dehumidifier clicks on, okay. And then when it
172		lowers below 54 clicks back off again. You don't actually need to think about
173		it. It's not gonna work for you.
174	Interviewer:	Okay
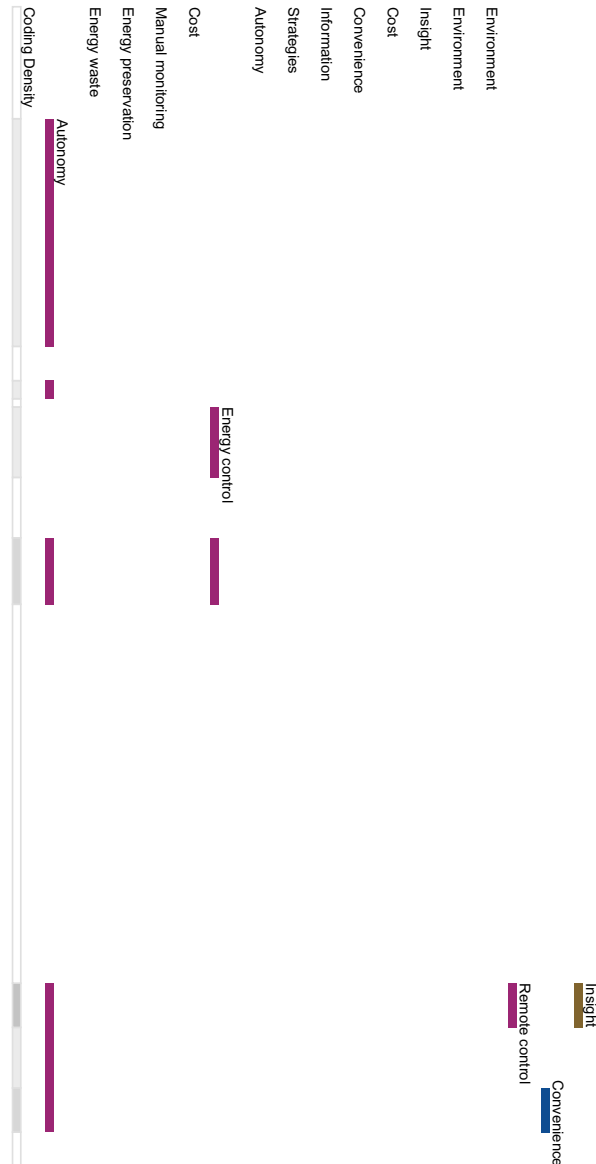
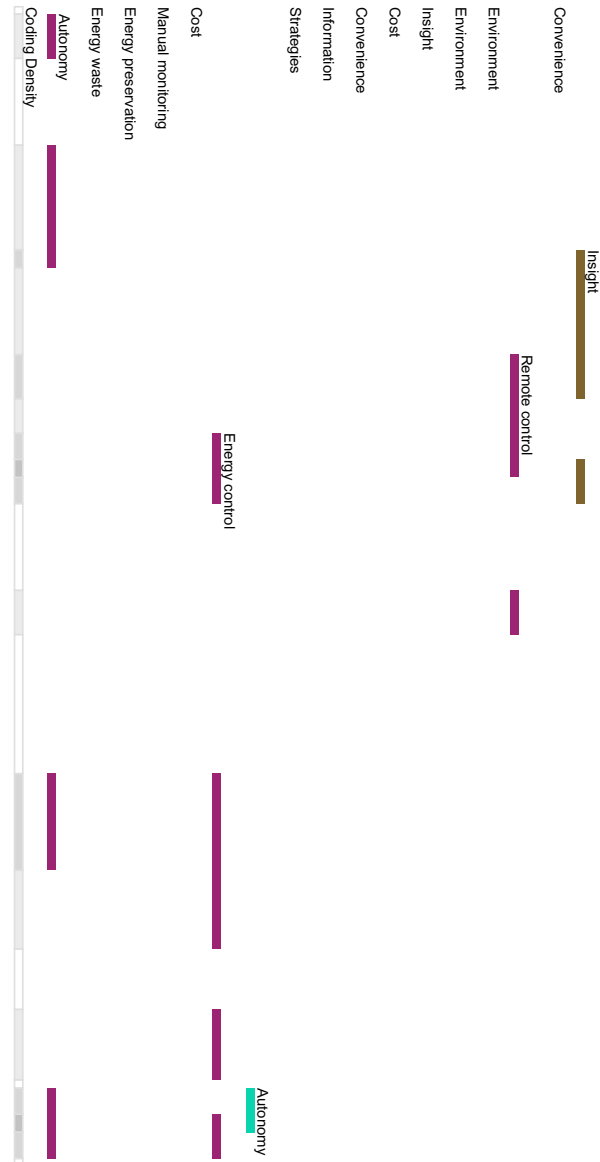| 175 | Participant 1: | So it's just programming in a row that the, the hygrometer will literally pick |
176		up. Yeah.
177	Interviewer:	Two questions. So the last two, so question nine, what do you think of when
178		you think of a smart home?
179	Participant 1:	Pretty much exactly that it's a home where technology serves the purpose that
180		it removes the need to think about things. So not a home that obviously
181		governs itself, but, but assists you in your day to day life. So like, the the
182		dehumidifier example is that I need the humidity in that room to stay at a
183		certain percentage, I have set it up so that it will do that for me. And I don't
184		have to worry about monitoring that on a daily basis. And I can also check at
185		the end of the day, there's a readout on my phone, which will show me when
186		the height when the humidity spiked when the temperature drops to a certain
187		level. So nowadays, we've just got an eve camp, we just got a camera for the
188		back on, okay. Which allows us to pick up when the counsellor leaving, and it
189		will literally show us exactly when that is and I can also switch the light on
190		from my phone to share the scare the crap out of them, which is something I'm
191		never going to tolerate doing to be honest. But yeah, I love stuff like that,
192		being able to monitor things remotely like that. It's pretty useful. But it also
193		allows me to monitor our power usage. So it's kind of like using a house. It's a
194		house that helps you. Yeah, so it's not obviously like the science fiction. The
195		whole house is run by an AI that like small increments that can that can help
196		you work towards a better future for you and the house around you. Yeah. No,
197		I have a strong future. So I know. It is. Apple home is really useful. Like the
198		fact that we can have everything linked to a centralised network, I mean, my
199		Sonos the Sonos in each different room completed for music. I can have
200		different music playing in the study the den downstairs, the kitchen the lounge,
201		and have different songs playing in every single room. And as a kid, that
202		would have been a mind blowing idea. So it's really cool.
203	Interviewer:	I guess like it's a way to help you. Manage a certain level of quality of life.
204	Participant 1:	Yeah, because you don't need to worry. No worries, right? It is the same as our
205		heating. Our heating will click on when it drops below a certain temperature.
206		So if it drops below 18 degrees, it will click itself on and heat the house
207		straight back up, which is absolutely fantastic. Because again, it's something
208		we don't have to monitor, we don't have to be like, oh really cold switch that
209		on the whole house runs on a on a system that basically monitors it for us to
210		improve our quality of life, which is pretty cool.
211	Interviewer:	That is super cool. And then the last question is, in what ways do you think a
212		smart home could allow you to be more energy efficient?
213	Participant 1:	Exactly that I can monitor exactly what power we're using exactly when to
214		make sure that it is only used in a necessity, we're not wasting it, that we're
215		keeping the house warm when I'm realistic, when in reality, it's just because
216		we've got a chill about us. It's because the house has dropped to a certain
217		temperature. The dehumidifier works to specifically optimise power usage to
218		ensure that in both rooms where humidity is an issue. I mean, it's not an issue.

