"I Can Watch What I Want": A Diary Study of On-Demand and Cross-Device Viewing

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ABSTRACT
In recent years, on-demand video services, such as Netflix and Amazon Video, have become extremely popular. To understand how people use these services, we recruited 20 people from nine households to keep a viewing diary for 14 days. To better understand these household viewing diaries, in-depth interviews were conducted. We found that people took advantage of the freedom and choice that on-demand services offer, watching on different devices and in different locations, both in the home and outside. People often watched alone so they could watch what they wanted, rather than coming together to watch something of mutual interest. Despite this flexibility, the evening prime time continued to be the most popular time for people to watch on-demand content. Sometimes they watched for extended periods, and during interviews concerns were expressed about how on-demand services make it far too easy to watch too much and that this is often undesirable.

CCS Concepts
•**Human-centered computing** → **Empirical studies in HCI;** *Human computer interaction (HCI);*

Author Keywords
On-demand video; film; television; video; streaming; diary study; mobile viewing; IPTV; VoD; SVoD; binge watching

INTRODUCTION
Consuming video through on-demand video services has become a popular activity in recent years. According to the Nielsen company, 43% of people globally watch some kind of on-demand video at least once a day [3]. Subscriptions to paid services (e.g., Netflix and Amazon Video) are rising year on year, and total on-demand viewing as a percentage of all viewing (including viewer-recorded content) is also increasing annually in the UK [12].

With the rise in popularity of on-demand services, what impact is this having on how people consume video content? Large-scale surveys, such as those from Ofcom [12] and Nielsen [3], are useful for giving a general impression of the popularity of on-demand services. However, such surveys can lack the necessary level of granularity to unpick what is driving these viewing practices. For example, Ofcom [12] suggest that the TV is still the most popular way to view, but that 21% of the online population choose to watch on a phone, 23% on a tablet and 33% on a computer at least once a month. These surveys provide useful data but do not ask about important contextual and situational factors that might be affecting why people choose to watch on one device over another. Does this decision of which device to use depend on where the person is watching? Who they are watching with? What time of day they are watching? What they are watching? We focus here on what motivates such decisions that people take when viewing.

In this paper, we describe the results of a diary study conducted to provide a detailed snapshot of everyday viewing behaviours using on-demand services. The work presented here extends an initial analysis of these viewing diaries [16] by describing the prevalence of different practices surrounding on-demand viewing. In particular, we focus our analysis on unpicking differences in viewing behaviour on handheld mobile devices and non-mobile devices. In this paper we also present the results of in-depth interviews that were conducted to better understand these household viewing diaries. These interviews focused on understanding what motivated different viewing behaviours: why people choose to view on particular devices, watch in different locations, and watch alone or together. We also develop an understanding of people's positive and negative perceptions of on-demand services.

RELATED WORK
Prior to the advent of on-demand video services, viewers had limited choice about what they watched, and when and where they watched it. Previous research from this era gives us an insight into "traditional" linear TV viewing practices. For instance, evening viewing after the working day was especially popular, particularly in the living room [18]; people watched TV regularly, often for multiple hours per day [8]; and personal viewing schedules were based around broadcast schedules, which in turn influenced other household activities [6].

Considering the current popularity of on-demand video services and mobile viewing, surprisingly little HCI literature has addressed it. An early study by O'Hara et al. [13] sought to better understand how watching video on mobile devices fits into people's lives. In agreement with similar findings by Ofcom [11], O'Hara et al. [13] found that portability and fitting

TVX '18 June 26–28, 2018, SEOUL, Republic of Korea

ACM ISBN 978-1-4503-5115-7/18/06.
DOI: https://doi.org/10.1145/3210825.3210832

in with other peoples' schedules were important factors. They also found other reasons for watching, such as simply passing time, and being able to be present with others while still consuming video privately. Conversely, O'Hara et al. [13] also found that mobile video was used to disengage with others and signifying the wish to be left alone. This study mainly focused on the motivations rather than establishing prevalence, perhaps due to being conducted back in 2007, before powerful mobile devices and on-demand video services were commonplace.

McNally and Harrington [9] conducted a more recent study on how teens and millennials consume mobile video, again focusing on motivations rather than prevalence. They found that motivations depended on mood and emotional state. McNally and Harrington also investigated how content was chosen, finding that it was based on the level of stimulation provided, as well as video length and amount of engagement required.

Bury and Li [2] conducted a survey study in 2013 into different ways of consuming TV. They found that mobile viewing was unpopular, with 70% of respondents never having used mobile devices for viewing. Those that participated in mobile viewing mainly did so when travelling and commuting. However, this seems to have changed in recent years, with mobile viewing growing in popularity [12]. This study also clearly shows a general shift away from live TV viewing to online viewing.

Barkhuus and Brown [1] conducted in-depth interviews to understand how TV watching was changing as a result of new technologies. In particular, they focused on personal video recorders (PVR) and internet downloads, as this study was conducted in 2009, before on-demand video services were common. They found that most participants who used a PVR system had moved away from watching live TV almost entirely, preferring to queue up recordings from their downloaded library. This freedom from the TV schedule was particularly valued by those with non-standard work schedules.

Irani et al. [7] conducted a diary study of people's viewing habits. This study examined the temporality of viewing in 14 households, which included the use of time shift and early on-demand services. They found that viewing was typically based around the rhythms of individuals' lives, households, and peers. The ability to choose when to watch could help align televisual schedules, allowing members of a household to watch together. There was also much discussion in households about what to watch and about the content of a show. Irani et al. also found that TV content was used as a background to other tasks, and to fill gaps of unscheduled time.

A study by Vanattenhoven and Geerts [20] also looked at how different ways of consuming media occurred around the house via qualitative interviews, including on-demand content. They noted that viewing depended on the context of other things happening in the household. They found that on-demand viewing typically involved "heavier" content requiring more focus (e.g., films and TV series), and took place in the evening. In contrast, broadcast TV typically involved "lighter" content (e.g., news), which was watched while doing other tasks.

Nogueira et al. [10] analysed a large dataset from a Portuguese IPTV operator. While the insights from this work are largely concerned with the technicalities of delivering video to consumers, it does offer some high-level insights into viewer behaviour. Nogueira et al. found that users interacted with this service throughout the day, though viewing was most popular in the evening. They also found that users exhibited a large amount of "zapping" behaviour in order to select content, similar to "channel surfing", taking on average 2.5 minutes to settle on something. However, their data does not offer insights into mobile viewing, and only covers use of a single video service.

