Non-Intrusive Notifications on TV
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Report Prepared for

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Non-Intrusive Notifications on TV
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Introduction
Christina Wasson

Overview

This project was conducted for Motorola's Applied Research and Technology Center by a class in design anthropology at the University of North Texas. Our client was Crysta Metcalf, Anthropologist and Distinguished Member of the Technical Staff. Our interactions with Crysta were highly productive and collaborative. She showed an impressive level of dedication by participating in our weekly class meetings via phone, as well as visiting us in person three times over the course of the semester. She was also a strong intellectual partner throughout, shaping the project goals and design before the class started, and providing feedback during the semester to keep the class focused on what was most useful to Motorola.

The goal of our research was to elicit new ideas for designing interactive elements on televisions powered by Motorola products. In particular, we focused on the design of notifications for Social TV. Motorola was worried that such notifications might be perceived as intrusive, since TV watching is widely considered a "lean back" activity that allows people to engage in a "brain dead" or "chill out" experience that places no demands. Would notifications be perceived negatively due to the demands that they placed on viewers? This was the concern that animated our project.

In order to investigate this issue, we conducted research on interruptions during leisure activities. We broadened the domain from only examining notifications received on a screen because we believed that understanding how people handle leisure-time interruptions generally would provide more powerful insights into the design of Social TV.

This report details the results of our project. It provides:

- An overall framework for understanding interruptions

- Research findings about how people experience interruptions, and what makes them a positive, negative, or neutral experience

- The design implications for Social TV notifications

The framework is presented in Chapter 2. Chapter 3 focuses on our primary discovery, namely that people tend not to mind interruptions when they come from close friends and family, due to the power of the human relationship. Chapter 4 describes the concern that many people have with managing their time, and the techniques that they have evolved to successfully manage interruptions in ways that often prevent annoyance. Chapter 5 considers what happens when the power of the human relationship comes into conflict with the desire to manage one's time. Finally, Chapter 6 shifts to a rather different type of insight to describe the sensory dimension of interruptions, and what kinds of sensory experiences are perceived as pleasant or unpleasant. In Chapters 3-6, design implications are provided for each set of research findings.

The Research Process

We used photo narratives to help our study participants identify interruptions, and then conducted ethnographic interviews to solicit insights concerning those interruptions. The class participated in a collaborative analysis process.

Our study included eight research participants, recruited by the students. We sought to ensure diversity in terms of gender, age, ethnicity, and occupation. Four participants were male, four were female. Two were in their twenties; four were in their thirties; one was in her fifties; and one was in his seventies. In terms of ethnicity, one was African-American/ Latino, one was Latino/non-Latino white, and the rest were white. Their occupations varied widely, from retired musician to corporate manager. Information about each research participant is provided in Appendix A.

Data Collection

Each research participant received a digital camera for a weekend and was asked to take a picture of all interruptions he or she experienced during that time. Then students conducted in-depth ethnographic interviews where they asked about the pictures. The students worked in pairs and videotaped the interviews. Interviews typically lasted about an hour and a half. Across the eight study participants, we collected 134 photos of interruptions. They are listed in Appendix B. The report also discusses some additional interruptions that participants described during the interviews, but that took place outside of the weekend when they were taking pictures.

The student researchers placed the photos, detailed fieldnotes about each interview, and extensive video clips from the interviews on a Google Site that they created for this class. This made field data available to the whole group for comparison and analysis purposes.

Data Analysis

Much of the analysis was conducted during class time, by all students working together as a group, with myself as guide and facilitator. The students presented findings from their research over the course of four weeks. Each team of students verbally narrated their fieldwork experience, and illustrated key moments and insights with photos and video clips. Other students asked questions and discussed the fieldwork.

During this process, I as facilitator wrote down examples and emergent insights in a Word document that was visible to the whole class via an LCD projector. Initially, the Word document functioned somewhat like a more sophisticated and deep version of a flipchart. As the Word document became longer, students started to group the ideas by having me cut and paste bits of text. Information was organized into three columns: instances, patterns, and design implications. This process was somewhat similar to creating an affinity diagram, moving to an increasingly sophisticated and abstract level of analysis. Over time, five main topics emerged, which became the five main chapters of this report.

Report Preparation

Toward the end of the semester, students were asked to choose which topic they would focus on for the report. Each chapter included a mix of anthropology and design students, plus in two cases a marketing student. The anthropology/marketing students reviewed all fieldnotes for pertinent material in order to complete the analysis process started by the whole class. They wrote the research findings part of each chapter. The design students developed visual images and descriptions of the design implications for each chapter. All students working on a chapter coordinated their efforts in order to ensure that each chapter would be coherent.

Chris Ryan, an MFA student in communication design, took on the large task of preparing the PowerPoint presentation and designing the layout for the written report. For the presentation, he took the slide text and images provided by the chapter authors and combined them into a coherent whole, as well as designing some animations and preparing the video clips. For this report, he created a layout to visually link the research findings and design implications.

The Students

The students in this class included:

- 5 undergraduate anthropology majors

- 5 undergraduate communication design majors

- 4 master's students in anthropology

- 1 MFA student in communication design

- 2 PhD students in marketing

The class was therefore a fairly even mix of anthropology and design students, with a few marketing students for additional diversity of insights. This mix generated a productive interdisciplinary collaboration. The project benefited from the expertise of each discipline.

What Is an Interruption?
Adam Bonner and Bob Fabrize

This project originated with Motorola's concern about the potential intrusiveness of Social TV notifications. Our research was designed to investigate the factors that could make interruptions annoying, and our goal was to develop ways of minimizing the potential intrusiveness and annoyance of notifications. However, over the course of the research, we came to reformulate the problem. Through collaborative discussions with Crysta Metcalf about our data, we realized that interruptions are not intrinsically negative or intrusive, especially when they come from close friends or family. We came to call this "the power of the human relationship." Furthermore, we found that people who liked to have control over their time had developed techniques that they were often able to use to manage interruptions in a way that prevented frustration for them. Other people were relaxed and flexible about their time and therefore did not mind interruptions from people they cared about.

However, we did also find some situations where interruptions were experienced in a negative way. One kind of situation was when a person's wish for autonomy trumped the power of the human relationship. Another was when the sensory aspect of the interruption was unpleasant, such as a loud, long-lasting noise.

In this chapter, we present an overall framework for understanding interruptions. We start with our understanding that the outcome of an interruption may be either a positive, neutral, or negative experience. Then we consider the key factors that shape the interruption experience. Finally, we describe the six types of interruptions found in our data, and place them on a continuum from other-initiated to self-initiated.

The Outcome: A Positive, Neutral, or Negative Experience

As mentioned, the class started with a concern that interruptions would tend to be a negative experience. This was simply not the case. In fact, so many of the interruptions in our data were classified as positive and neutral that negative interruptions were in the minority.

Positive interruptions, like pleasant surprises, were illustrated when June went out of her way to do a donut-related good deed, when Susie noticed the rain, or when Johnny's comic book friend dropped by. They could be initiated by someone else, by oneself, or by an unusual event.

Neutral interruptions, those that the person being interrupted neither spurned nor embraced, could be task-based, as in the case of Optimus Prime cleaning dishes, social involvement-based, such as June "just checking" on her neighbor with a black eye. They could also be self-initiated, such as Johnny Longhorns starting to make some food because he felt hungry.

Negative interruptions were most often born from a desire for autonomy, and manifested themselves in the rejection of social behavior. Cassandra felt wrongly interrupted when her friends drop by without calling. Chris was displeased when his girlfriend called "during his alone time." For example Chris said that when he watches his favorite television show "Lost," he will not talk during the show, will not answer calls or texts, and will only leave the television set briefly during commercials. Sometimes, Chris said, when he wants to concentrate on the show, he will go to his bedroom to watch it alone if the social situation in the living room impedes his concentration. In addition, interruptions could be negative because the sensory experience was unpleasant.

Key Factors That Shape the Interruption Experience

Our analysis of the interruptions in our data in terms of whether their outcomes were positive, negative, or neutral led us to identify seven key factors that shape the interruption experience. Those factors are:

- What was the sensory experience of the interruption?

- What was that person's level of engagement in the prior activity?

- Is the person laid back about interruptions?

- Does the person like to carefully control his or her time?

  - If yes, is he or she able to control the interruption experience, either by putting the prior activity on hold or by ignoring the interruption?

- What is the relationship with the person who interrupted?

- What was the content of the interruption?

  - For self-initiated interruptions, what is the nature of the new task?

- What is the frequency of interruptions by that person?

These seven elements are described in detail below.

1 Sensory Experience

Many research participants found the sensory experience of the interruption important. For example, Susie hated the sound of the microwave buzzer because it was harsh and insistent. Cassandra did not like interruptions that were scary, such as her daughter sneaking up on her and startling her. Subjects indicated that they preferred short natural sounds that did not repeat. They also indicated that they disliked grating sounds and visuals. See Chapter 6 for more on this topic.

2 Level of Engagement in the Prior Activity

The study participants indicated that their level of engagement in their prior activity also related to the type of interruption that they found acceptable. For example, Ancient Augustus's level of engagement was important in his work repairing musical instruments. He mentioned that when he was working, he focused on the repair at hand to the exclusion of everything else. On the other hand, Chris indicated that

he had very low levels of engagement during certain shows, particularly reruns of Seinfeld. He indicated that he would look for things to keep him occupied during these shows. This topic is revisited in Chapter 4.

3 Laid Back or Not

Certain research participants were more laid back about interruptions than others. Some participants were open to people interrupting them, such as Cassandra who had friends dropping by, and Ancient Augustus, who expected his wife and dogs to interrupt him. Others, such as Optimus Prime, refused to be interrupted when they were engaged in activities important to them. See Chapter 4 for more on this topic.

4 Level of Control

In some cases, the extent to which a research participant wished to manage his or her time had an effect on their experience of interruptions. For example, young mothers Sally and Susie faced the challenging situation of balancing work and family responsibilities. They had developed a set of techniques that allowed them to manage interruptions successfully. For instance, they used DVR to pause a TV show when their children or other people demanded their attention. Due to these techniques, they generally did not experience interruptions negatively.