Coding Density

Autonomy

Energy waste

Energy preservation

Manual monitoring

Cost

Strategies

Information

Convenience

Cost

Insight

Environment

Environment

Convenience

Insight

Remote control

Energy control

Autonomy

	219		It's a modern house. We've got no problem. I'm just paranoid. But it ensures
	220		that the humidity is monitored.
	221	Interviewer:	People naturally produce low humidity
	222	Participant 1:	Yeah, absolutely. And we live we live near a river. Like we live there's a
	223		stream pretty much down the road from us. So there's always that paranoia.
	224		Plus, like I have an insurance policy on paper items. They are remarkably hot
	225		and humidity. So stuff like that. It's pretty interesting. But yeah, there we go.
	226		Yeah, that's probably good.
	227	Interviewer:	Thank you very much.
	228	Participant 1:	No worries. I appreciate you talking to someone massive nerd when it comes
	229		to stuff like that.
	230		
	231		

INTERVIEW 2, PARTICIPANT 2

Interviewer: So, this this recording now typically, I know you will have like, just gonna jump immediately into the question. So the first question is, what appliances do you think required the most energy in your home.

Participant 2: So most energy in our home would probably be washing machine and tumble dryer Combi. Really games consoles, because we have a number of homes running at one time, so they use quite a lot of power. We do try and buy energy efficient appliances. So you know, the fridge freezer, the dishwasher all have good eco ratings.

Interviewer: Okay, interesting.

Participant 2: And the dehumidifier so we have a dehumidifier that runs 24/7. Okay, but it's a smart one. So it'll drop down. When it needs to run Max, say if you've had a shower, and it'll drop down throughout the day, okay. And again, that's eco. So I'm not sure how much impact that has on our electricity.

Interviewer: I know you've mentioned it a little bit about running the dehumidifier. But with regards to the other appliances, when do you use them?

Participant 2: So we have solar panels. So what we try and do is run them during the daytime when we're getting that solar energy. So typically, if I'm putting the washer on, I'll do that in the daytime, if I'm doing the dishwasher, we get we load it in the evening, but we weren't on till the morning when the sun's out. And we'll do it then. And then of course, we work both work from home the majority of the time, so laptops, computer screens, all those things they're on in the daytime, in the evening, there will be watching TV, then games consulted that because energy consumption happens in the evening.

Interviewer: So do you think your energy consumption changes throughout the day? Or do you think like maybe using more electricity in the morning compared to afternoon, do you think there is a certain pattern?

Participant 2: I would say we use the ballpark high, we actively try to use the bulk of electricity in the in the daytime, so mid morning through to mid to late afternoon and minimise it in the evening. But of course, naturally in the evenings, you need to put the lights on. And we're going to be doing something to relax that usually involves electricity. And we do charge our phones overnight while we're sleeping. So I think probably is peak in the daytime. But it was not, not a huge peak of you know, I mean, because it's it's evenly throughout.

Interviewer: So how much you consider the electricity cost when running these appliances.