In summary, previous research has provided useful perspectives into how people use on-demand video services. A common theme is that people value and and take advantage of freedom from the broadcast schedule, allowing them to choose viewing times that suit them. Furthermore, much of the literature reveals a strong social element to watching TV. Be it watching together, selecting content together, or discussing shows with friends and colleagues, social factors appear to affect viewing practices. Prior research also gives us a limited perspective on viewing on mobile devices, specifically regarding motivations for doing so, which are many and varied.

While the phenomena of on-demand viewing and mobile viewing are strongly coupled, they have not been investigated together from an HCI perspective using recent, real-world data, which would allow us to develop deeper behavioural insights. Furthermore, we do not know exactly how people are using these services throughout the day over longer periods of time, across different devices and services, and what motivates particular viewing behaviours. In the following sections, we present the results of a diary study with interviews that was conducted over a 14-day period with 20 people from nine households. We asked people to record the details of each time someone viewed on-demand content in the household. These diaries focused on when and where viewing took place, as well as which services and devices were being used. Pre- and post-study interviews were also conducted to further probe and understand these present-day viewing practices.

METHOD

Participants

Ten UK households who watched at least five hours of on-demand content a week were recruited through word of mouth and advertisements (see Table 1 for breakdown). One (household C) withdrew, leaving 20 remaining participants from nine households. Mean age was 29.8 (SD = 13.8). Households were paid £100 (~$137) for 14 days of continuous participation.

Materials

Households chose either a paper or digital diary. Seven chose digital and two chose paper. For the digital diary, data was entered into an online form using any device with a web browser. Results were stored in a spreadsheet. For the paper diaries, custom diary booklets were created for each household. After data collection, they were digitised in the same format as the digital ones for ease of analysis. Diaries were designed to make data entry as easy as possible, e.g. with checkboxes for names, locations, and services.

Participants completed information about each viewing session, defined as a period of viewing with at least 30 minutes of

Household	Responses	Location	Notes	Participant	Age	Gender	Nationality
A	27	Birmingham	Cohabiting couple	A1	57	F	British
				A2	68	M	British
B	36	Birmingham	Parents and their children	B1	33	M	British
				B2	38	F	British
				B3	8	M	British
				B4	4	F	British
				B5	2	M	British
C	-	-	Withdrew	-	-	-	-
D	22	London	Cohabiting couple	D1	32	M	Spanish
				D2	29	F	Spanish
E	18	London	Cohabiting couple	E1	31	M	Danish
				E2	29	F	Danish
F	24	London	Cohabiting (others not participating)	F1	27	F	Mexican
G	14	London	Cohabiting couple	G1	32	M	Italian
				G2	32	F	Italian
H	15	Oxford	Cohabiting friends	H1	27	F	British
				H2	30	F	British
I	7	London	Cohabiting couple	I1	27	F	German
				I2	35	M	British
J	15	London	Cohabiting couple	J1	31	M	German
				J2	33	M	British

Table 1: Participant household profiles

non-viewing activity either side to allow for short to medium breaks. Participants were required to fill in basic information about their viewing: who was present, start and finish times, what was watched, how long for, devices and services used, location, and breaks they took. They were also asked to justify and explain their responses, where appropriate.

For this study, on-demand content is defined as that which is accessed at the viewer's convenience. This includes catch-up services (e.g. BBC iPlayer), subscription services (e.g. Netflix, Amazon), short-form content (e.g. Youtube, Facebook), and content downloaded or recorded onto computers or personal video recorders (e.g. TiVo). We also focus on two groups of devices: non-mobile devices (TV, desktop computer, laptop computer) and handheld mobile devices (phone and tablet).

Procedure

After recruiting participants, a preliminary interview was conducted to ascertain their general on-demand viewing habits and motivations. They were then briefed on how to enter data in their diaries. Participants were requested to create at least one diary entry per day, but this could simply be to say that no viewing took place. For each household, one participant was nominated to be responsible for the diary and complete it on behalf of others if necessary, though other household members were encouraged to fill in the diary as well. During the study, participants were sent SMS reminders every evening to encourage participation. After the study was over another interview was conducted to ask them about their experiences with using the diary, as well as to explain particular behaviours.

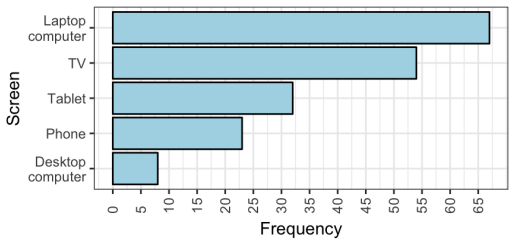

Figure 1: Distribution of viewing screens

RESULTS

Participants created 202 diary entries in total. Of these, 24 said that no on-demand service usage occurred that day, leaving 178 remaining entries describing on-demand viewing. Mean entries per household was 20.6 (*SD* = 9.1). These diaries captured 188:36:00 (HH:MM:SS) of viewing time, with a mean of 20:57:20 per household (*SD* = 08:10:11). We provide both a quantitative and qualitative analysis of diary entries. For all statistical analysis we opted to aggregate data by household rather than at the level of the individual participant. Interviews were also conducted with participants at the end of the study to learn more about their diary entries and on-demand viewing habits. These interviews were transcribed and were analysed thematically using an inductive coding approach.

In this section, we present data from both the diary entries and direct quotations from the thematic analysis of our interview data. We cluster this around eight different headings. First, *viewing screens*, is where we consider which devices people chose for viewing and why. Second, *viewing location*, where we consider the places both inside and outside of the home where people chose to view. Third, *viewing time of day and duration*, where we consider how viewing fits into people's daily activities and how long they view for. Fourth, *services used*, where we consider exactly which on-demand services people used to access content. Fifth, *watching alone and watching together*, where we consider participants' co-viewing habits. Sixth and seventh, *positive perceptions of on-demand viewing* and *negative perceptions of on-demand viewing*, where we explore what people like and dislike about these platforms. Finally, *binge watching*, where we focus on how on-demand services can facilitate viewing a lot of content in one session, and how people think about and define binge watching.