By contrast, Optimus Prime also had a strong wish to manage his time, yet he was often unsuccessful, leading to frustration. For instance, he got stuck behind a car that didn't turn in the left-turn lane; and he was forced to immediately plant a tree he had purchased when it started raining. This topic is explored further in Chapter 4.

5 The Relationship with the Person Interrupting

Our study participants' relationship with the person who was interrupting was also a key factor in their experience of interruptions. For young mothers Susie and Sally, interruptions by their children were often seen in a positive light. Ancient Augustus had similar feeling toward the interruptions by his wife and his dogs. On the other hand,

Johnny Longhorns found interruptions by his nosy neighbors to be unpleasant. This topic is the focus of Chapter 3.

6 Content of the Interruption

Study participants indicated that the content of the interruption was a factor. Though June enjoyed her family, she did not like being interrupted by her sister because of her sister's negative attitude. Chris wanted his interruptions to be short, for example asking for information that he could give quickly and return to his show. Sally found emails from work to be a negative interruption because they took her away from family.

For self-initiated interruptions, the content of the new task was also a factor. For Johnny Longhorns, attending to his hunger by fixing dinner was important and pleasurable. However self-initiated interruptions could also turn out to be a chore, such as Optimus Prime rushing to plant his new tree ahead of the rain. For Chris, a self-initiated interruption of chatting on Facebook during a boring program that couldn't keep his focus was a necessity to keeping him entertained. The content of an interruption or new task is addressed in Chapter 5.

7 Frequency of Interruption by the Same Person

Frequent interruptions by the same person also emerged as a key factor in our study. Frequent interruptions affected different study participants in different ways. For the young mothers, the frequent interruptions of their children were taken in stride. However, others found frequent interruptions by friends or family annoying. For instance, Chris viewed the frequent interruptions by his girlfriend during his "alone time" as intrusive—particularly when she asked him to pay her credit card bill. This issue is addressed in Chapter 5.

A Typology of Interruptions

When we began our research, we believed that interruptions were something that happened when an outside agent intruded into a person's leisure

activity. The most surprising thing we found through the photo narratives and interviews was that people interrupted their own leisure activities. Thus interruptions were both something that someone could do to you and something that you could do to yourself.

In our analysis, we identified six different types of interruptions. We placed these on a continuum from other-initiated to self-initiated interruptions. Other-initiated interruptions were divided according to their outcome: a positive/neutral or a negative experience. Since self-initiated interruptions were consistently experienced as positive/neutral, we grouped them according to whether they were impulsive or compulsive. Finally, we identified a relatively small number of interruptions that were intermediate between self- and other-initiated. These fell into two categories, household tasks and unusual events. Our study participants experienced household tasks as neutral in nature, while unusual events could be either neutral or positive. The following sections describe each type of interruption.

1 Other-Initiated Interruptions—Positive/Neutral

We defined other-initiated interruptions as those caused by people other than the study participant, either directly or indirectly, that impinged on the study participant's leisure activity. The first category encompasses those that are either positive or neutral in nature. They may be positive/neutral because the power of the human relationship is greater than the leisure activity the person is enjoying alone. For example, a positive other-initiated interruption happened to Johnny Longhorns when his comic book reading friend dropped by and they began reading together. In cases such as Cassandra or Ancient Augustus, their laid back nature toward interruptions prevented potentially annoying interruptions from being experienced as anything worse than neutral. Both of these subjects seem to be more oriented toward other people in the social environment than to themselves as individuals involved in a leisure activity. A third factor in creating a positive/neutral experience was when the study participant had good time management techniques. For example, Sally made good use of the pause function on her DVR when she was interrupted by her children .

2 Other-Initiated Interruptions—Negative

Negative other-initiated interruptions occur when the desire for control over one's own time trumps the power of the human relationship. Examples of negative other-initiated interruptions would include when Johnny Longhorns was being hounded by annoying neighbors during TV viewing, and when the inattentive driver at a red light delayed Optimus Prime.

3 Self-Initiated Interruptions—Impulsive Behavior

Self-initiated interruptions are those that people start themselves. Our study participants experienced them as neutral or positive. First we will consider impulsive self-initiated interruptions. These self-initiated interruptions are generally the result of people's efforts to keep themselves entertained. When they lose interest in an activity, they switch focus to a new activity. For example, Johnny Longhorns and Chris both chose to interrupt one self-chosen leisure activity to take up another leisure activity.

4 Self-Initiated Interruptions—Compulsive Behavior

Self-initiated interruptions with compulsive behavior are different. In this scenario, the interruption occurs several times during the leisure activity, almost as if a person just can't help him or herself. For example, Susie and Cassandra both interrupted their TV watching by checking Facebook. These two women frequently used the online social networking site to either check for messages from friends, or as a gaming portal (Facebook Farmville). For these study participants, whom interviewers found to be very relaxed, the show on television appeared secondary to social interactions.

5 Intermediate Interruptions—Household Tasks

These intermediate interruptions were related to things that needed to be done around the house. The study participants viewed this type of interruption as neutral. For example, Optimus Prime interrupted his leisure activities to clean the dishes and to wash his clothes for work. To Optimus Prime, these were things that just needed to be done to keep the household running. They had neither positive or negative value. Another example

occurred when Optimus Prime's wife stopped the family from going out until she had the coffee pot cleaned and ready to go. In this case, having the coffee pot ready for making coffee was a necessity if the household was to run efficiently in the future. However, it might be considered as a case for making for more leisure time in the future; if the coffeepot is clean, then when the family wants coffee, they will not have to face the chore and instead enjoy the beverage.

6 Intermediate Interruptions—Unusual Events

In this final type of interruption, someone's attention is caught by something unusual that draws their attention, or an unusual event forces them away from their normal routine. The interviewees found these interruptions to be either neutral or positive. For example, when June saw her neighbor sporting a fresh black eye, she had to get out of the car and talk to her. While Susie was enjoying television in her home, the sound of the rain caught her attention and she had to go and look out the window at it. A neutral example occurred when June saw the Dunkin Donuts shop and stopped in to pick up a gift certificate for a coworker. Though she had been planning on getting the sick coworker something, the gift certificate popped into her mind when she saw the sign for the donut shop.

As we developed our research findings, we discovered that interruptions in leisure activities were a much more complex phenomenon than we had originally envisaged. The creation of a continuum of interruptions, from other-initiated to self-initiated, allowed us to refine our understanding of how people engage in leisure activities. Though we originally cast interruptions as a negative experience, we found people saw them also as neutral and positive. Furthermore, we identified a tension between people's desire for connection with others and their wish for autonomy. As we continue to learn about interruptions and how they are experienced on Social TV, we must remember that watching television is not a simple, one-way ingestion of broadcasts, but rather a complex social activity peopled by a variety of "players," including both viewers who may interact with each other, and the broadcasts themselves.

The Power of the Human Relationship

Andrea Tuckness, Brittney Wright and Scott Spooner

The power of the human relationship was one of the main themes drawn from our fieldwork. The power of the human relationship influenced numerous individuals' attitudes toward interruptions tremendously. In this chapter, three elements of the power of the human relationship will be discussed: some things seem less annoying when they are done for other people, some individuals feel urges to compulsively check on friends and information related to friends, and some people enjoy having group activities where they can converse with multiple people.

Helping Others

Research Findings

When examining numerous instances of the "power of the human relationship" we found significant evidence that "some things seem less annoying when they are done for other people". This evidence can be found in the following sets of fieldnotes: June's Interview, Susie's Interview, Ancient Augustus' Interview, Cassandra's Interview, and Optimus Prime's Interview.

June expressed several situations where her daughter's visit interrupted her usual weekend activities, but the interruption was not to be considered negative because she always cherishes time spent with her daughter. She shared the story of doing her daughter's laundry as compared to her own house laundry. She felt the house laundry was more of a negative experience; however, doing her daughter's laundry was a tremendously positive experience because she could help her daughter.

June also shared the story of her husband who has to regularly take medication for health conditions at certain times of the day. June expressed that his health does affect the activities she and her husband are able to partake in. Also, she explained that the medicine schedule often interrupted their activity and was a somewhat negative interruption at the time. However, the medicine schedule was for a greater good and to help her husband feel better; therefore, it was actually a positive interruption.

This specific attitude toward interruptions can also be seen in Susie's interview. In the fieldnotes, Susie described a situation where her painting activity was interrupted by her baby crying because it was the child's feeding time. Susie felt the interruption was positive because she loves taking care of her young child. This is very similar to June's interruption with her daughter's laundry.

Next, Susie described how she must use a breast pump to collect milk for her baby. She planned her daily schedule around the routine use of the breast pump. Susie shared how the schedule became annoying and that the interruptions were negative; however, overall, she felt the interruptions should be considered positive because her child will benefit from the process. The positive outcome in the end, which was feeding her baby, outweighed the inconvenience she experienced due to the breast pump schedule. This example was very similar to June's story about her husband's medicine schedule.

Ancient Augustus also shared stories of how he did not feel interruptions were necessarily negative when they involved his loved ones. Augustus described several instances where his puppy interrupted him while he was working on an important document. The puppy wanted Augustus to play and was demanding his attention. Augustus did not consider the interruption negative because he loved the puppy and wanted to show his love for the puppy by playing with the young dog.

Another example with Ancient Augustus was when his wife interrupted him while he was working on instrument repairs. It seemed that this interruption too was neutral, and certainly not negative. Augustus stated that if the interruption had been caused by something he did not love he

might have felt negatively towards it. This experience was very similar to both June and Susie's views that "some things seem less annoying when they are done for other people".