Participant 2: So currently, with the energy bills and enterprises going up quite a lot yet, but historically, much less. So I've only been very strict about when we put the appliances that we can time on. In the last I would say nine months or so. Previously, it was like I guess I want to goes on whatever I mean, it's from dishwasher at night. So we've definitely had a shift now to thinking much more consciously about energy prices and energy consumption. Just because the prices have gotten so much higher.
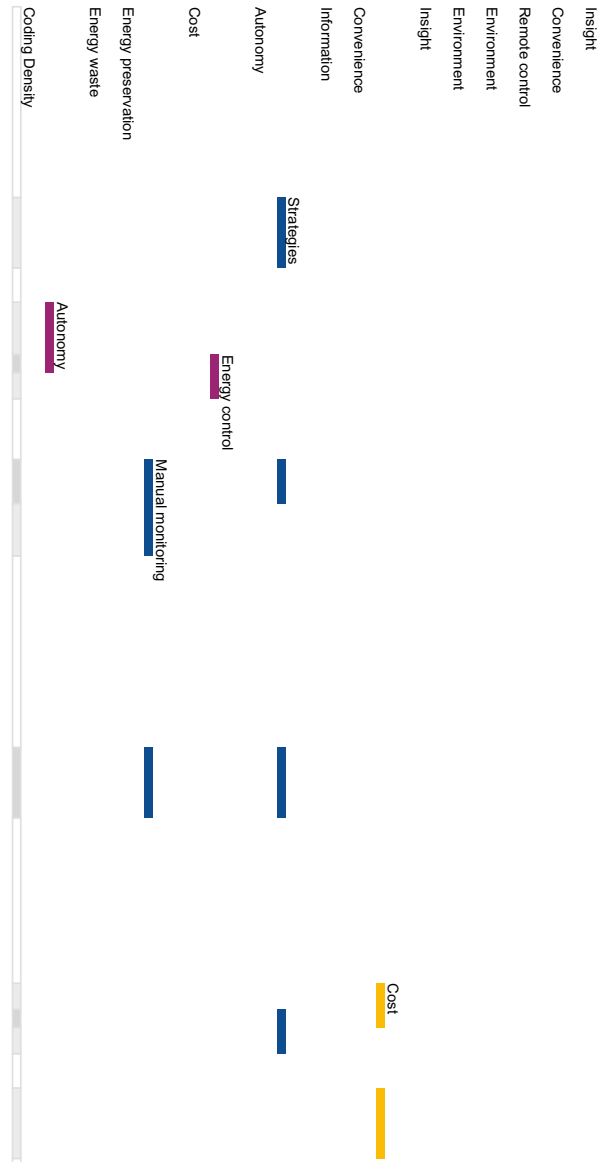
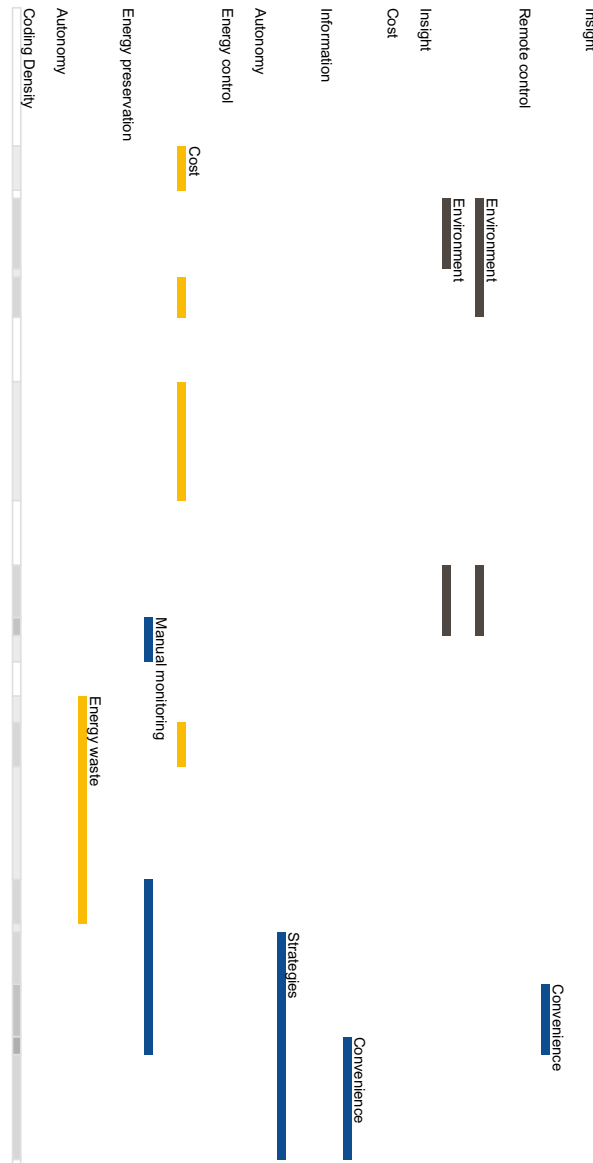| 45 | Interviewer: | So with regards to your solar panels, how would you describe your attitude |
46		towards yourself?
47	Participant 2:	How would I describe? Okay, so genuinely positive. So we bought a new
48		build. So it came with the solar panels, I think that's the government
49		legislation is that new builds have to have them. So it wasn't an active choice.
50		But I do really like them, because I have noticed that, you know, they keep
51		some of the costs off, we've not had the same jumps that some people have.
52		And they make me feel also there is that feeling of you know, I'm doing
53		something for the environment, because I'm using the solar energy as much as
54		I can rather than taking it off the grid from you know, fossil fuel production.
55		So that is it gives you that kind of ethical moral moral boost as well as the
56		financial benefits as well.
57	Interviewer:	Since your house already came with the solar panels imagine if it did not, and
58		how likely would you be to actually instal it yourself?
59	Participant 2:	Because of the cost. And you know, the amount of wiring so as you know,
60		you've got to wire them in, you've got to have a box in our cupboard,
61		essentially, that it's all wired to so because of the cost of installation, I think it
62		would be very unlikely we would have had them installed had we bought an
63		older house.
64	Interviewer:	So overall, what are your thoughts on using solar panels to supplement the
65		energy in your home? So you can think about the efficiency?
66	Participant 2:	Yeah, so I think overall, I think it's, it can be done. And I think it will it can
67		have an impact can have an impact on your individual energy consumption.
68		Then in terms of fossil fuel energy, but I also think that it's not necessarily the
69		easiest because you have to actively think about when you're doing things.
70	Interviewer:	Okay? And why is that? Why do you have to actively think about it?
71	Participant 2:	We don't have a battery. So how's it when you have a solar panels that have to
72		come with the battery, in fact, the majority of solar panels to my
73		understanding don't, because the batteries are very pricey and take up a lot of
74		space. So instead, the energy goes back to the grid. Now, that's really good for
75		other people and the energy companies because there's energy going back. But
76		what it means for us as individuals is that if we're not using it, at the time it's
77		being produced. So minute by minute, then we essentially lose access to that
78		energy. And instead, we withdraw from the grid. And so the energy we use in
79		the evening isn't from our solar panels, it's from from the grid. So to make the
80		most of them, you've got to be thinking, okay, when do I need to consume
81		energy, and make sure that you're doing it in the hours of daylight? So for
82		example, if I want to run the dishwasher, I've got to remember to put it on the
83		right time. If I get to the end of my working day, in the winter, it's going to be
84		dark. So then it's a case of deciding, do I wait till tomorrow? Is there enough
85		space? You know, we only run it when it's full? So can I leave the staff on the
86		surface until tomorrow, because it won't fit in the dishwasher and run the
87		dishwasher tomorrow and reload? Or do I run the dishwasher in the evening,
88		in which case I'm not using the solar panels are not being less efficient. Yeah.