Viewing Screens

We first focus on the kind of screen that participants used to view content. Diary entries fell into five distinct viewing device categories, pre-specified in the participants' diaries. These are shown in Figure 1. We further collapsed these device categories into two distinct groups: non-mobile devices (TV, desktop computer, laptop computer) and handheld mobile devices (phone and tablet). Of the 178 entries, 55 (29.9%) contained viewing on a handheld mobile device (i.e., phone or tablet). Households reported more viewing sessions on non-mobile devices (M = 14.0, SD = 8.3) than on handheld

mobile devices (M = 5.8, SD = 6.7). However, this difference was not significant, $t(8) = 1.98$, $p = 0.08$.

To further understand how people chose a viewing device, we next look to diary their entries and what was said during the end of study interviews. It became clear that different viewing devices were chosen for different reasons. For example, participant A1 described how she and A2 (her partner) would choose their tablets when they wanted to watch content individually, while still being together in the same room.

A1: [We watch] the stuff on the tablet singly — we both watch different things on that — but on the TV we tend to put something on that we both want to watch.

This was later clarified:

A1: I can watch what I want to watch. We both put our earphones on and we can then watch our own watching[...]. The TV, that's our bit of relaxation together. But our little bit of YouTube is what we do on our own.

Portability was another factor. Participant B1, an eight-year-old child, said he liked to be able to watch anywhere, instantly:

Interviewer: Why do like to watch it on a tablet?

B3: Because I can take it anywhere. TV, [...] you have to leave it there. And [other devices] take loads of time to set up if you take it somewhere.

Participant J1 said that the device could dictate the content that was viewed, with phone viewing only being for short clips:

J1: Most of the time the phone is usually for only shorter snippets it's like YouTube, or Twitter things... like really short up, to five minutes or so. [...] if I'm taking the time to watching something for longer, I can also take the time to just sit on the couch and relax.

Participant F1 said the phone was her preferred device in many cases, also due to the immediacy of it:

Interviewer: You seem to watch on your phone quite a lot. Is that your preferred device?

F1: Yeah, I mean that's when I'm at home. I think when I'm [at work] I use my laptop.

Interviewer: So what do you like about the phone for watching stuff on?

F1: That it's just more immediate.

However, mobile viewing was consistently seen as being unfavourable and was often avoided if possible. This was typically due to small screen sizes, as stated by household I:

Interviewer: So do you ever watch on tablets or phones?

I2: No.

Interviewer: Never? Absolutely never?

I2: Never.

Interviewer: Okay and why is that?

I1: Screen is too small.

Participant B1 spoke in disbelief that someone could watch for long periods on a small screen:

B1: I was talking to [my friend] about this earlier and he said every night he'll sit and watch a film on his phone. He'll sit there, like, next to [his wife] and she'll sit there watching something he's not interested in and he'll sit there and watch a film or watch videos on YouTube, something to do with work, whatever. And his phone is the same size as mine. I couldn't imagine watching a whole film, just because it's too small.

When asked further about mobile viewing, he clarified:

B1: I don't really get much pleasure holding the tablet to watch something. [...] It doesn't interest me, I'd rather sit and watch it on the telly or not bother. [...] One, you've got to hold it and two, the size of the screen.

However, he did see a benefit to mobile viewing in keeping children occupied:

B1: What I would say about the tablet and the phones, though, is having the kids, when you're out and, say you're going for a meal or something like that, having the phone or tablet with video or like you say, YouTube, is really quite handy because it does keep them occupied.

While the laptop was the most popular viewing screen, participants consistently said that they would prefer to watch on a television. One of the main reasons for this was the bigger screen, but participants also liked the associated comfortable seating. Household A said how watching on the TV was just part of their routine:

Interviewer: Why do you watch, for instance, Better Call Saul on the TV?

A2: Bigger screen.

A1: Bigger screen, yeah. [...] And it's our sort of evening routine, we come in [the living room], we sit down and we watch TV and that's... yeah, it's our routine really.

Participant D1 said watching on a TV is the ideal situation, even though he did not own one himself:

Interviewer: In an ideal world what would you choose to watch on?

D1: A really cool and expensive and nice TV.

Interviewer: And why is that?

D1: Because the quality is quite nice, and if everything is integrated with the streaming service and all that then... lying down on the sofa is the best option.

Viewing Locations

We next consider the location where participants viewed content. As shown in Figure 2, viewing occurred in 10 distinct locations, with the living room and bedroom being the most popular locations. We can again further collapse these locations into two distinct groups: watching in the home (living room, bedroom, kitchen, etc.) and watching outside of the home (workplace, public transport, public place). Households reported more viewing sessions inside the home (M = 17.7, SD = 8.9) than outside of the home (M = 2.1, SD = 2.2), and this difference was significant, $t(8)$=4.82, p = .001. Moreover, four

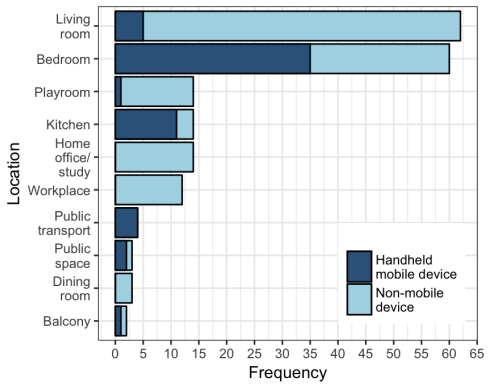

Figure 2: Distribution of viewing locations

of the nine households never once reported watching content outside of the home. Most viewing sessions were reported to have taken place in a single location; there were just five diary entries (2.8%) in which participants reported moving between two locations, and all of these were entirely inside the home.

Diary entries and interview data suggest that viewing location was often not a concious choice, but a result of situational and contextual factors. Participant F1, living in a shared house in London (where it is common to convert communal living spaces into extra bedrooms), spoke about how she could not watch in the living room:

Interviewer: Why do you prefer to watching the bedroom than in the living room for instance?

F1: Because I don't have a living room.

While small screens on mobile devices were often seen negatively, some participants spoke favourably about being able to view on public transport due to their portability, such as H1:

H1: You can use it on a plane.

Interviewer: Why is that?

H1: Because you can just put it on the little table.

Interviewer: Because it's smaller?

H1: It's smaller.