Cassandra also experienced interruptions that were influenced by the power of the human relationship, but her feelings about the interruptions were a bit different than the feelings we saw with June and Susie. Cassandra's daughter came to her late one night after Cassandra had already settled down for the night, and told her she needed something from the store for school the next day. Although Cassandra had already settled down for the night, she was compelled to take her daughter to the store. Unlike June and Susie, she did not express that the end outcome of this interruption was positive. Instead, Cassandra categorized this interruption as neither positive nor negative. The overarching pattern that emerged from the three mothers was the significant factor of helping or assisting a loved one. After an interruption by a loved one they were willing to stop their current activity and help the loved one in need.

Similar to Cassandra's interruption, Optimus Prime was also interrupted by his daughter. He and his family were enjoying an evening out for a movie night. His daughter interrupted him by informing him she had to use the restroom. Optimus Prime took his daughter to the restroom, which interrupted his movie viewing. This interruption was similar to Cassandra's interruption because he did not say the interruption was positive or negative. By reading the fieldnotes and exploring his explanations about the interruption, he seemed to believe it to be a neutral interruption.

The power of the human relationship is a strong determining factor when interruption is caused by another human being or loved one. When delving deeper into the theme, it seems to not make any difference if the interruption is routine like June with her husband's medicine, and Susie with her breast pump, or unexpected like Cassandra having to take her daughter to the store at night. It appears that as long as the interruption is for or about a loved one, it tends to be considered a positive or neutral interruption. In the fieldnotes, when interruptions by or for others occurred, the interviewees did not become aggravated but simply tended to the needs of the person who was in need of assistance.
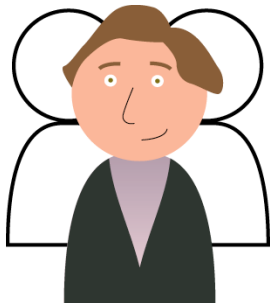
Design Implications

From the data collected and analyzed, we propose that notifications should be designed to reflect this powerful characteristic of the human relationship. To many individuals it seems that some things are less annoying when they are done for other people.

The notification design should maximize the presence of the buddy. For instance, June discussed how she enjoyed seeing photographic pictures of her loved ones, especially when conversing with them. This led to our idea of having photos as symbolic representation for the clients of Social TV or even perhaps the option for video chat through the TV screen.

The images in the margin illustrate two options for highlighting the presence of buddies. Both represent an invitation to a group chat. One uses a photo, while the other uses an avatar.

Maximizing the Buddy

Users can choose to use a photo (top) or an avatar (bottom) to personify themselves in Social TV.

We also developed the idea of categorizing buddies into three groups, each with a different level of permission to interrupt. This would ensure that the power of the human relationship would be honored for close friends and family, while interruptions from more distant acquaintances could be managed appropriately.

The images below show the visual representation of these three levels of buddies, using the easily accessible traffic light metaphor of green, yellow, and red categories. Green buddies have the highest level of access to the user, yellow buddies have a medium level of access, and red buddies have minimal access; the red group represents people whom it is socially awkward to decline as buddies, while at the same time the user does not really wish to interact with them.

Social Needs and Compulsive Behavior

Research Findings

Another pattern uncovered was how some individuals felt the urge to compulsively check on friends and information related to friends. They did this by frequently breaking away from their leisure activities to log on to social networking websites.

Susie felt compelled to constantly check her Facebook and considered it to be "fun, informative, and addicting." She did view Facebook as a distraction because she felt it was something she had to do in order to keep up with her friends and loved ones. Cassandra checked her Facebook with great frequency to see her progress on the Farmville game on Facebook. The game served as a form of social interaction and competition with her friends.

Design Implications

The compulsive behavior expressed through Susie and Cassandra's interviews implies that users should have ease of access to information about their Social TV buddies and to be able to rapidly connect with online friends.

These users may prefer the option to instantly see all notifications and messages sent to them, as soon as they are sent, as shown in the image below.
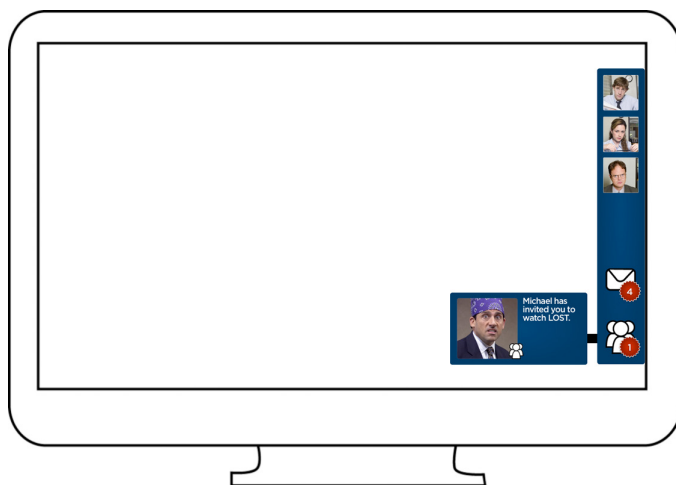
Furthermore, these compulsive checkers should also have easy access to check on their buddies in the Social TV menu.   Provided here is an example of an interface, keeping in mind that compulsive checking
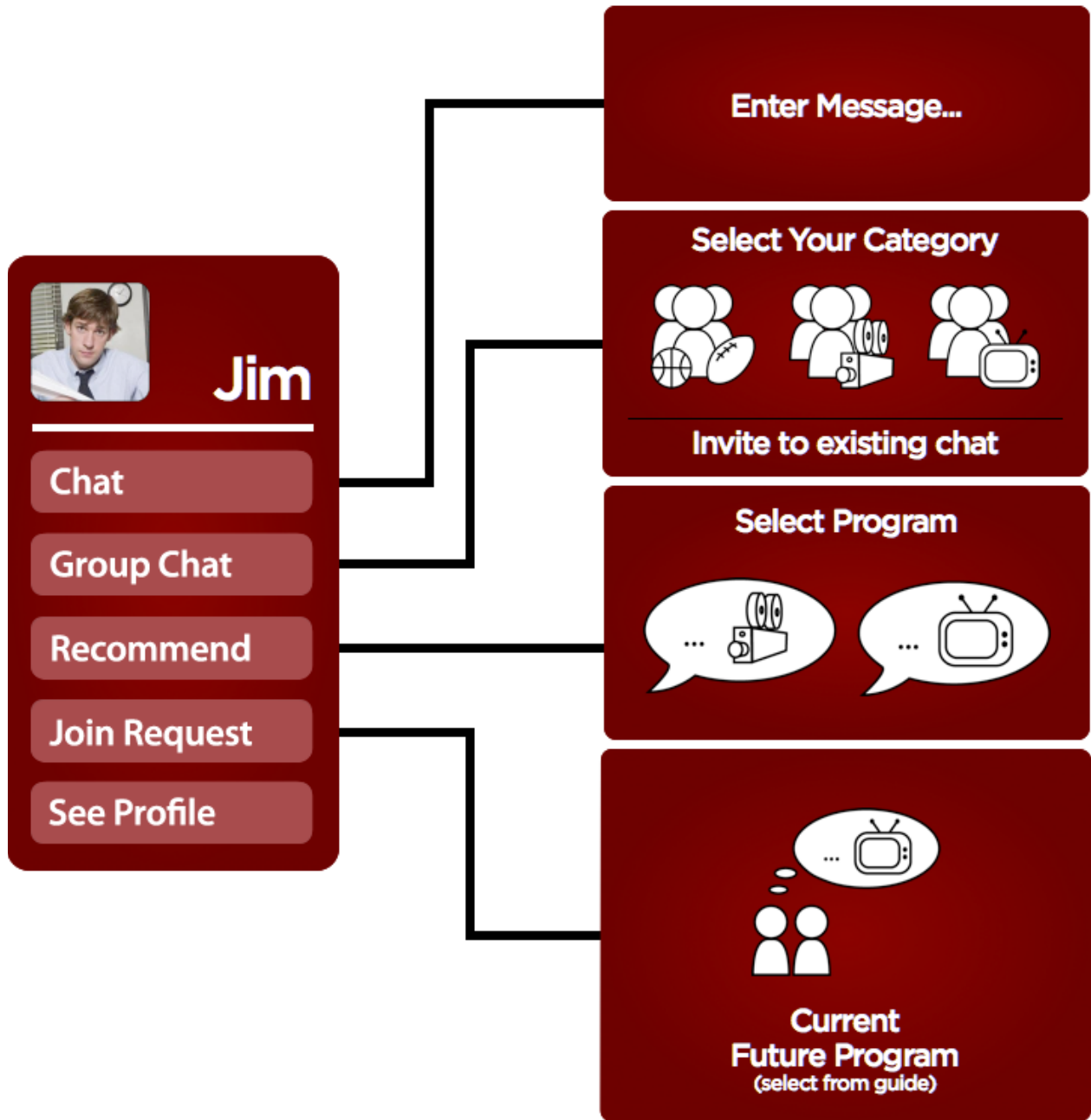
is essentially a self-initiated activity and therefore not covered entirely by notifications which are other-initiated. This interface presents a way to quickly access information about particular buddies.
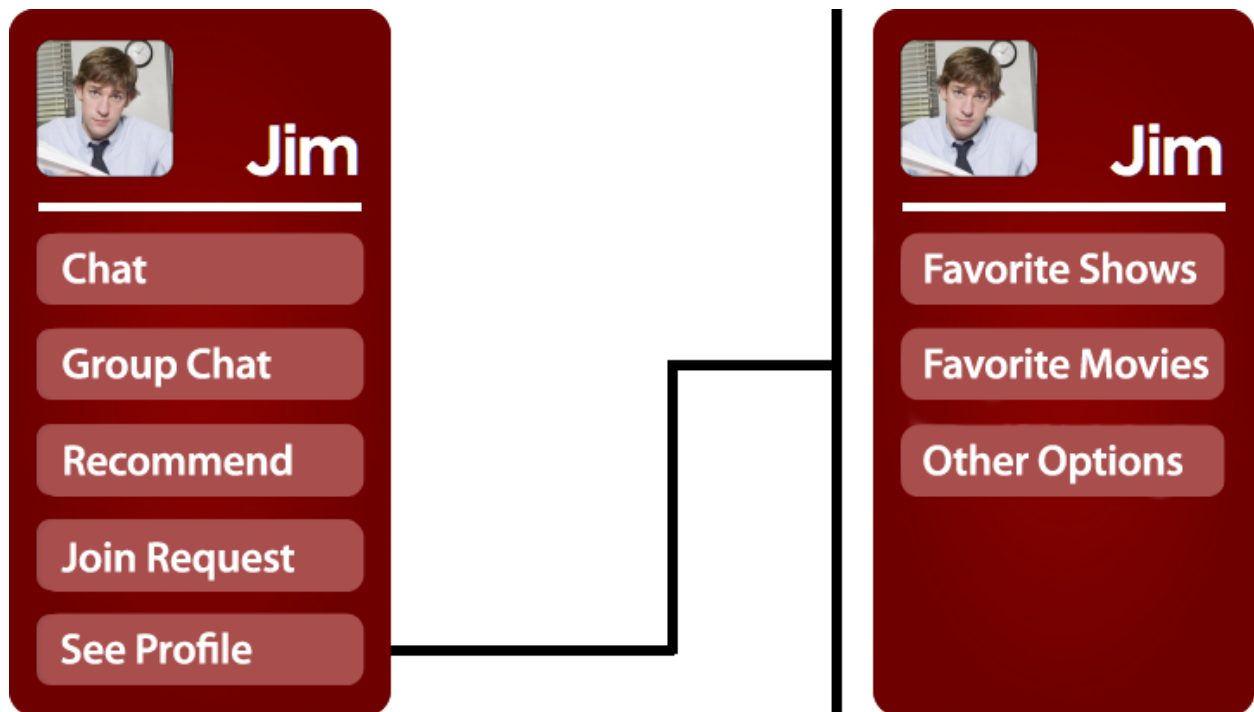
Virtual Social Groups