Coding Density

Autonomy

Energy preservation

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Convenience

Convenience

Convenience

89		Same with clothes washing, and with clothes washing, because you want to do
90		the drying, we use a heated era, again pulling the energy from the solar panels,
91		well, that takes longer. So if you don't do your washing kind of in the
92		morning, or lunchtime, you're getting less time drying it using the solar energy
93		coming through the panels.
94	Interviewer:	So what's your impression with regards to the flexibility of using it, of using
95		the solar panels, that kind of suits your lifestyle,
96	Participant 2:	It's fine, it's okay for us, because we work from home, we didn't work from
97		home, it'd be much harder because we wouldn't be at home at the time was
98		when it would be most useful to do the additional energy consumption. It's not
99		just the constant underlying, you know, appliances going on in the background
100		that kind of thing. So in order to use that, to have that discretionary usage, we
101		would need to be home. And you know, we work full time who can work from
102		home now, before the pandemic? Yeah, we probably didn't optimise the solar
103		panels at all, because we weren't there to do so. So I think it would be useful if
104		there was, you know, if you could say, programme, your washers and things
105		like that, and we we've got decent appliances, we don't have high tech
106		appliances, and those, they're really smart appliances possible for money. So
107		to you know, to replace everything with them, one in terms of the ecological
108		efficiency and environmental efficiency, you would be getting rid of perfectly
109		good appliances, that's wasteful. There's energy consumption in the production
110		of those appliances. So in terms of net zero, you're not going to get that that
111		way. So we have the appliances we have till they break, we won't replace
112		them. So that means that we have to actively keep doing it. If you forget you
113		forget that's human, there's no way Oh, we don't set an alarm to get the
114		dishwasher on. Yeah. And there's nothing smart to say, hey, the solar panels
115		are on. In fact, I have to go and check. We've got a box in the cupboard, and
116		we have to go and open the door and stand and watch it. If the red light is
117		blinking, the solar panels are working. If the red light is on permanently, then
118		they're not they're not working, because there's not enough light. So on a
119		cloudy day, you might find yourself having to go and stand in your cupboard
120		and stare at a box to find out if your solar panels have enough light to actually
121		be producing solar energy at that time.
122	Interviewer:	That's interesting. So considering your experience with solar panels, what
123		challenges do you think people face when using solar panels?
124	Participant 2:	The lack of affordable storage options, I understand why the batteries are
125		pricey. But at the same time without the battery, you are going to have a lot of
126		energy running off now it is going back to the grid. So it's not is helping the
127		country overall, I guess but it's still helping the individual. I think another
128		challenge will be I have no idea how to maintain them. And I wouldn't know if
129		there was something wrong with them. And so I went and stared at the box. So
130		actually, knowing that they're not work when they're on and when they're off
131		is a bit of guesswork. So it'd be it'd be good to have a way of understanding on
132		hot to optimise it. You know are they working? I don't know if they are
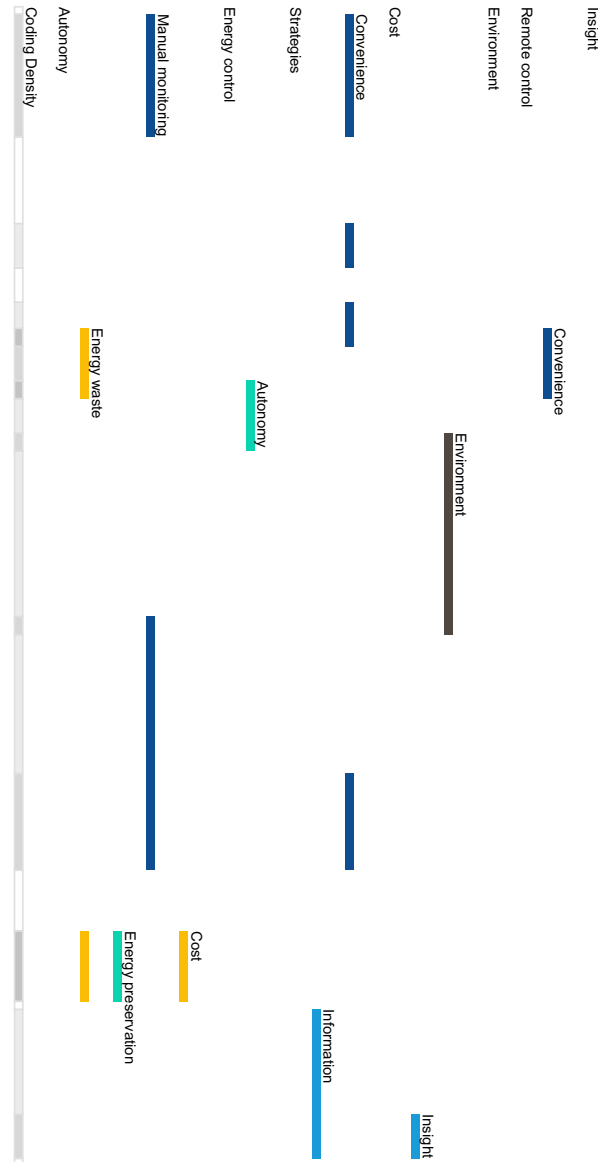
| 133 | | producing more energy at some times and other times whether there's more |
134		energy on a sunny day than a cloudy day I guess there might be and actually
135		we are we have a smart electricity metre mm But because we changed energy
136		provider, what they didn't tell us until after we've moved is that while we have
137		a smart metre, they couldn't read it, only British Gas at the moment can read a
138		smart metre and we're with Aeon. Okay, so my smart metre, little box thing
139		doesn't work. So I can't actually look and see what my energy consumption is.
140		And the smart metre, even if I did only tells me what I'm taking, I assume
141		through the metre, not from the solar panels, okay, so don't actually ever know
142		what I'm using from the solar panel. So it'd be nice to have a smart metre type
143		setup, but that that would say, your solar panels are producing this much
144		energy, and you are using X percentage of that, because that might then trigger
145		me to go, oh, hang on, I need to charge my Kindle. I'll do that. Now. Because
146		I've got 20% energy that I could use. I'll go whack my phone on charge,
147		because that'll put me out. And I could do things even more efficiently.
148	Interviewer:	So you don't actually have an insight into how much energy is being produced.
149		And how much energy is being consumed?
150	Participant 2:	I have a box that blinks a red light when they're working. And that is the end
151		of everything I do. And the rest is essentially looking at
152		my bill and comparing. So for example, at one point, we were leaving the
153		laptops and computer monitors on standby overnight, I noticed the energy
154		consumption was going up. So we stopped using them overnight. But that
155		difference is because we're not using the energy not because we're using the
156		solar energy. Yeah, I don't have a point of comparison in this household to
157		know what the difference would be using them with or without now, as we're
158		getting into winter, we'll have a couple more hours of using not solar energy.
159		So we might be able to tell but on the other hand, the prices have just gone up
160		in October. So that will probably mask it. Yeah, there isn't really a way for me
161		to work out what they're saving me or how much of it I'm using and how much
162		of it I'm sending back to the grid.
163	Interviewer:	Very interesting. So what do you think you could improve, you could do to
164		improve the energy consumption in your home?
165	Participant 2:	More access to the information about what, what, what energy I'm producing,
166		and how much of it I'm using, I think it'd be key to me, also being able to
167		share, as I say schedule things, so that they automatically go on either a set
168		time or more usefully when there is the energy available from the solar panel.
169		So I don't know whether if I'm running a washing machine and dishwasher at
170		the same time. One is using all the solar energy, so the other is pulling from
171		the grid. And I would be better off staggering them so they could each take
172		their turn with a solar energy. I don't know that.
173	Interviewer:	Okay. So what do you think when you think of a smart home?
174	Participant 2:	When I think of a smart home, it's things like the light bulbs that you can turn
175		on and off from your phone. Nest thermostats, which we could think about
176		getting around to Google Home or Apple and all those things. So we've got
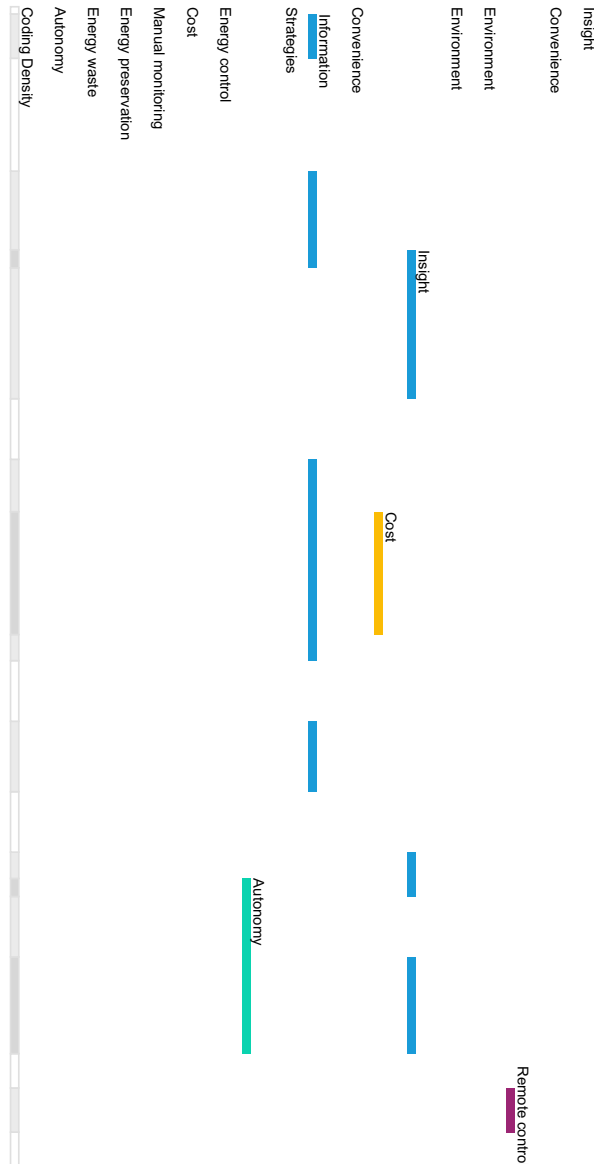
| 177 | | we've got the apple smart devices in our home. So we can, you know, we |
178		mostly use and play music through the house, we do have one of the we've got
179		actually got two dehumidifiers. So one of them is connected to that system. So
180		sat here with you right now, I could technically go in there. Turn on and off
181		the fan. If you give me the fire. I can play some music in the bedroom, but
182		only the cats could hear. Well, yeah, and that's pretty much all I can do from
183		here, maybe control the Apple TV, we could use that more I could do the
184		lights through that I could do the heating, but we don't have it installed. And
185		part of that is that they've also pricey, a smart light bulb is going to set me
186		back the best part of 20 pounds. Standard. Just led energy efficient light bulb,
187		less than a fiver. So I'm not. Affordability is an element, but also, in some
188		cases, usefulness. With light bulbs. Just turn them off on the switch when you
189		leave the room. I think there's been quite some focus on Smart Home things
190		that sound cool, like, Hey, you can play music anywhere. Hey, you can turn
191		lights on and off. When am I gonna want to do that when I'm at home? Turn it
192		all off before you leave. That's not hard. The heating thing is useful, I think.
193		So we don't have a nest thermostat but it would be good to be able to go hey,
194		we're out so don't bother turning the heating up because we're not in cuz we do
195		it on a timer on our thermostats to be able to say actually don't bother because
196		we're out here or you know what we're about to come back and it's limited
197		freezing. Turn it up a bit so it's nice and warm when we get home again,
198		would be nice to be able to do from your phone work with the appliances to
199		turn the dishwasher washing machine. I know there are smart appliances that
200		do that. We don't have them.
201	Interviewer:	So in what ways do you think a smart phone smart home could allow you to be
202		more efficient? - when it comes to your energy consumption.
203	Participant 2:	I think to be more efficient, I mean, there's the thermostat thing. But again, we
204		set quite good when setting the timer and turning it up and down when we're
205		not in etc. So for me, it would really be it being in sync with that solar panel
206		piece and be able to say, hey, the solar panels are working. We'll turn this
207		device on, or we'll optimise it, optimise the energy consumption, toggle this to
208		turn itself down or whatever, you know, you'd have to pre load the dishwasher
209		or the washing machine. But if you could set it to go, if it's low, if there is a
210		tablet in there, and the device is on, but on standby, don't start the wash cycle,
211		start the wash cycle, when the solar energy is at the maximum and you've got
212		it there to do. So it's almost like the two devices communicate. Yeah, so the
213		two devices communicating saying this one saying hey, I'm all set up. Yeah,
214	Interviewer:	Interesting.
215	Participant 2:	Yeah, I think it would need to, for me the efficiency would be we as a
216		household or what, sorry, I as a member of the House quite on quite on it in
217		terms of when we're using what, but it would be good to have it be able to me
218		go right at night or put everything in the washing machine dishwasher. Smart,
219		whatever, turn it on when it's got the solar panel to do it.
220	Interviewer	Lovely, thank you for your help. Is there anything else you would like to add?