Viewing Time of Day and Duration

We next consider the times at which participants watched during the day, and how long their viewing sessions lasted. A histogram of viewing start times can be seen in Figure 3. It can be seen in the figure that late evening tended to be the most popular time to start viewing, though lower levels of viewing also took place throughout the day, apart from in the very early hours of the morning. In terms of total viewing time, 105:08:00 (55.7%) of viewing took place in the evening period between 18:00 and 00:00. It can also be seen in the figure that viewing on handheld mobile devices was particularly popular in the morning, and during late night and the early hours of the morning. There appears to be a noticeable transition from the pre-bed social ritual of watching on a TV to personal viewing on mobile devices at bedtime.

When considering how long participants viewed for, we found that mean viewing session duration was 01:03:00 (SD = 00:55:56). A histogram of session durations can be seen in Figure 4. Of all the sessions, 122 were one hour or less (69%), and 158 sessions (89%) were two hours or less. Figure 5 shows a detailed view of these sessions, where the most common durations is 30 minutes (often the length of one episode). Only 22 (12%) viewing sessions were over two hours. The longest session was six hours, and the shortest two minutes. On average, households reported longer viewing sessions on non-mobile devices (M = 01:15:37, SD = 00:34:42) than on handheld mobile devices (M = 00:38:24, SD = 00:18:58). However, this difference was not significant, $t(6) = 2.14$, $p = 0.076$.

Amount of Content Viewed

To better understand what was being watched during a session, we also consider the amount of content that was watched. For this analysis we consider each episode or separate video to a different item that is watched. Participants reported watching 481 items across 178 sessions; watching 2.7 items per session (SD = 2.7, range: 1–20). The largest number of items viewed in a single session was 20 YouTube videos over 90 minutes. We found that households tended to watch more items on non-mobile devices (M = 38.1, SD = 33.1) than on handheld mobile devices (M = 15.3, SD = 23.4). However, this difference was again not significant, $t(8) = 1.59$, $p = 0.15$.

On-demand Services Used

Participants were also asked to record which on-demand services they used for viewing. They reported using 13 distinct services. These are shown in Figure 6 along with the number of sessions they featured in. We divided these services into two categories: short-form, which consisted of YouTube, Facebook, Lynda iOS app (a training course app), Vimeo, WhatsApp, and The Guardian website (news); and long-form, which consisted of Netflix, Raiplay (Italian on-demand service), BBC iPlayer, unofficial streaming services, home recordings, and Amazon Video. There was no difference in the number of sessions reported by households for using either only long-form services (M = 10.6 SD = 7.3) or only short-form services (M = 8.6, SD = 6.5), $t(8) = 0.56$, $p = 0.59$. Households reported longer viewing sessions when sessions featured only long-form services (M = 01:21:49, SD = 01:04:40) than with sessions containing only short-form services (M = 00:38:13, SD = 00:30:40), and this difference was significant, $t(8) = 3.75$ $p = 0.006$.

Watching Alone and Watching Together

We also explored whether people watched alone or with others (i.e., co-viewing). Watching alone was more common than co-viewing. In total, 135 sessions (75.8%) were watched alone, and 43 (24.2%) by multiple people. In this context, co-viewing refers to more than one person actively watching.

Motivations for watching alone were explored during the interviews. A common theme was differing interests. For example, household E (a cohabiting couple with 88.9% of their sessions viewed alone), had very different tastes:

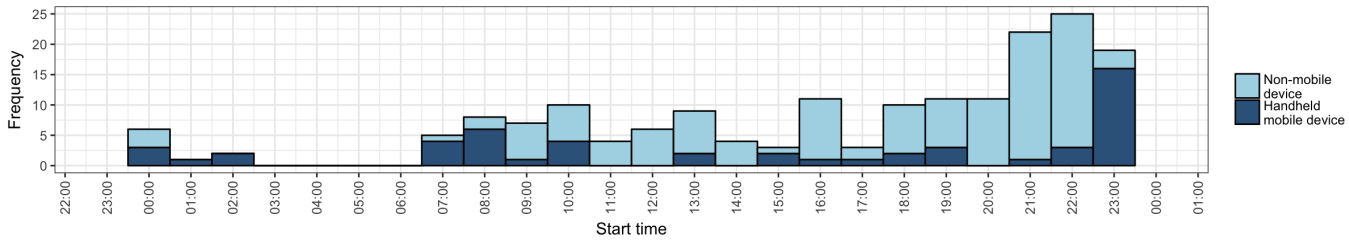

Figure 3: Histogram of viewing start times

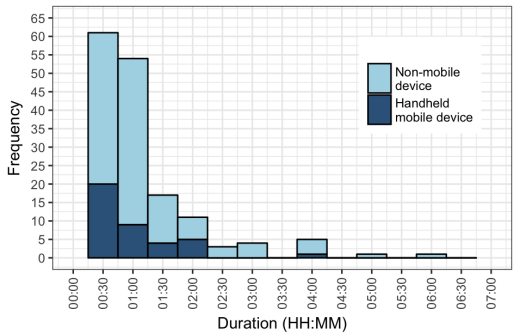

Figure 4: Histogram of viewing session durations

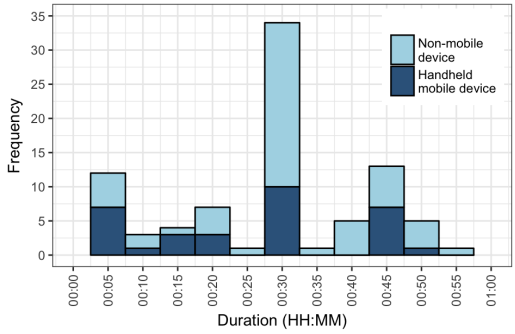

Figure 5: Histogram of viewing session durations for sessions with a duration of one hour or less

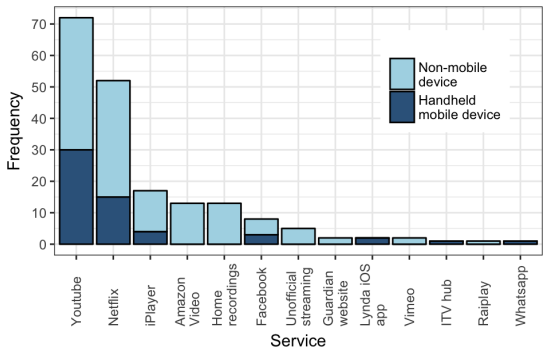

Figure 6: Popularity of different services

Interviewer: So what affects whether you watch together? Is it that you like different things, is it that you're just around at different times?