Research Findings

Some people enjoy having group activities where they could interact with multiple people. Throughout the fieldnotes, there were many instances of individuals being interrupted by friends via text messages, phone calls, friends stopping by to visit, etc. We also heard from one of our research participants, Cassandra, that she enjoyed watching sports with a virtual group by using Facebook chat to discuss the game while it was happening live.

Design Implications

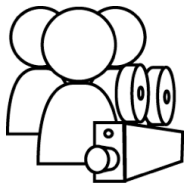From this data, we believe that it might be beneficial for clients to provide them with notifications for a virtual group chat. This would allow clients to converse simultaneously directly through their TV with multiple people in one formatted social area. This chat-room-like social area would allow for group conversation about sports, movies, television shows, etc. Users would not have to turn to social networking websites and phone texting to converse with groups of people. They would be able to join together and partake in an activity as a group simply by using their home television.

We suggest that there could be three variations on the group chat notifications, depending on whether the participants were watching sports, movies, or TV. For sports, continuous chatting would be facilitated, while for movies and TV, users might prefer restrictions on the frequency of messages. For instance, chatting might be limited to the commercial breaks of a TV show. Also, for sports, it would be nice if the chat menu moved away from the top or bottom of the screen so as to keep the running score bars visible.

Group Chat Notifications
Icons that reflect a group's activity (sports, movie or television) can indicate a restriction on the frequency of messages.

Users Want to Have Control Over Their Time

Atefeh Yazdanparast, Justin Frey and Manuel L. Jose III

Another major pattern in our findings was that most people want to have at least some amount of control over their time. However, some people were more "interruptable" than others. To simplify, we will talk about "high control" people and "laid back" people. We found that "high control" people, who preferred to manage their time carefully, had generally developed techniques that allowed them to manage interruptions without annoyance. Of course, sometimes they were helpless to prevent unwanted impositions on their time, and this could lead to frustration and a feeling that they had lost their autonomy. "Laid back" people were more relaxed and flexible about their time, so they were less inclined to be bothered by interruptions. We also discovered a third category of people who had yet a different relationship to time management. These were young men who were easily bored. In their quest to keep themselves entertained, they wanted to be able to easily hop from one activity to another.

We begin with an overview of our research participants' general tendency to control or manage their time, to at least some degree. This tendency to manage time extended to many areas of our participants' daily lives. For instance, Susie had recorded most of the TV shows that she watched, because she wanted to manage her time to watch them when she liked according to her plan. Another instance of Susie's tendency to manage and make use of her time was when she talked about using the microwave to heat her tea. She mentioned that 30 seconds "is plenty of time to do a litany of things." Moreover, she had turned off all notifications on Facebook but she checked her Facebook regularly. This is another instance of managing her time since she wanted to check Facebook on her schedule. In other

words, she did not want to be annoyed by notifications, but she wanted to know about the updates in Facebook. She said "I can check it when I want to."

Sally provided another instance of the tendency to manage her time when she described watching TV while having her hair dyed by her sister. She mentioned that she did not have time to do that, but doing that while she was watching TV was not disruptive since she could both watch TV and have her hair dyed. Similarly, Chris liked to take the trash out and do other activities during the commercials since he did not want to miss what he was watching, and he tried to manage his time so that the other activities did not interfere with his TV watching activity.

Another example of the tendency to manage time and make use of one's time was when Optimus Prime was at the red light and used that time to make phone calls and send text messages (like Susie while heating tea in microwave). Optimus Prime was bothered when his son delayed the decision about going to a restaurant; he felt it was wasting his time. Optimus Prime had the same opinion about the commercials in cinema. He mentioned that commercials are "a waste of his time". Finally, June also raised the issue of managing her time. In describing several interruptions, she said she did not find them negative because they did not interfere with her plans. She provided an example of a negative interruption, when her sister called her and interfered with her activity.

"High Control" People Want to Manage Interruptions

Research Findings

Many of our research participants fell into a category that we labeled "high control" people. These people preferred to manage their time carefully, and had generally developed techniques that allowed them to manage interruptions without annoyance. Of course, sometimes they were helpless to prevent unwanted impositions on their time, and this could lead to frustration and a feeling that they had lost their autonomy. Overall, the ability to control or manage an interruption to a leisure activity mitigated

the negativity of the interruption, since it reduced the influence of the interruption on the ongoing leisure activity. Interruptions that individuals were unable to control were more likely to be regarded as negative. We can conclude that:

- The experience of interruptions as positive or negative is influenced by the amount of control the person has over the interruptions

- The possibility of choosing an activity, rather than feeling compelled to do it, will make it more positive

- Interruptions can be managed or controlled either by pausing the activity that is being interrupted, or by postponing or ignoring the interruption.

- For high control people, there is a tendency to want to control the time of the interruption

- Being interrupted at a desired time ("the right time"), when the person is more willing to interact with the interrupting element, will make the interruption more positive

Many examples from our data support these five points. For instance, Susie provided several instances of managing interruptions by pausing the activity that was being interrupted. Whenever she was watching TV and she was interrupted for any reason, she paused the show using DVR. This mitigated the negative impact she felt since she could come back and follow what she was watching. Susie referred to an interruption that occurred while she was watching TV as "not a big deal." Sally, another research participant, also paused TV shows using DVR whenever she was interrupted while watching TV.

Other research participants managed interruptions by postponing or ignoring interruptions. For example, Chris did not want to be interrupted during certain TV shows. He was willing to reject interruptions during specific times. A similar idea was also mentioned by Susie when she said "when I am watching an old movie, I don't want to be interrupted."

Sally mentioned that receiving work-related texts during her time of

watching TV was negative, since she felt obligated to respond to them. This is a good indicator of the fact that not having the possibility to manage (either to postpone or cancel) the interruptions makes the interruptions more intrusive. Susie had the same feeling when she was talking about using her breast pump, since she could not postpone or cancel this activity. She said she "definitely" preferred to have the possibility to select the time for this activity.

June had also a negative attitude toward feeling compelled or obligated to respond to an interruption. She mentioned that if she felt compelled to do an activity, her attitude would differ from a situation where she chose to do that activity. Overall, the inability to control interruptions made them "frustrating" for June. She mentioned that in the fitness center she had no control over the sound of TV or fans, while at home she could control the level of noise and make them less intrusive.

The timing of the interruption was also influential in June's attitude toward interruptions. She mentioned that "you need to catch your kids at the right time when they are not too tired or too stressed." As a counter example, she described her negative feeling when she was interrupted by her sister calling her "at the wrong time" (while she was busy or tired). She mentioned that if her sister called her on a regular time schedule, she would have a choice whether to answer the phone and talk to her or not. This is an indicator of June's wanting to be in control of the interruptions.

The same idea was also expressed by Optimus Prime when he described the time that his daughter wanted to fly a toy helicopter while he was watching TV. The interruption became negative because his daughter had not selected the right time and Optimus Prime had to pause the TV. He tried to postpone the interruption to the next morning when his daughter asked him to help her assemble the toy while he was watching TV.

Optimus Prime experienced the most serious loss of autonomy among our participants because his job required him to be on-call that weekend. The inability to postpone or ignore the interruptions made by his on-call phone was very negative. Another instance where Optimus Prime was aggravated by a loss of control over his time was when he had to plant a tree he had
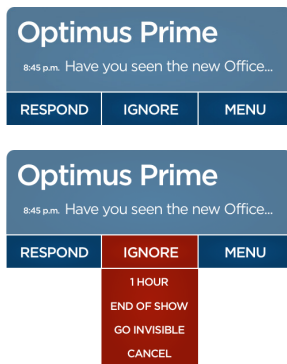
purchased because it started raining. This is similar to Susie's feeling when she was out taking a walk but due to the rain, she had to come back home because she could not control the rain and it affected her activity, so it was negative. Finally, Optimus Prime had no control over the interruption that was caused by a driver ahead of him who had not paid attention to the traffic light and made him wait for another cycle of lights. He considered that a negative interruption because it was wasting his time and was out of his control.

Design Implications

Given the fact that many individuals prefer to manage their time as well as interruptions, we recommend the following tools that can help users control or manage the interrupting effect of notifications.