221   Participant 2:   No, I don't think so.
222
223
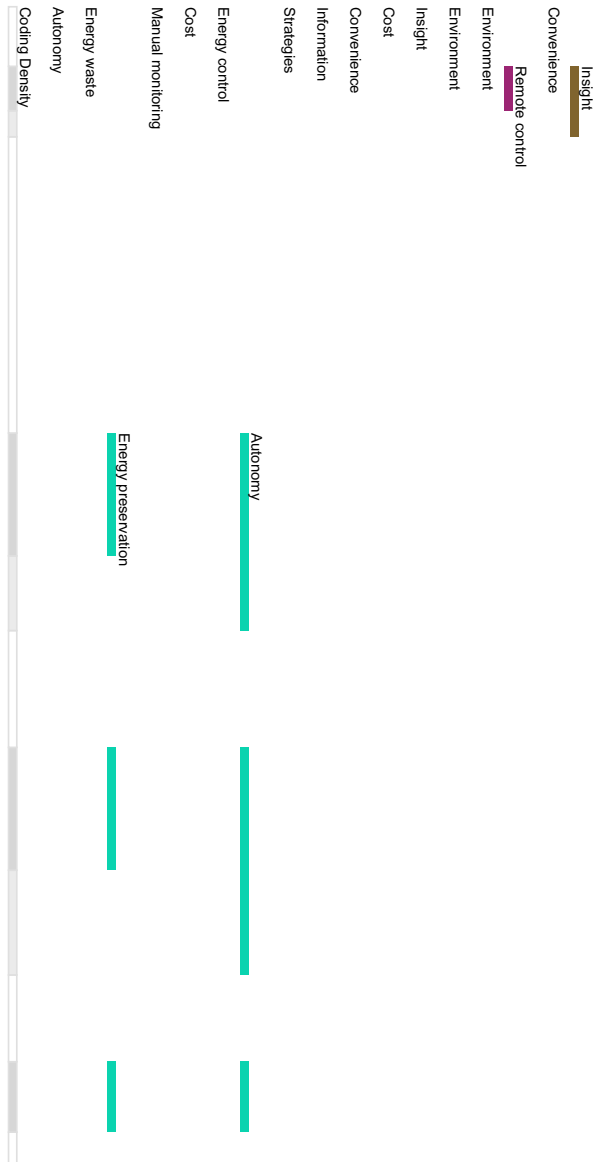
Insight
Convenience
Remote control
Environment
Environment
Insight
Cost
Convenience
Information
Strategies
Autonomy
Energy control
Cost
Manual monitoring
Energy preservation
Energy waste
Autonomy
Coding Density