E1: Yeah I think I like watching it more than [E2] does, and different things. I really enjoy watching House of Cards whereas he's more, I guess, logical with what he chooses to watch.

Household D (53.3% of sessions viewed alone) also cited similar differences in personal tastes:

Interviewer: And you said you don't ever watch things together?

D1: Not really. [My girlfriend] falls asleep all the time.

Interviewer: [...] apart from that is there another reason? Do you like different things?

D1: We do really like very different things, and I think the rare occasion we watch something together is... Well actually, we do watch quite often The Big Bang Theory during dinner. But it's fifteen minutes and we watch the same episodes all the time. So it's more as kind of a background thing... We tried watching other TV series that we might enjoy watching together but those haven't existed to this point.

Interviewer: Okay, so you said she goes to sleep all the time. Is it because she sleeps early and you go to bed late? Is that a factor?

D1: No no, it's more that she only wants to watch what she likes, and if I don't adjust to it she really finds it really boring and just falls asleep.

Household A had a more even split of watching alone (58.33%) versus together (41.67%), but still expressed different tastes which influenced whether or not they viewed together:

Interviewer: So, why don't you want to watch what [A2] wants to watch?

A1: Because it's food programmes...

A2: Health...

A1: (Laughing) I can answer it myself. Yeah, it's generally food programmes, health programmes...

Interviewer: Okay. And [A2], why don't you want to watch what [A1] wants to watch?

A2: I can't watch another camper van conversion [on YouTube]!

Interviewer: (Laughing) Okay.

A2: And [A1]'s tutorials, he watches an awful lot of tutorials, which wouldn't interest me.

However, often watching alone was driven by situational factors rather than conscious choice — sometimes people just happened to be alone when they watched. Participant F1 (90.91% of sessions watched alone), an international student, discussed how she often watches alone when in the UK, but with family when back in her home country:

Interviewer: Do you normally watch alone then, when watching on-demand stuff?

F1: Yeah well, when I'm here, yes. ... If I go for holidays back home then I might do it with my, I don't know, with my sister, or my mom.

Participant G1 discussed how watching at work for a break meant they often watched alone:

G1: ...we like some similar shows and therefore we watch them together, but also because, I mean even for instance, [...] during lunch break if I'm alone, I watch something and therefore I am alone!

Participant H1 also referenced her living situation, having recently moved into a different household with new housemates:

H1: But maybe that's just because of my living circumstances. Before I used to just watch TV with other people.

Interviewer: So which would you prefer? Or does it depend?

H1: It depends, but I prefer to watch stuff with other people I think.

Positive Perceptions of On-Demand Video Services

Participants generally had favourable opinions about on-demand services. One of the most obvious themes from the data was the benefits provided by these services in terms of freedom, convenience, and choice for viewers. The results presented above show this clearly — participants watched in a variety of locations, at different times and on different devices. They also spoke about this in interviews, such as the following quote from participant A1:

A1: You can choose when you watch it then can't you? You know you don't have to say "ooh it's on at 8 o'clock tonight, we've got to be there for 8 o'clock". If we watch it on-demand you can think "I'll watch it at 10 o'clock if I want".

A number of households spoke about the catalogue of content available, which can make it easy to find something to watch:

E1: I think I watched the first thirty minutes of it but didn't really... And that's the thing about on-demand — if you don't really like it, you can just find something else.

F1: It's been so long since I watched the TV that I don't even remember how it is that you have to wait every week for a new episode or whatever, for the series, right? So now I just watch them whenever I want, whenever I have the time.

J1: I can always find something [more easily] on on-demand, because on broadcast TV I am limited to [...] forty different channels? And most of it is just reruns, and on-demand I have the selection of fifteen-thousand videos or something.

Participants also remarked on the quality of content available via on-demand services in comparison with broadcast TV, which was generally seen as similar if not better:

D1: I think I went into Netflix because of the catalogue they had, and a couple of their own productions like House of Cards, Orange Is the New Black, and the fact [that] they had a lot of stuff [...]. I tried it out and I enjoyed it.

However, participant J1 did note how broadcast TV was still useful for time-sensitive content:

J1: I think that quality is quite similar, I think. Broadcast TV also has some more things to offer like as news coverage which you don't get on demand.

Negative Perceptions of On-Demand Viewing

While opinions were generally positive, participants noted some negative aspects. Typically these were in relation to watching large volumes of content, or at least the potential to. Some participants spoke about being addicted to particular shows. Household A spoke about AMC's *Better Call Saul*:

A1: Yeah, well we like to watch two or three at a time, don't we?

A2: Yeah.

Interviewer: Why is that?

A1: We can't stop watching them because they're addictive.

A2: The trouble is, when you watch one that's on for almost an hour... you just, you feel as though you've been short-changed, you need to watch some more.

A1: Yeah, you're drawn in aren't you? You just want to watch more.

Participant F1 also spoke about a compulsion to watch:

F1: It becomes a bit addictive now. At least on the TV if you missed an episode you will be like "Oh okay, I'll just watch it next week" and then you will do other stuff. But now, I have this theory about habits. Because I can watch whenever I want, and it's the sort of thing where I need to be watching now to go to sleep.

Other participants also spoke about becoming hooked on a show, and how certain services made it very easy to watch another episode:

E2: Normally when you watch something you have to say "Should we see one more?". Then we would actually take an active choice to press next button, but Netflix there's like five seconds countdown. So often we [think] "Should we see one more?", "Hmm, I don't really know" and then, the intro screen is on and Netflix started.

E1: It made the choice for us.

E2: Yeah, I think if it didn't start automatically and we actually had to push the button, then I think we would talk. I probably would talk about if we should see one more, because now it was the fourth in a row.

Participants also spoke about trying to control their viewing to ensure they didn't spend more time watching than intended:

E1: You also want to see a lot of these like, Suits, or whatever... We don't want to get dragged into it because I can't get out of it (laughing). [...] I know myself too well that I'll end up spending half a day there.

Participant H1 said something similar:

H1: I didn't want to start a series one time because I knew I would just waste so much of my time watching it.