- An option for Social TV that allows people avoid those individuals they do not want to talk to at that time

  - Having a menu that allows the user to specify who can interrupt them

  - There could be three levels of friends with default or customizable settings. Users can add their friends to these groups based on their own decisions (this is discussed in other chapters).

- The possibility to group buddies into different categories based on show preferences, such as sport followers, comedy lovers, and so on, to give users the opportunity to specify which group they are interested to receive notifications from during each show.

  - Being visible to a specific group of friends and invisible to others based on TV viewing preferences (or other criteria).

  - Receiving notifications from the selected groups and blocking the notifications sent from members of other groups.

- An option to ignore notifications from specific persons or notifications sent from friends during a specific TV show or during a specific period of time.
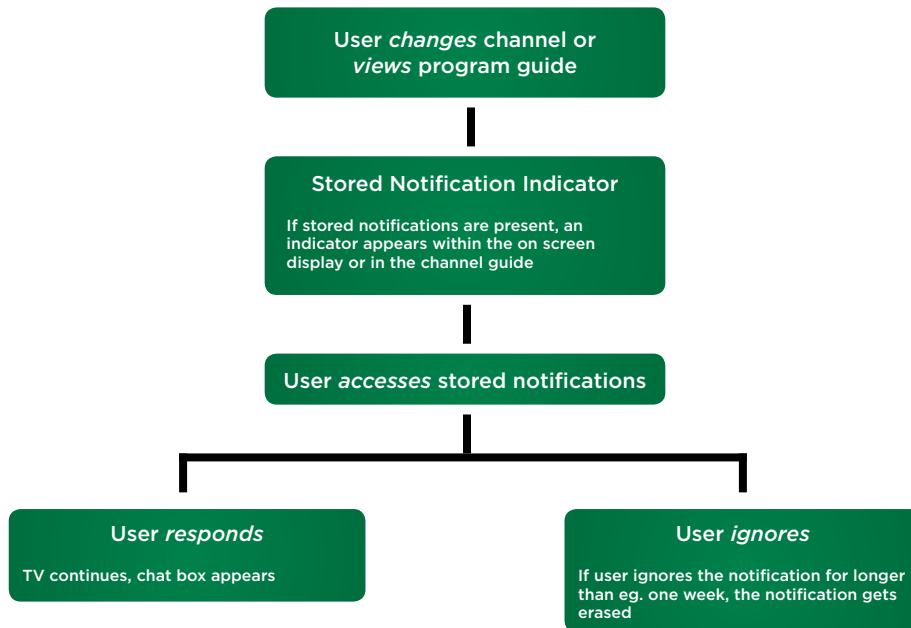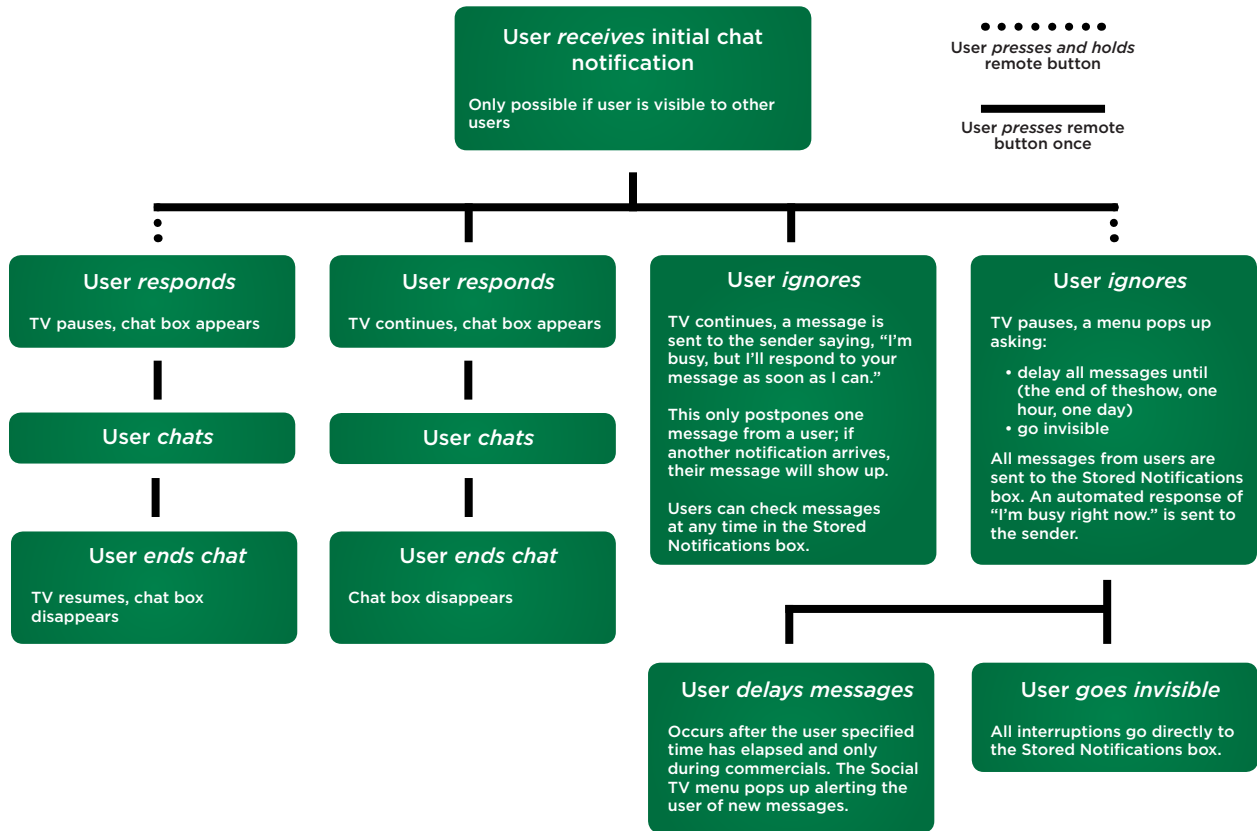
- An option to postpone notifications until the person wants to read them.

  - This time might be during the commercials, after the show, or any time that the person prefers. Susie liked the idea that "all the things that I want to know about are collected in one central area that I can go and check when I want to and not constantly be bombarded."

- An option to undo or cancel the action, in case the user changes his/her mind or mistakenly postpones a notification that he/she did not want to postpone.

- An option to pause the TV show or movie that the person is watching when a notification is received. However, pausing the show might create a problem in cases where a person is watching a show with other friends (joint TV viewing) – Social TV would need to pause the show for all buddies involved.

- The option to send a default message such as "I'm busy now", "will contact you during commercials", and so on when someone contacts the user and the user does not wish to interact at that time.

  - These default messages could be given to the system by the user so that each user creates his/her own default messages.

Optimus Prime
8:45 p.m. Have you seen the new Office...
RESPOND   IGNORE   MENU

Optimus Prime
8:45 p.m. Have you seen the new Office...
RESPOND   IGNORE   MENU
         1 HOUR
         END OF SHOW
         GO INVISIBLE
         CANCEL

Notification Response

Users can choose to ignore a notification if they do not wish to be interrupted.

The next page illustrates the options that a user might be given for responding to a chat notification. In this scenario, the user has four choices: respond while pausing TV, respond while TV continues, ignore while pausing TV, ignore while TV continues. The specifics of these four choices are detailed in the flowchart. Furthermore, in this scenario, the notifications reappear when the user changes the channel or goes to the channel guide, since these actions indicate a loss of interest in the current program. The image in the margin shows how this notification might look.

User *receives* initial chat notification

Only possible if user is visible to other users

• • • • • • • • •
User *presses and holds* remote button

⎯⎯⎯
User *presses* remote button once

User *responds*

TV pauses, chat box appears

User *responds*

TV continues, chat box appears

User *ignores*

TV continues, a message is sent to the sender saying, "I'm busy, but I'll respond to your message as soon as I can."

This only postpones one message from a user; if another notification arrives, their message will show up.

Users can check messages at any time in the Stored Notifications box.

User *ignores*

TV pauses, a menu pops up asking:

• delay all messages until (the end of theshow, one hour, one day)
• go invisible

All messages from users are sent to the Stored Notifications box. An automated response of "I'm busy right now." is sent to the sender.

User *chats*

User *chats*

User *ends chat*

TV resumes, chat box disappears

User *ends chat*

Chat box disappears

User *delays messages*

Occurs after the user specified time has elapsed and only during commercials. The Social TV menu pops up alerting the user of new messages.

User *goes invisible*

All interruptions go directly to the Stored Notifications box.

User *changes* channel or *views* program guide

Stored Notification Indicator

If stored notifications are present, an indicator appears within the on screen display or in the channel guide

User *accesses* stored notifications

User *responds*

TV continues, chat box appears

User *ignores*

If user ignores the notification for longer than eg. one week, the notification gets erased

"Laid Back" People Accept Interruptions with Equanimity

Research Findings

We found that some of the participants in our research accepted most interruptions and were hard to annoy in this regard. Ancient Augustus, Cassandra, and in some instances June, fit this group. They were not bothered by interruptions most of the time, and even if they felt irritated by an interruption initially, they accepted it and went with the flow. In addition to personality differences, we also found that the "interruptability" of users depended on their mood and desired level of engagement in a particular interaction.

Cassandra had a generally accepting attitude toward interruptions. For instance, she mentioned that when her neighbor stopped by and wanted to talk to her, she did not have a negative feeling toward this interruption. Cassandra said "she is an elderly woman and she doesn't have anyone around to talk to." Moreover, when she was interrupted by her friends who had come to visit her unannounced, she was annoyed at first, but later, she enjoyed seeing her friends and she did not label this interruption as a negative one.

Similarly, Ancient Augustus mentioned that interruptions within his home were never too intrusive because he expected to be interrupted by his wife and dogs. He said that he has accepted these interruptions. To him, most of the interruptions were things that he just accepted as everyday life and chose not to think of them as anything more than that.

Moreover, there might be times when any person feels more open to interruptions and other times when the same person does not want to be interrupted. One possible reason for such different behaviors is the mood of the person at the time that he/she is interrupted. June mentioned that "you need to catch your kids at the right time when they are not too tired or too stressed" to explain that the mood of the person you want to interact with (or the desired level of engagement in interactions) affects the attitude of the person toward the interruption.