INTERVIEW 3, PARTICIPANT 3

1		
2		
3	Interviewer:	All right. Mr. [name], first of all go through ethical considerations. In line with
4		ethical guidelines for conducting research interviews, your name will be
5		anonymized and replaced with an ID number. The interview recordings will be
6		securely stored on Password Protected laptops. And the data will be reviewed
7		and analysed only by the group members and solely use for initial intended
8		purpose. Sure. So I'll go through 10 questions, and we will please answer
9		them.
10	Interviewer:	So the first question is, what appliances do think require the most energy in
11		your home?
12	Participant 3:	I think most appliances are Energy Efficient in my home. However, the most
13		the one which uses the most electricity is probably the shower oven and
14		electric heaters.
15	Interviewer:	Would you say the heaters are the most consuming ones?
16	Participant 3:	Yeah. Especially in the winter if you use. Yeah. All right.
17	Interviewer:	When do you use them? So you said the heater in the winter and the others
18		obviously, oven you use it more often? When you cook, and then shower, you
19		use it frequently?
20	Participant 3:	Pretty much every day. If it's basically on a daily basis, showers ona day to
21		shower and oven pretty much on it.
22	Interviewer:	Would you use heaters during the rest of the year or only in winter?
23	Participant 3:	Winter.
24	Interviewer:	How much do you consider the electricity cost when you run these appliances?
25	Participant 3:	The shower uses quite a lot of electricity, I think. Probably a pound per
26		shower.
27	Interviewer:	So when you're taking showers or cooking you mean a kilowatt? Now, I mean,
28		when you when you use these appliances, do you think about electricity cost?
29		Do you take that into consideration?
30	Participant 3:	Oh, I need to finish my shower quicker or things if you're if you're on a
31		budget, you probably would consider you would think about how long because
32		you're showering
33	Interviewer:	Do you think about this on daily basis or time to time or you don't really take
34		that into consideration?
35	Participant 3:	I do. So I would rather use say like with a heater, I'd rather use the gas heater
36		rather than using electricity heater because it's more energy efficient.
37	Interviewer:	And with our appliances do you think of when using them to use them less?
38	Participant 3:	Not really, I don't think about it. I just Okay, yeah. Obviously, things like
39		tumble dryer. If the weather's good outside, then you wouldn't use tumble
40		dryer because it uses quite a lot of electricity as well.
41	Interviewer:	All right. Next, we'll move on to questions regarding solar panels. How would
42		you describe your attitude towards solar panels,
43	Participant 3:	I think it's a pretty good idea to have solar panels. I'm, I'm for it. I actually did
44		have solar panels to our panels, and it was very efficient. The solar panels
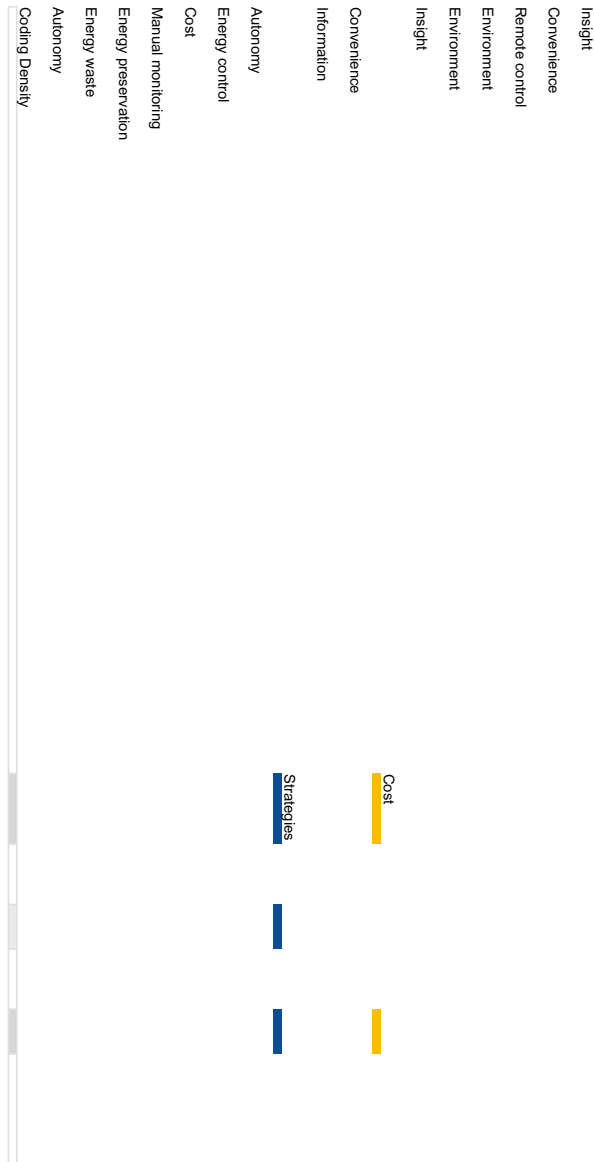
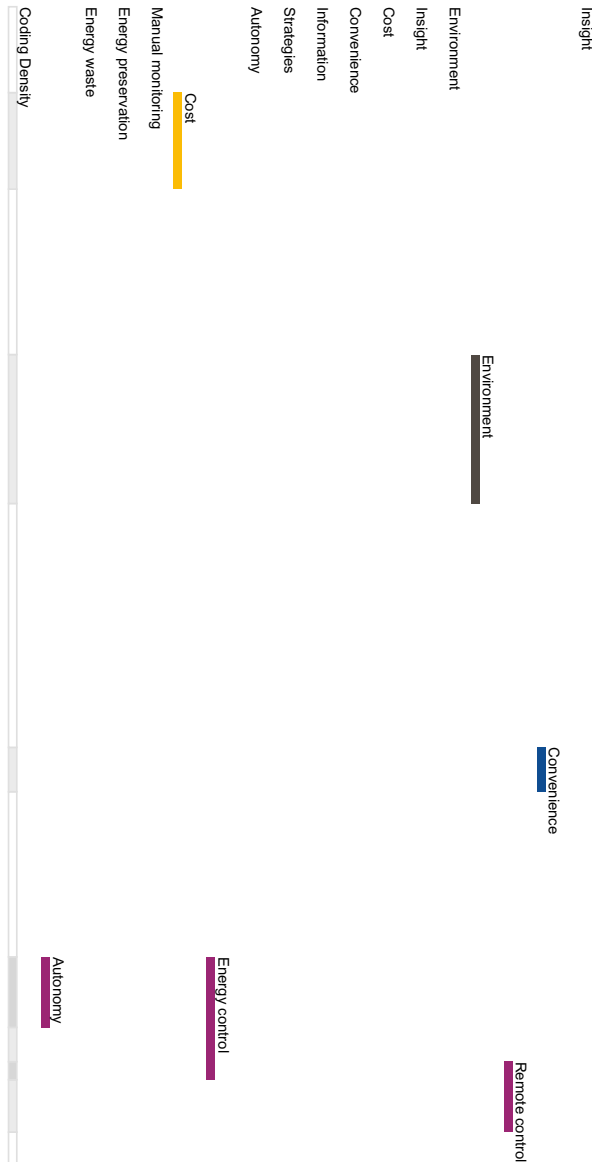| 45 | | were installed maybe about seven or eight years ago, when there was an |
46		incentive for people to instal the solar panels. And during that time, the
47		National Grid used to offer good rates to buy your electricity and I've
48		benefited quite quite a lot from it. So I the electricity I used to produce from
49		solar panels was enough for me, obviously for the day to day use. And also I
50		used to sell quite a lot of it as well. So which used to cover the bills for gas as
51		well. So I pretty much haven't paid for electricity when I had solar panels.
52	Interviewer:	Okay so you can't answer this question now, but we'll go through it. What are
53		your thoughts on using solar panels to supplement the energy in your house?
54	Participant 3:	With solar panels obviously you've got several types of solar panels. I had
55		both. So I've had the heated solar panels which obviously used to produce the
56		hot water in your house. But also I used to have the normal solar panels which
57		which is for electricity periodic, I think. Like, what there is a requirement now
58		for new homes. Like when when you apply for planning, they, the requirement
59		is to have the solar panels as well as plugin plugin for the electric cars. So
60		which which, which is pretty good idea, I think, because that would bring UK
61		or any other nation who got those requirements into more like a energy
62		efficient world, which means people will be using less electricity and moving
63		towards self producing, obviously electricity.
64	Interviewer:	I see. Yeah. So, you mentioned two types of panels, which ones do you think
65		are superior?
66	Participant 3:	Electricity, because the electricity one obviously produces the general
67		electricity, but also, you can use that electricity to heat up the water in your
68		like to act as a immersion heater. Yeah.
69	Interviewer:	I see. Thank you. And finally, what chain challenges do you think people face
70		when using solar panels? Can you talk about what challenges you had?
71	Participant 3:	I think the main main challenge, obviously, having the right type of house. So
72		if you have a south facing is obviously you're gonna get better energy out of it
73		as well, because you you have electricity pretty much all day. The second
74		challenge is applying for planning permission. Because to have the solar
75		panels you have to apply for planning which have to be approved by Council,
76		you can't just instal them, because it's changing the appearance of the building.
77	Interviewer:	I see. Thank you. And for the last section of our interview, I'll ask you about
78		smart homes. What do you think you could do to improve the energy
79		consumption in your house?
80	Participant 3:	In my own house, I've got what my house is very smart. So I've got smart TVs,
81		switch to control each radiator. But I also have the smart control which
82		controls the temperature in the house, which means my well the heating my
83		house is not running constantly. This one second thing is the lighting
84		obviously nowadays with a smart technology, you can dim the lights which
85		uses less electricity as well. And say like if you've if you left home and you
86		forgot to turn the turn off the lights, you can still turn them off by using your
87		phone which is pretty good I think. Yeah.