This type of boundary setting was also mentioned by other participants. Participant F1 thought that excessive viewing might be having a detrimental effect on other areas of her life, and so spoke about creating hardware boundaries to combat it:

F1: No I don't have Netflix on my phone, and I don't want to put Netflix on my phone.

Interviewer: Why is that?

F1: Because at least with the tablet you know I leave it at home, and I know that I won't use it unless I am at home at night.

Interviewer: So that's one way of setting a boundary?

F1: Yes, I mean I always feel to set these boundaries and they work, but the problem is for the last few months I've become an addict to YouTube. I don't think I was like that last year. I was a bit more able to control myself.

Interviewer: How about watching outside of the office and outside of home? So, maybe in a public place or while you were travelling for instance. Can you talk about if you did any of that?

F1: No, because so first of all I don't have enough data to watch videos, and I also deliberately don't pay more [...] so that I can restrict myself from watching videos, because otherwise I would just be watching everything.

Participants also said how watching too much content often meant they wasted time or ended up going to bed too late:

A2: I think sometimes we normally stay up a bit late with on-demand.

H1: Um, well, because then I'll watch maybe three episodes in an evening...well, on a bad evening or like I'll watch two and the next evening I'll watch two. If there are lots of episodes in the series then that's a big waste of time.

Binge Watching

Discussions of consuming too much content often brought the subject specifically to binge watching, which was discussed with all of the participants. Most of the participants were familiar with this behaviour and said they participated in it themselves. It seemed that this phenomenon could be thought of as a particular type of excessive viewing. However, when pushed to define binge watching, few participants had a clear idea of what binge watching was. Some would define it as being based on the number of episodes of a show that was watched, e.g. participant G1 defined it as three or more episodes, but only when watching TV shows:

G1: I have always thought about it in terms of TV shows [...]. So, watching many more than just one single episode, in one sitting.

Interviewer: So how many episodes is it before you are binge-watching?

G1: I would say from three.

Interviewer: So if I watch three five minute YouTube videos, is that binge-watching?

G1: Not exactly. My understanding was [...] that you are watching episodes of 45 minutes each.

Participant J1 also agreed with this:

J1: I think binge watching should be sort of a TV series episode length. An hour, or 45 minutes, or 42 minutes... and you watch more than two of those in a row.

Others said it was based on the amount of overall time spent, such as participant D1:

Interviewer: How many episodes do you think is binge watching?

R: Ooh, erm, anything that goes above four or five hours.

Interviewer: Okay, so it's more about the time than the number of episodes for you?

R: Yeah, because it's not the same to watch a whole TV mini-series that has 10 episodes [that are] an hour and 15 minutes each, [as it is to watch] ten episodes of The Big Bang Theory or Friends.

Participant I2 also agreed with this, specifically noting how the number of episodes was inconsequential. He also seems to think that it is possible binge watch shorter content:

I2: Well, the [time and number of episodes] are synonymous, right? So if the programme was 10 minutes per episode, then I would go through [many] more episodes probably to achieve the same amount of time.

Household B also thought it was based on the amount of time spent, but disagreed about the actual definition.

Interviewer: So how would you define it? Is it the number of episodes or is it the amount of time that you watch?

B2: The amount of time. [...]

Interviewer: So, how many episodes would have to watch and how long would you have to watch for, for it to be binge watching?

B3: I don't know. I guess if you sit there, waste your whole night. [...]

B3: Yeah, I've never thought about it before, so I don't know. Um, four or five hours I guess. [...]

B2: I'd go for three.

Such disagreement as to what constitutes a televisual binge was also present in other households, such as in household A:

A1: Didn't we watch three [episodes] in the last couple of weeks? We watched three [episodes].

A2: Oh three... yeah, but I wouldn't say that constituted binge watching, but maybe it does.

R1: I think three is, yeah. Three is, I would say, yeah.

R2: I don't know... but yeah we did watch three.

Interviewer: So would you say that that's binge watching?

R2: I wouldn't say that's binge watching.

Interviewer: Why not?

R2: I don't think there are enough episodes there.

Interviewer: Okay.

R1: I would say... I think more than two is binge watching.

Unlike some, H1 did not think that episodes necessarily had to be watched back-to-back or even on the same day:

H1: I think it's watching multiple episodes compulsively. [...] it could be one episode but you watch an episode per evening or it could be within a shorter space of time...

Participant J1 also suggested that watching one episode per evening could be binge watching, but was not entirely sure:

J1: Maybe it is... maybe seven episodes in seven days is binge watching [...] it's difficult to say. I think... like in a short period of time, watching something that was made for once a week maybe.

Participant I1 thought binge watching was more related to viewing intentions:

I2: It depends, yes, because if I'm supposed to work and I tell myself, "Okay, one. One video" and then I end up watching six, then it's kind of binge watching too, because I was supposed to take just a 10 minute break.

I: So does it depend on what you are supposed to be doing, for you?

R2: Yeah, I guess what the intention was. If I really just want a fifteen-minute break and I end up, you know, watching something for thirty minutes, then I kind of escalated there, so in a way that would be binge watching. If it's a lazy Saturday afternoon and it's raining and I end up watching three or four episodes, then yeah I think four or five is turning into binge watching, but otherwise if I have the time and nothing else to do...

DISCUSSION

The findings of this study show that although on-demand video platforms have the potential to change viewing behaviour, viewers still often conform to traditional viewing habits. For instance, in terms of viewing time, most viewing occurred during the evening "prime time" slot. Furthermore, the most common session duration was 30 minutes, typically the length of one episode of content. The TV was also still a popular viewing screen. However, changes as a result of new technology can also be seen. YouTube was the most common viewing platform, showing how shortform content has become popular. We also found that a third of viewing happened on a mobile device, and instances of very long viewing sessions.

When considering viewing screens, we can see that the laptop was slightly more popular as a viewing device than the television, which may not be possible without the cross-device availability of on-demand services. This could be due to the ease of access to different services via the internet, as well as the balance of screen size and portability that laptops provide. However, for the purposes of viewing they function similarly to a TV — a fairly large screen that can be placed in a comfortable location, with the ability to watch with others. Though most viewing occurred on larger screens, a third of viewing sessions were on handheld mobile devices. This was generally seen as unfavourable, and mostly seemed to be down to necessity — in interviews, participants expressed their dislike for viewing on mobile devices, citing the small screen as a reason. This agrees with previous work showing how viewing on small screens can lead to a reduced viewing experience [15]. However, participants said that they would watch on a mobile device if no other device were available (e.g. when travelling). Most said they preferred to watch on a TV, due to large screen size and comfortable seating typically found nearby. Individual differences were evident however, with some participants entirely discounting watching content on phones, and others sometimes preferring it.