Design Implications

- An option to select the desired level of engagement in interactions via Social TV (the level of interruptability)
  - If the person is not easily bothered by the notifications, he/she can simply respond to a notification, as shown in the example in the margin.
  - If the person does not want to be interrupted at all, he/she can turn off all the notifications.
  - If the person does not want to be interrupted for a period of time or during a TV show, he/she can set the Social TV accordingly
- Users who are laid back will probably use whatever layout is default. Therefore, we can focus the design more toward the other users who have high priority on being able to manage their time.
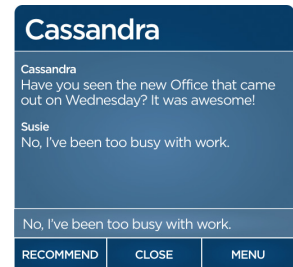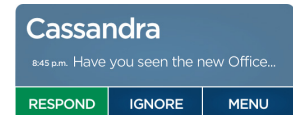
Notification Response

Users can choose to respond to a notification if they wish to interact with Social TV.

Easily Bored People

Research Findings

Finally, we identified two participants who fit a third profile with regard to time management. These two participants, Johnny Longhorns and Chris, were young men who were easily bored. They seemed to have quite a bit of leisure time, and jumped from activity to activity in a quest to keep themselves entertained. Many of their photos of interruptions actually showed self-initiated interruptions in which they switched from one leisure activity to another. We can conclude that:

- The desired level of engagement or demand for entertainment is different for different people.

- Social TV could be a good solution for people who demand higher levels of entertainment.

For instance, Johnny Longhorns switched from one activity to another, from listening to music or watching TV to watching Hocus Pocus, from listening to music to reading a book, and from studying to playing his guitar. Chris also provided several instances of switching activities and

getting bored easily. When he got bored of watching a TV show, he started working on his brother's laptop to find iTunes. Later, he just decided to listen to the music on Facebook. He said "music happens when I am bored". Both Johnny and Chris believed that TV should stimulate them (provide a high level of engagement) and if the TV show did not, they looked for other activities to supplement the level of entertainment they desired.

Design Implications

- For the easily get bored users, the passive system of the "Stored Notifications" provides an alternative, self initiated source of entertainment.

- Stored notification is a passive system that holds unanswered notifications.

- An option to send messages to friends to get an idea of what show to watch (a suggestion request)

2   111 Comedy Central

The Office   9:00 pm - 10:00 pm

As the summer interns prepare to depart, Michael hears from various members of the office that two of the interns might be dating, but feels upset that he was left out of the gossip. He talks about the situation with the third intern, and learns that the three interns had recently gone to a club, where they saw Stanley dancing with a woman, presumably his wife Teri.

2   Stored Notifications

8:45 pm **Optimus Prime:** *Chat*
8:45 pm **Cassandra:** *Watch invitation*

111 Comedy Central

The Office
9:00 pm - 10:00 pm

When Autonomy Trumps Relationships

Matt Baline, Jocelyn Huelsman and Daniel Führer

As described earlier, the power of the human relationship between the interrupter and interrupted is often enough to trump the annoyance of losing control over one's time. There are situations, however, when this power fails and a desire for autonomy outweighs the relationship at hand. This section describes instances in which a participant's desire for autonomy trumped the human relationship between the interrupter and the participant. Interviews with participants revealed two distinct patterns within this larger theme. In some cases, participants' desire for autonomy trumped a relationship because the relationship was weak. In other cases, the relationship in question was strong, but was still trumped by an even stronger desire for autonomy. These patterns suggest that an interactive TV system should enable a user to ignore or delay notifications from distant and close relationships alike.

A Desire for Autonomy Trumps Weak Relationships

Research Findings

Instances of the first pattern, in which the desire for autonomy trumped a weak human relationship, were most clearly expressed in the interviews of three participants: Johnny Longhorns, Cassandra, and Chris. In most cases, the participant described being engaged in a leisure activity and experiencing an interruption from a friend or acquaintance that bothered them. In some of these cases, participants discussed ultimately acquiescing to this interruption and other times they explained how it would be ignored or put off. What seems most significant, however, is not the participant's

ultimate handling of an interruption by a person with whom they have a weak relationship, but their initial reaction of displeasure.

As noted, Johnny Longhorns illustrated one instance of this reaction and of the desire for autonomy trumping a weak relationship. He discussed with the interviewer how he had different reactions to interruptions by different neighbors. One neighbor evoked a positive reaction; Johnny described him as an "old friend" and noted that the interruption was positive and not intrusive. Another group of neighbors, however, evoked a negative reaction. Johnny noted that he had not known these neighbors for very long and he described how he felt like they wanted too much of his time, especially when, "I get back from class and I just wanna sit down, watch TV or do something by myself." His desire for autonomy clearly trumped the relationship he had with these people. Thus, it seems that a key factor in determining when a desire for autonomy trumped a weak human relationship was the age and type of relationship that Johnny had with each interrupter.

Johnny also expressed frustration at the frequency of interruptions by these neighbors. He noted that they seemed to drop by too often and at the wrong times, telling the interviewer "They're nice guys. I like these guys, but sometimes enough is enough! But they don't seem to think that way". He added that he felt like "they're waiting for me" to get home and hang out. Thus, it seems that another key component in leading Johnny Longhorns to favor autonomy over the weak relationship with his neighbors was the frequency and timing with which they interrupted him.

Cassandra provided a similar tale of a negative interruption perpetrated by friends who interrupted at the wrong time. In this instance, Cassandra's friends showed up at her apartment unannounced and interrupted her plan to enjoy a quiet meal and television time alone. As she told the interviewer, her friends expected her to be there and so they decided to stop by without calling. According to Cassandra, she asked them, "Oh, you didn't want to call to see if I'm here?" and they responded, "Well if you're not working and you're not at school then we know you're at home." Cassandra seemed visibly disturbed by this revelation while relating it, and noted that she would have to "change that up some" in the future, presumably to avoid

them. Later on Cassandra stressed that the unannounced nature of their arrival was what bothered her the most. Even though she ultimately acquiesced to the intrusion of her friends, Cassandra was initially put off by their arrival and, like Johnny Longhorns, it was the frequency and timing of this event that led Cassandra to favor autonomy over the weaker relationship.

Like Johnny Longhorns and Cassandra, Chris also described several interruptions that followed the pattern of autonomy trumping weak relationships. For example, Chris explained to the interviewers that when he is watching Lost, he lets only the strongest relationships interrupt him: He does not take calls during Lost episodes. He won't even look at the phone until it's over. He likes to discuss theories about the show or guess at what the next twist will be when he watches with his brother, but that's it. Thus, Chris' desire to watch Lost trumped all but his strongest relationships, like the one he has with his brother. Weaker connections that might try to contact Chris were ignored.

Chris described two other examples of this pattern during his interview, but in these situations the balance between autonomy and the human relationship was inverted. Chris indicated that when nothing good was on television he was willing to interact with those he has a weak relationship with. Thus, it can be supposed that at times when there is something good on television, Chris would not be willing to interact with those same people. In one case, he described a Friday afternoon when he had "no set TV watching schedule" and a friend dropped by to invite him out. Chris was a little annoyed by the interruption to his leisure time, but quickly decided that getting out once in a while was good for his social life, since he still had friends and a "decent social life" in his hometown, where he was at the time of the interruption.

In another case, Chris noted his positive reaction to a friend calling and interrupting him while he was watching TV. Chris felt that there was nothing good on and he knew that the friend would offer him something more exciting to do. Thus, it appears that Chris is willing to compromise his autonomy for "decent" (as opposed to strong) relationships and opportunities for more exciting activities, when he does not place a high

value on what he is doing with his leisure time. Presumably, if he were watching Lost, or another program that he valued highly, these invitations would have been declined.

Design Implications

The experiences of Johnny Longhorns and Cassandra clearly indicate that there are times when the desire for autonomy trumps weaker relationships. Furthermore it seems like these instances are made especially negative by the frequency and timing of these interruptions, particularly the tendency of these friends to pounce on the participant when he or she is engaged in a leisure activity alone. Given these findings, it seems that any system of interactive TV notifications ought to prohibit users from pouncing on each other, especially in cases where the relationship is a weak one. This recommendation does not imply any particular interface design, but instead suggests how the system should handle notifications. For example, it may make sense to allow Johnny's neighbors to see that he is available on the system, but prevent them from polling constantly (as some IM programs allow) and receiving a notification as soon as he signs on or takes some other action. This would mitigate the uncomfortable feeling of being tracked that both Johnny and Cassandra expressed.

Chris' experience lends additional support to the idea that there are times when a desire for autonomy trumps a weak human relationship. He has developed his own explicit rules about when interruptions from such sources will be tolerated and when they will not. This suggests that any system of interactive TV notifications should be configurable to accommodate any such rules a user might have. At a minimum, users should be able to indicate which of their connections are unwelcome at times of high viewing engagement.

Perhaps more interestingly, Chris' experience also suggests that an interactive TV system might benefit from affording the user the opportunity to become "promiscuous". In those cases when Chris welcomed interruptions from people with whom he had weaker relationships it was because he was not particularly engaged in his television viewing. An interactive TV system could accommodate this mood by allowing a user like Chris to

notify all of his connections (weak or strong) that he is actively interested in being interrupted by them. In order to avoid turning such a user into an interrupter of others, however, this "promiscuous mode" should likely be represented by a passive notification rather than an active blast to one's connections. Adding a particular icon to the buddy list interface or creating a presence status associated with this mode are two possible ways of achieving this.

The images in the margin, below and on the subsequent page illustrate these points. Here the system accommodates the user's rules about when interruptions will be tolerated. At a general level the contact list is split into categories such as family, friends and coworkers to make connections more manageable. The user can set a status relative to each group that controls when its members can interrupt. Moreover, individual contacts have been further assigned an individual prioritization that dictates when they are allowed to interrupt. Finally, notifications appear in different locations on the screen depending on the rules set forth by the user. For example, weak relationships appear minimized on the side of the screen because they are less important.