Coding Density

Energy waste
Energy preservation
Manual monitoring
Autonomy
Strategies
Information
Convenience
Cost
Insight
Environment

Insight

Cost

Environment

Convenience

Autonomy

Energy control

Remote control

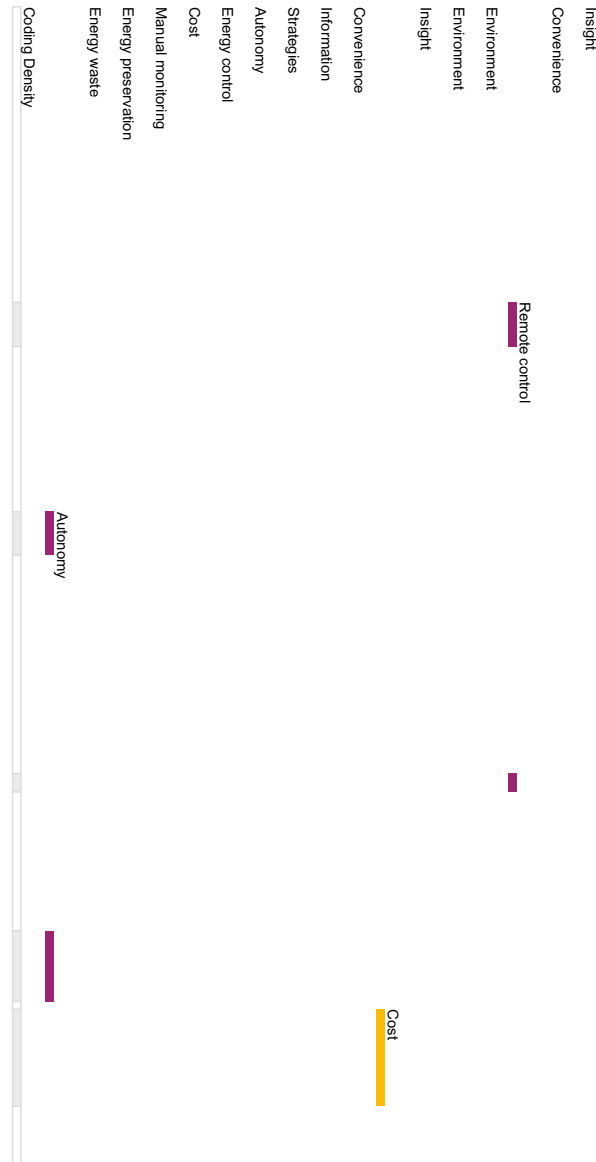|	Interviewer:	So, you describe that you already have a very smart house to begin with. Do
88		
89		you have any ideas how you could improve over what you already have?
90	Participant 3:	I guess because the smartphone produces that there are so many smartphone
91		produces and not all the devices compatible to each other. So I think if that
92		was centralised that would that would be very beneficial. Because then you
93		don't have to shop with one company like not not all companies necessarily
94		have all the technology like if if you had all the companies using the same
95		centralised system then you can have a very smart home.
96	Interviewer:	Now in general step back - What do you think of when you think of a smart
97		home? Like describe the utopian smart home in your vision?
98	Participant 3:	The Smart Home Smart Home obviously uses requires the internet so your
99		your house have to be connected to the internet. And I'm totally for the
100		smartphones. I'm a I like the idea of it. I think what do you mean in terms of
101		let's say not only related to energy consumption even what other devices you
102		would have would make make your house home for example. Automatic
103		Hoover's or stove I know, Some smart iron that, so now we're going into
104		robotics on this side. Yeah, yeah. You could have a smart Cleaner in a house
105		or smart chef. Yeah. Is it as well. But I think the technology is there for most
106		of the things. And what I could use the smart home for, I think I'm using it for
107		I think, if I really wanted to, I could have like, an automatic garage and
108		automatic blinds for outside or automatic curtains, for instance. Yeah. Or the
109		doors for instance, rather than using the keys. It's like a keyless entry or
110		whatever. Yeah. But then there is obviously with a smart homes, there is also a
111		risk, I believe, because anything connected with the internet is a race because
112		someone can hack it. Someone can hack the house and use all the technology
113		smart technology. The second risk is obviously we don't know 100%. If our
114		data like if our data is actually being collected, yeah. Because obviously,
115		things like Alexa, always like that. It always listens. And based on what it
116		listens is, it makes the suggestion sort of what you should be buying. Yeah. So
117		I think that's the only downside of it. But other than that I'm for smartphones.
118	Interviewer:	All of these smart things also take into consideration US electricity. So having,
119		for example, a smart cook something like that will use a lot of energy. Would
120		you still go for it? Or do you think there is a limit at which we should let us let
121		humans still do it? Because it's more energy efficient? Or you think it's a
122		normal progression that we have?
123	Participant 3:	I don't believe the smart homes use a lot of electricity uses the same. To boil
124		the kettle? It's the same was what? It's the same as the human boiling the
125		kettle, I suppose. It's just a physical touch, I suppose. More about it. Okay.
126		Yeah, I suppose. I don't know how deep you want to go about it. Like if we go
127		for like self boiling technology, where you've got the taps, which constantly
128		keep the boiling water, then I don't believe it's 100% efficient, because you
129		don't always use the boiling water, but it's always heating. So, yeah.