We found that viewing device often depended on people's locations. The majority of viewing (89.9%) took place inside the home, and the living room was the most popular location. It is perhaps then not surprising that people tended to watch on larger display TVs and laptops rather than smaller mobile screens when in the living room. Mobile devices tended to be used in the home in locations where there may not be access to a TV, such as the kitchen or bedroom. Our participants did report watching on mobile devices when outside of the home, particularly when travelling and commuting to work. In recent years the lower cost of mobile data has made easier to watch on-demand services on the move. These instances of mobile viewing tended to be during longer journeys, possibly because it allows for an entire episode of content to be watched.

Participants spoke very favourably about on demand services, especially about how they have allowed them more freedom and choice than broadcast TV. However, a study by Vanattenhoven and Geerts [20] found that some consumers found the amount of choice available to be an annoyance, especially with regard to the number of different services available. Interestingly, we did not find this sentiment in any of our data.

This freedom also allowed participants to select content that matched their personal tastes. Our interview data revealed that these differing tastes among household members could lead to people choosing to view alone, which was reflected in the diary data showing that 75.8% of sessions were watched alone. This shows a stark turnaround of events when compared with an observational study by Saxbe et al. [17], who found that watching TV with at least one other person happened

for 61% of the time, and that the TV provided a platform for togetherness in the household. While participant D1 said he and his partner generally watched different content in different rooms due to differing tastes, participant A1 described how she and her partner used tablets and earphones to watch different content, but still be in the same room together. This agrees with Ofcom's findings [12] who found that people often turn to on-demand services for some "alone time".

Although we observed that only a quarter of sessions were co-viewed, we know from previous research that viewers value the way new broadcasting technologies can enhance the social aspect of viewing [1, 7]. While watching alone was more common than co-viewing, it may be that the sessions watched alone were driven by other latent social factors, such as being able to discuss the show with friends. Finally, it could be that co-viewing and other social factors work differently in different household configurations, e.g. we observed that the households with the highest percentage of co-viewing were household A, an older couple (42.1% of sessions co-viewed) and Household B, a family (41.7% of sessions co-viewed), while the household with the lowest percentage was household H, two young professional cohabiting friends (6.7% of sessions co-viewed). We cannot speculate beyond this with our data, but it would be an interesting focus of future research.

However, participants were often wary of the way instant access to large amounts of content could mean watching for long periods. This led to some participants creating boundaries to prevent this behaviour, either by simply not starting to watch a new show, or by restricting viewing in some other way, e.g. not installing Netflix on their phone. While it may in the interests of service providers to make it as easy as possible to view large volumes of content for revenue and engagement purposes, this was often troubling to our participants, some of whom commented that Netflix "made the choice for [them]" when deciding whether to watch another episode. As such, the introduction of small "design frictions" to combat automatic behaviours could lead to a better user experience [4], either by design or manually by the users themselves.

Discussing consuming large amounts of content typically led to talking about binge watching, which most of the participants said they participated in. However, when pushed to define what binge watching was, there were widely different responses and definitions often seemed to change depending on the context. This is reflected in other studies, where binge watching is defined differently by different authors. For example, some participants said it was watching two or more episodes in a row (as in [14, 12]), and said three or more episodes in a row (as in [5, 21]). Others said it was not so much the number of episodes watched but the total time spent watching, while others said it was a combination of these two features. Others said that it depended on their intentions when they started to watch. In summary, different people seemed to have different ideas of what binge watching is, and this disagreement reflects the diversity of definitions that appear in the literature on this topic. Such varying definitions suggest that it could defined on a scale, and vary with context and type of content, as suggested by Trouleau et al. [19].

While we took effort to recruit participants of various ages and living in different parts of the UK, most of our participants were London-based millennials without children. This bias in the sample may have affected our results. For instance, some participants lived in shared housing without a communal living room or TV. In place of this, viewing occurred on laptops and tablets in bedrooms. Considering millennials' typically high level of interaction with technology, we might have expected more activity that differs from traditional notions of TV viewing. This may have seen an increase if our sample featured more teenagers and children. Viewing mainly in the evening is perhaps to be expected, as our sample was mostly adults in full-time employment. However, there was a steady amount of daytime viewing, resulting from one household with children being at home and people viewing during work breaks.

Our sample consisted of 20 individuals from nine households. This could be argued to be a small sample size, however it is similar to that of comparable studies (e.g. [13, 1, 20, 9]). It also reflects the challenges of conducting this type of research, where prolonged studies with involved tasks for participants can deter participation, even when well compensated.This may have influenced the results of the statistical tests we employed — while the differences between means were often quite large, the high variance and low sample size did return some non-significant results. Notwithstanding, as the present study is qualitative in nature, we argue that the sample size is sufficient to illuminate many of the behaviours surrounding on-demand and mobile viewing, especially given the study duration.

A limitation of the diary study method is that some participants may not have recorded everything they watched. During interviews some participants did remark that they sometimes did not record very short viewing sessions (e.g., a short Facebook video) because of the effort involved. However, this was fairly uncommon, with most participants saying they recorded the vast majority of content they watched.

CONCLUSION

This paper extends our understanding of how on-demand viewing occurs in daily life. The results of a diary study show that this technology leads to new behaviours such as mobile viewing, viewing for long periods, and consuming shortform content. However, our sample still often conformed to traditional viewing habits. Viewing was mostly in the evening on a large screen, though this sometimes happened in new ways, such as by using a laptop. While mobile viewing did account for a third of all viewing sessions, in general this was seen as less favourable than watching on a large screen. Typically, mobile viewing seemed to occur for contextual reasons, such as being a practical device to use while travelling, or wanting to watch content privately when in the presence of others. We also found that viewing alone was far more common than viewing with other people. Participants had largely positive opinions about on-demand video services, but generally seemed to be wary about the ability watch for long periods and the impact it could have on other areas of their lives.

ACKNOWLEDGEMENTS

This research was supported by EPSRC grant EP/G037159/1.