These images also illustrate a "promiscuous" functionality. Here the user's status is set to "Available" and "Bored". In this way the user is indicating to his contacts that he is open to interruptions.
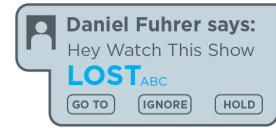
High Priority Contact

Notification pops up in the center of the screen. Hold option places message in your inbox.
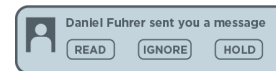
Medium Priority Contact

Message expands from Contact List on right of screen. Hold option places message in your Inbox.

Low Priority Contact

Message gets tucked under the contact list. A small orb of light glows to subtly notify user that they have been contacted by one of their contacts.
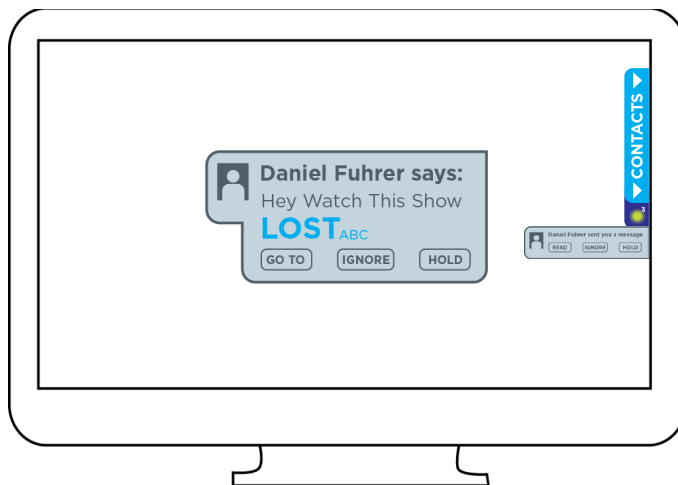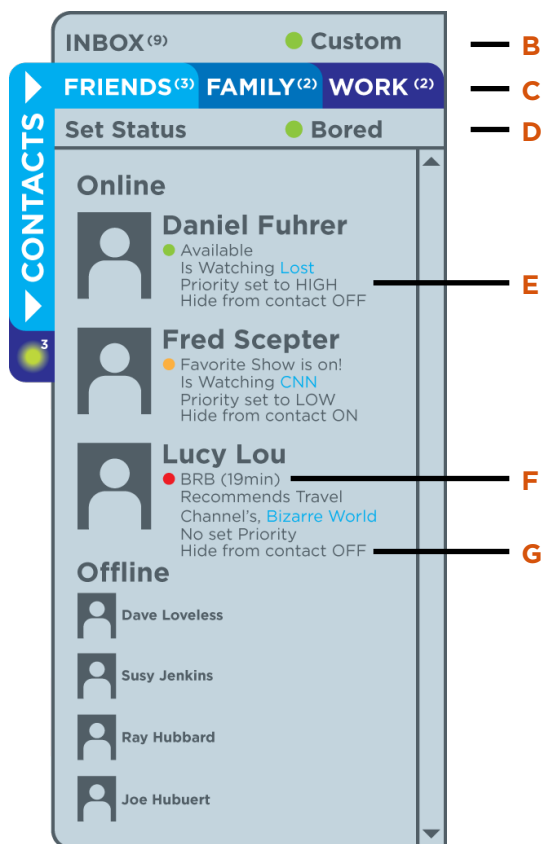
suggested placement of three notification types

Closed Contact List

A Glowing orb indicates a user has been contacted by one of their buddies

CONTACTS
3

────── **A**

Open Contact List

INBOX (9)   ● Custom

────── **B**

FRIENDS (3) **FAMILY** (2) **WORK** (2)

────── **C**

CONTACTS

Set Status   ● Bored

────── **D**

Online

Daniel Fuhrer
● Available
Is Watching Lost
Priority set to HIGH
Hide from contact OFF

────── **E**

Fred Scepter
● Favorite Show is on!
Is Watching CNN
Priority set to LOW
Hide from contact ON

Lucy Lou
● BRB (19min)
Recommends Travel
Channel's, Bizarre World
No set Priority
Hide from contact OFF

────── **F**

────── **G**

Offline

Dave Loveless

Susy Jenkins

Ray Hubbard

Joe Hubuert

3

B Overall status change, universally changes statuses through all contacts and categories, default statuses are available, invisible, BRB (Be Right Back) and Custom

C Tabs to categorize contacts, each tab has individual statuses to allow user to appear invisible or available to separate people, number of contacts online appear in parentheses

D Ability to set custom status messages instead of defaults

E Each contact can have an individual priority/notification level, either high, medium, or low. This setting will affect how notifications are shown on screen.

F Changeable color circles next to status generate a semiotic clue as to what level user is interested in contact, green being high level of interaction, yellow/orange as medium and red as don't bother me, busy, etc. When users view contacts, they can decipher a contact's status and decide whether or not to send them a message, based on color and context of message.

G Selective invisibility sets invisible status for individual contacts, so user can remain online talking to others wihtout being contacted by an unwanted person

A Desire for Autonomy Trumps Strong Relationships

Research Findings

While it may be expected that a desire for autonomy would trump weak relationships, our findings indicate that strong relationships can also be overwhelmed by an even stronger desire for autonomy. Relationships concerning immediate family and other loved ones require attention more regularly and thus can prove to be annoying. This leads to the need to separate oneself from another person for a period of time. Our study participants June, Sally, Optimus Prime, and Chris all discussed interruptions where constant interaction with loved ones became a burden. In these cases, a participant's relationship with an interrupter was strong, but was still trumped by an even more powerful desire for autonomy. It should be noted, however, that this trumping does not necessarily mean a close friend or family member was shut out. Rather, these viewers wished they could have remained autonomous even though many did not always take action to do so. Within these instances, two main factors are visible: repetitiveness and over-familiarity. It is difficult to discuss the two main ideas separately for familiarity is typically driven by the repeated action of another.

The participant June gave a prime example of these two main ideas. June spoke of her sister who had a knack for calling at inopportune times. Yet, it was not only the timing that made conversations with her sister unpleasant; it was the content of the conversation. As June stated, "She'll call and repeat the same thing over and over again." Despite her love for her sister, June found their conversations uninteresting because she was already familiar with her topics of discussion or really had no interest in them. Fuelled by these feelings, her desire for autonomy trumped in her mind. Yet, because June really cared for her sister she did always take the time to talk to her.

Another respondent, Chris, described the same predicament with his significant other and stated, "I talk to her so much, it's not as interesting or intriguing as talking to a friend... I'm with her, I talk to her so much. It's

just like another routine thing." Chris also spoke of a negative interruption that was a 30 minute long conversation and how it would have been fine if his significant other had simply asked a question or spoke of something relevant. Redundancy is a driving force for a preference of autonomy over the relationship. When questioned further, Chris stated that if he were intensely watching a television program, he would not answer his significant other's phone call.

Repetition can cause an otherwise enjoyable conversation or experience to become unpleasant. Sally was a mother and wife who demonstrated great affection towards her family in the interviews. She discussed an instance where her son was playing with the dog and making a lot of noise, mostly giggling, while she was watching a television program. At first Sally said this was cute and enjoyable, but as this interruption turned into about 20-30 minutes of giggling she did not enjoy it anymore. Also Sally spoke of an instance where she was watching television with her husband who started to question her. Sally said that it would not have been annoying if it were relevant to the television show they were watching or if he had waited for her to answer his questions until a break in the program. What initially started out as enjoyable activities with loved ones deteriorated into annoying disruptions during her television watching. When questioned about television viewing, Sally described it as, "80% is just time for myself." This shows that Sally already views television as a more autonomous activity.

In the case of Optimus Prime, the annoyance was due to repetition and familiarity from events initiated by his daughter. Optimus Prime was watching an intense football game in his family room when his daughter walked in to ask a question. This forced Optimus Prime to pause his game so he could give full attention to his daughter's inquiry. She asked if she could play with her toy helicopter in the family room because it was spacious. Optimus Prime did not desire for this interruption to continue so he told his daughter to play in the backroom that also had ample room for play. When questioned about this event, Optimus Prime discussed that the interruption was not about the toy, but about his daughter demanding attention from him since he was home. Due to his knowledge from previous occurrences, Optimus Prime said her main idea was, "Stop what

you're doing and concentrate on what I'm asking you." He also stated that she often wants to have others watch her play with the helicopter. Optimus Prime is familiar with his daughter's intentions, so while he still described this interruption as negative, he was able to execute a solution quickly and return to viewing his football game. In this way Optimus Prime's desire for autonomy trumped the strong relationship he described having with his daughter.

Unlike Optimus Prime, Chris had an interruption due to familiarity that he could not extinguish quickly. Chris' significant other called him asking for a favor. She forgot to pay a bill and was away from the means to do so. She knew that Chris was just relaxing at home so he could do it for her. This involved Chris needing to turn his attention away from the show he was watching, get materials for taking down her information, and finally to go online to pay the bill. Chris described this as a very negative interruption since it removed him so far from his relaxing television viewing. While he ultimately acquiesced to his significant other's request, he clearly wanted to put his autonomy first.

While Chris' tale of paying a bill is an isolated case, one could note the idea that with Social TV other viewers will know when a viewer is online and most likely not participating in anything too demanding. This could lead to favor requests like the one Chris was faced with. Others will know when a viewer has "down time" which the viewer may not want their entire social contact list to know. This might be problematic because, as is commonly known, many viewers have television on as background noise while doing other tasks. Other Social TV users might not be able to distinguish this type of viewing pattern from others and may assume that the viewer is watching television and relaxing whenever they have an online status and then seek to interrupt them for a favor. Such a request might go unanswered or interrupt an actual task being performed away from the screen.