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Cost

130	Interviewer:	All right. Thank you. And last question, in what ways do you think a smart	
131		home could allow you to be more energy efficient? You've already talked	
132		about it if you could do a quick TLDR	
133	Participant 3:	So, I've gave you an example of heating, smart heating, obviously. So by	
134		setting up the temperature, the temperature in the house obviously keeps the	
135		temperature it doesn't require the doesn't require you to obviously turn on the	
136		heating and keep it on until it reaches the particular temperature, where the	
137		smart home will allow you to maintain the temperature which works out	
138		cheaper in a way because it doesn't have to constantly work. Same with the	
139		lighting, obviously, I've mentioned about the lighting. So Dimming the lights	
140		or have a habit on the automatic mode also is very efficient. And thermostats,	
141		obviously if you've got the rooms which you don't use in the house, so you	
142		don't have to hit them so which means you can switch them off on your phone	
143		and that saves electricity as well.	
144	Interviewer:	All right, thank you very much for your time. Have a nice day. Mr. Berger.	
145		Thank you. Is there anything you want to clarify or add?	
146	Participant 3:	No, that's all, thanks.	
147			
148			

INTERVIEW 4, PARTICIPANT 4

Interviewer: What supplies do you think require the most energy in your home?

Participant 4: I think it's a gas cooker.

Interviewer: Okay.

Participant 4: And the next thing is the computers

Interviewer: Okay, so when do you use them?

Participant 4: I always use my gas cooker to cook my lunch and cook my dinner.

Interviewer: So, how much do you consider that are the electricity costs? How much do you consider the electricity when you're using the appliances, like how much money you think it's costing you a month?

Participant 4: Gas cooker don't consume a lot of electricity, is consuming natural gas.

Interviewer: Okay.

Participant 4: On the other hand, computer consumes a lot of electricity because I need to write my papers files and run some simulations, and something like that. Yeah.

Interviewer: Okay, yeah, we are going to ask some question related to solar panels. So, how would you describe your attitude towards solar panels? So, what do you think about it?

Participant 4: Oh, yes, actually solar panels are very good, can provide very clear energy compared with fossil fuels. It has some problems like energy fluctuation because you know, some go into waste when sun goes down every day, right. So you can't have clean energy to burn when some cloud covers sky or are a night, you can't have the clean energy for your electricity

Interviewer: Yeah. If you have them now why if not, no, why not?

Participant 4: Yeah, I actually I don't have. I didn't install them into my house. But I'm a scientist. I do actually do some experiment about solar panels.

Interviewer: What are your thoughts on using solar panels to supply the energy in your home?

Participant 4: I think if you if you use solar panels to provide energy to your home, firstly, you need to consider the energy fluctuation. It is the most important thing and also renewable energy and also to wind power. I think if you really want to use solar panels, I would suggest to you to instal also some batteries and compose them into a system. Okay. Because if you, if you go to work in the day, you abandon a lot of clean energy. If you have batteries, you can store the electricity and when you come back home, you can use that.

Interviewer: Okay. Yeah. And what challenges you think people face when they using solar panels? What do you think?

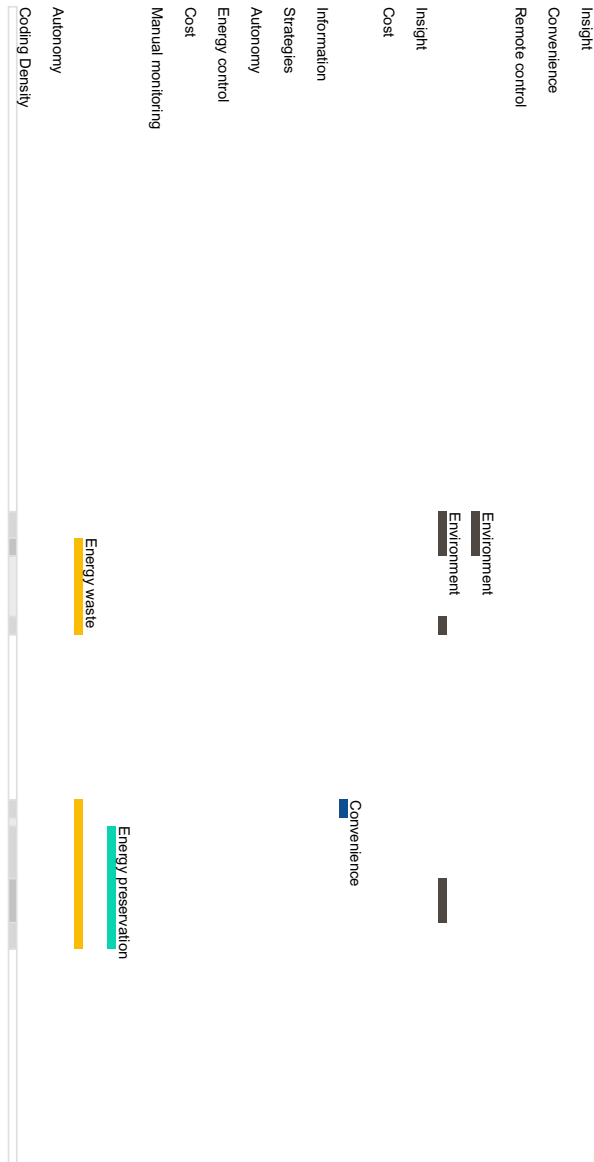Participant 4: Like, I just thought, the energy fluctuation.

Interviewer: Okay, yeah. And that's it.

Participant 4: Sorry, that's all. That's all the challenges. It's the most important thing. What do you also need, is to have enough area to instal the solar panels. Yeah. You should have wider range, something with much more space to instal solar panel.

45	Interviewer:	Yeah. And next, I'm gonna ask some question related to the smart homes. So
46		what do you think? What do you say? What do you think your do to improve
47		his energy consumption in your home?
48	Participant 4:	I think the most efficient way is turn off the light when you don't need that.
49	Interviewer:	Yeah, yeah, exactly. And what do you think of when you think of a smart
50		home?
51	Participant 4:	I don't get an actual definition about a smart home, to me is likely a patient
52		home or a home with installed renewable energy system or renewable energy
53		appliances. Solar panels, you can consider it as energy efficient home that uses
54		artificial intelligence like Google Home or artificial intelligent home. Yeah.
55		So, you can consider it all for, you know, your energy efficiency and waste.
56		Come through all of it. You know? Maybe it's a good idea. When I think about
57		the will, always think about the smart home. Yeah. Like, it can control your
58		home. Automatically. Yeah. While you're in a room the light will turn on.
59		Yeah. And when you leave for work, it will turn off. Yeah. That's a good idea.
60	Interviewer:	Yes. So in what way do you think a smart home could allow you to be more
61		energy efficient?
62	Participant 4:	I think the most important thing for a smart home is financial control system.
63		Oh, yeah. Maybe, maybe you can use some artificial intelligence to control the
64		energy and energy costs. Yeah, energy flow and energy cost, anyway.
65	Interviewer:	That is the end of the interview, is there anything you want to add?
66	Participant 4:	No, thank you.