REFERENCES

1. Louise Barkhuus and Barry Brown. 2009. Unpacking the Television: User Practices around a Changing Technology. *ACM Transactions on Computer-Human Interaction (TOCHI)* 16, 3, Article 15 (Sept. 2009), 22 pages. DOI:http://dx.doi.org/10.1145/1592440.1592444
2. Rhiannon Bury and Johnson Li. 2015. Is It Live or Is It Timeshifted, Streamed or Downloaded? Watching Television in the Era of Multiple Screens. *New Media & Society* 17, 4 (2015), 592–610. DOI: http://dx.doi.org/10.1177/1461444813508368
3. The Nielsen Company. 2016. On-demand Demographics: VOD Viewing Across Generations. (2016). http://www.nielsen.com/uk/en/insights/news/2016/on-demand-demographics-vod-viewing-across-generations.html
4. Anna L. Cox, Sandy J.J. Gould, Marta E. Cecchinato, Ioanna Iacovides, and Ian Renfree. 2016. Design Frictions for Mindful Interactions: The Case for Microboundaries. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '16)*. ACM, New York, NY, USA, 1389–1397. DOI: http://dx.doi.org/10.1145/2851581.2892410
5. Dimph de Feijter, Vassilis-Javed Khan, and Marnix van Gisbergen. 2016. Confessions of a 'Guilty' Couch Potato Understanding and Using Context to Optimize Binge-watching Behavior. In *Proceedings of the ACM International Conference on Interactive Experiences for TV and Online Video (TVX '16)*. ACM, New York, NY, USA, 59–67. DOI: http://dx.doi.org/10.1145/2932206.2932216
6. David Gauntlett and Annette Hill. 2002. *TV Living: Television, Culture and Everyday Life*. Routledge.
7. Lilly Irani, Robin Jeffries, and Andrea Knight. 2010. Rhythms and plasticity: television temporality at home. *Personal and Ubiquitous Computing* 14, 7 (01 Oct 2010), 621–632. DOI: http://dx.doi.org/10.1007/s00779-009-0280-1
8. Robert J. Logan, Sheila Augaitis, Robert H. Miller, and Keith Wehmeyer. 1995. Living Room Culture - an Anthropological Study of Television Usage Behaviors. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, Vol. 39. SAGE Publications Sage CA: Los Angeles, CA, 326–330. DOI: http://dx.doi.org/10.1177/154193129503900507
9. Jennifer McNally and Beth Harrington. 2017. How Millennials and Teens Consume Mobile Video. In *Proceedings of the 2017 ACM International Conference on Interactive Experiences for TV and Online Video (TVX '17)*. ACM, New York, NY, USA, 31–39. DOI: http://dx.doi.org/10.1145/3077548.3077555
10. João Nogueira, Lucas Guardalben, Bernardo Cardoso, and Susana Sargento. 2017. Catch-up TV Analytics: Statistical Characterization and Consumption Patterns Identification on a Production Service. *Multimedia Systems* 23, 5 (01 Oct 2017), 563–581. DOI: http://dx.doi.org/10.1007/s00530-016-0516-7
11. Ofcom. 2016. Linear Vs. Non-linear Viewing: A Qualitative Investigation Exploring Viewers' Behaviour and Attitudes Towards Using Different TV Platforms and Services Providers. (2016). http://www.ofcom.org.uk/research-and-data/tv-radio-and-on-demand/tv-research/linear-vs-non-linear-viewing
12. Ofcom. 2017. The Communications Market Report 2017. (2017). http://www.ofcom.org.uk/__data/assets/pdf_file/0017/105074/cmr-2017-uk.pdf
13. Kenton O'Hara, April Slayden Mitchell, and Alex Vorbau. 2007. Consuming Video on Mobile Devices. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '07)*. ACM, New York, NY, USA, 857–866. DOI: http://dx.doi.org/10.1145/1240624.1240754
14. Matthew Pittman and Kim Sheehan. 2015. Sprinting a Media Marathon: Uses and Gratifications of Binge-watching Television through Netflix. *First Monday* 20, 10 (2015). DOI: http://dx.doi.org/10.5210/fm.v20i10.6138
15. Jacob M. Rigby, Duncan P. Brumby, Anna L. Cox, and Sandy J.J. Gould. 2016. Watching Movies on Netflix: Investigating the Effect of Screen Size on Viewer Immersion. In *Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct (MobileHCI '16)*. ACM, New York, NY, USA, 714–721. DOI: http://dx.doi.org/10.1145/2957265.2961843
16. Jacob M. Rigby, Duncan P. Brumby, Anna L. Cox, and Sandy J.J. Gould. 2018. Old Habits Die Hard: A Diary Study of On-demand Video Viewing. In *Proceedings of the 2018 CHI Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '18)*. ACM, New York, NY, USA. DOI: http://dx.doi.org/10.1145/3170427.3188665
17. Darby Saxbe, Anthony Graesch, and Marie Alvik. 2011. Television As a Social or Solo Activity: Understanding Families' Everyday Television Viewing Patterns. *Communication Research Reports* 28, 2 (2011), 180–189.
18. Alex Taylor and Richard Harper. 2003. Switching off to Switch On. In *Inside the Smart Home*, Richard Harper (Ed.). Springer London, London, Chapter 7, 115–126. DOI:http://dx.doi.org/10.1007/1-85233-854-7_7
19. William Trouleau, Azin Ashkan, Weicong Ding, and Brian Eriksson. 2016. Just One More: Modeling Binge Watching Behavior. In *Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD '16)*. ACM, New York, NY, USA, 1215–1224. DOI: http://dx.doi.org/10.1145/2939672.2939792

20. Jeroen Vanattenhoven and David Geerts. 2015. Broadcast, Video-on-demand, and Other Ways to Watch Television Content: A Household Perspective. In *Proceedings of the ACM International Conference on Interactive Experiences for TV and Online Video (TVX '15)*. ACM, New York, NY, USA, 73–82. DOI: http://dx.doi.org/10.1145/2745197.2745208

21. Emily Walton-Pattison, Stephan U. Dombrowski, and Justin Presseau. 2016. 'Just One More Episode': Frequency and Theoretical Correlates of Television Binge Watching. *Journal of Health Psychology* 23, 1 (2016), 17–24. DOI:http://dx.doi.org/10.1177/1359105316643379