Design Implications

One possible design implication that emerges from these findings is the ability to have an invisible status. Social TV users should be able to utilize

the program without showing others that they are online. This prevents other users not just from trying to interact with the person but also from assuming their domestic habits. This method would be useful for a viewer to retain complete autonomy while being able to feel socially connected with others through the device.

Another idea within the scope of an invisibility mode is "selective invisibility." As noted earlier, some conversations with loved ones become redundant over time. If a person wished to end the conversation, but remain active on Social TV, they could simply become invisible to that one individual. This may prove useful when someone who usually has top priority becomes a hindrance to television viewing. Also in many social groups, television shows are watched as a catalyst for conversation. A viewer may be watching a show with their coworkers and friends who are on various group lists. Since it could be bothersome to change friend category lists for one show, there needs to be another way to block known intrusive companions.

Another idea for handling a desire for autonomy is to provide polite messages that would notify all parties trying to contact the viewer that they are unavailable. With this method the viewer could inform other users about their precise activities thereby removing the ability of others to assume the viewer's habits. The idea of remaining autonomous should not be limited to managing notifications but also to externalizing one's own desire to be autonomous.

Again, the images above illustrate these design ideas. An "Invisible" status is available to the user at the overall and group levels. Moreover, each contact reflects the user's preference to appear selectively invisible to that person. Finally, the custom status message that can serve as part of a "promiscuous mode" also operates to politely inform others that the user is unavailable. Here the user has set the message to read "Bored", but it can be changed. Should he want to politely reject those who contact him and dissuade others from doing it too, he could change the message to something like, "Totally in the zone watching LOST" or "Drowning in paperwork."

Experiential Aspects of Interruptions

Michaela Cline, Louis Liao, Jessalyn Bradley, Paul Samples and Anna Niess

During research, many participants discussed the experiential aspects of interruptions – their visual, auditory, and temporal dimensions. Through analysis, we have identified the dimensions that typically result in a pleasant or unpleasant sensory experience. This analysis has generated design ideas that will crucially shape the viewer's experience with Social TV notifications. Below we present four dimensions of the sensory experience of interruptions, along with their design implications.

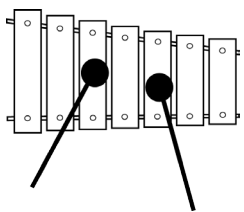## Avoid Grating Sounds/Visuals

Research Findings

We found that participants typically preferred to be notified of texts, emails, and calls by simple and unobtrusive noises and images, rather than by grating sounds such as an alarm going off or dogs whining, or distracting visuals such as the ads that come on the screen while watching a show.

With regard to sounds, for example, Sally checks Facebook regularly and has her cell phone somewhere near her most of the time. When we asked her what she preferred to use as her text/call notifications (audio wise), she replied that she favored subtle noises, or "short sounds." She gave us an example of the noise her phone makes when she gets a text, which was the sound of a glass clinking. She liked it because it was simple, and not repetitive. Susie dislikes loud, long, and monotone sounds (i.e. the microwave beep) so she picked a "fun and uplifting" ring for her cell phone and keeps her short e-mail notification "ding" sound.

We found that noises such as alarm clocks (long-lasting and loud), doorbells (unexpected and loud), and sounds such as dogs barking, or cats meowing, were low on the list of noises people preferred to be interrupted with. The reason that these noises are annoying is because they are long in duration, or because they imply obligations that are necessary to deal with, but not particularly enjoyable.

In terms of visual interruptions, Susie recalled how she felt "bombarded" when moving overlays on her TV impaired her ability to see the full screen during a show. Instead of being able to watch her show, she felt "compelled to watch" the small advertisement, until eventually it went away. A more appealing notification, therefore, would be much less visually dominating.

Design Implications

- Audio and visual notifications should be short and "to-the point". They should not last a long time, as an extended duration is consistently referred to as a negative attribute.

- The auditory and visual experience of a notification should be subtle and low key

- Natural sounds like rain tend to be positively evaluated; however, since notification sounds should not disappear into the audioscape of a TV show, they need to have a distinctive character.

- Sounds associated with enjoyable activities tend to be positively evaluated, such as clinking glass or musical notes.

- Noises should not suggest inescapable obligation, such as alarm clocks, doorbell ringing, and dogs barking/whining. Our research suggests that reminders of such obligations are negative experiences.

- Visuals should not dominate users' attention when they want to be focusing on a show.

Subtle Sounds

Examples of subtle, pleasing sounds include popping bubbles, clinking wine glasses or a chiming xylophone.

Avoid Scary Interruptions

Research Findings

Our research revealed that, not surprisingly, startling interruptions were generally an unpleasant experience. In some cases the interruptions were from people. One example is from a participant named Cassandra who has a sixteen-year-old daughter who likes to watch television in her room while Cassandra likes to watch television in the living room. Unlike Cassandra, her daughter likes to watch scary movies and television shows in which the daughter gets insights on ways to scare Cassandra. Her daughter likes to disappear during the commercial breaks and sneak up on Cassandra to scare her when she is involved in the show. Sudden pop-ups or sudden loud occurrences on the screen would not be welcomed by many who are engaged by their shows.

Design Implications

Agreeable sounds were addressed in the previous section – here we will focus on non-scary, non-startling visual solutions.

- Unobtrusive size and placement of notifications. The icon that pops up should not overpower anything airing on the television or any information displayed on the toolbar. In the image, we have used small circles in the corner of the screen, to give the user enough information to know they have an available chat without being bogged down by graphics and type so that they get distracted from the show.

- Gradual emergence of initial notifications. By having a notification appear gradually, it can still be seen visually and will not alarm the person watching television. Below are two examples of possible non-intrusive ways for a chat notification to pop up for the first time on a TV screen.
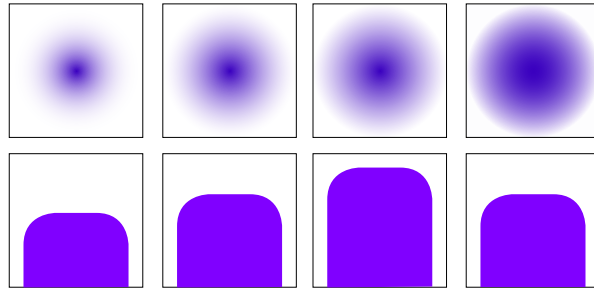
- Subtle movements for repeated notifications. Visual notifications for ignored or idle chats, to remind users that someone would like to engage with them, could include a subtle pulsing or bouncing effect. This effect will not distract the person from the show if they want to ignore it.
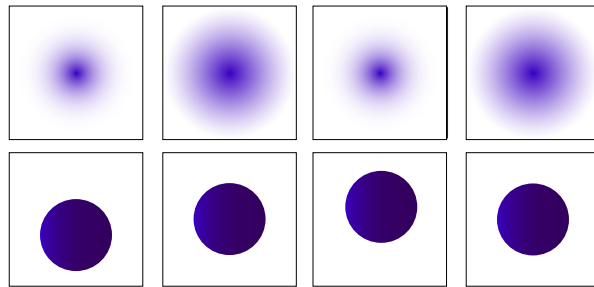
Avoid Frequent Interruptions

Research Findings

Examples across age and gender indicate that viewers do not like frequent and repetitive interruptions. Even the most patient person would be annoyed after too much repetition, and an initially pleasant interruption will become disagreeable. For instance, Johnny Longhorns got annoyed when his new neighbors knocked on his window wanting to hang out all

the time. He found it a negative interruption because of how often they did it. Sally enjoyed playing fetch with the dog when she was watching a show but she would stop after "five to seven times" because the repetition eventually turned it into a negative interruption. The same applied to her son playing the drum, which she found cute initially but eventually the repetitiveness of the drumming noise became irritating. June found telephone conversations with her sister a burden because not only did her sister like calling at inappropriate times, she also liked to repeat the same topic over and over, which June did not particularly enjoy.

Design Implications

- Notification frequency option: the viewer should to be able to choose how often they wish to receive notifications (i.e. every 15 to 30 seconds or 5 to 15 minutes).

- Other ideas for tools to help users make interruptions less frequent are found in Chapter 4, under the design implications for the section "High Control People Want to Manage Interruptions."

Avoid Abstract Interruptions

Research Findings

Some people find abstract sounds and images bothersome. Although many people might find images or sounds that they do not understand pleasing or entertaining, not all people will find the abstractness enjoyable or soothing. The only interruption Ancient Augustus had strong negative feelings about was a particular commercial with a storyline that he did not understand. He felt that there was no real meaning to it. Whatever theme the commercial was trying to convey is of little importance to a person if he does not understand. Susie found the cricket ringtone on her husband's phone annoying because "every time it goes off, I feel like we're camping." Apparently, she did not understand why a person would want to feel like it's the outdoors when the phone rings. Therefore, we believe that the less ambiguous and complicated the notification is, the more positively it will be perceived by the viewer.

Design Implications

It is extremely important that the notifications are kept simple. Simple, nonetheless, can also be sophisticated. Susie enjoys the sound of the rain hitting tin or metal, and such a crisp sound symbolizes an awakening of the moment, and refreshes the person. Although this does not apply to everyone, it is an example of how a simple sound can yield a relaxing result.

- The simpler the notification is, the better. The focus should not be on reducing navigation options but rather on creating less friction and ambiguity for the viewer.

- Not all notifications have to be simple and non-abstract, but there have to be options. For instance, offer at least two to three choices of sounds for notifications that go from the simplest to the most sophisticated. This would allow most viewers to find a favorable notification style to match their own need.

- The sounds and images shown earlier in this chapter illustrate these principles.

Research Participants

Ancient Augustus

Gender: Male
Age: Mid-70s
Race/Ethnicity: White
Occupation: Retired musician

Cassandra

Gender: Female
Age: Mid-Late 30s
Race/Ethnicity: African-American/Latino
Occupation: Student

Chris

Gender: Male
Age: Early 20s
Race/Ethnicity: Latino/non-Latino white
Occupation: Student

Johnny Longhorns

Gender: Male
Age: Mid-70s
Race/Ethnicity: White
Occupation: Retired musician
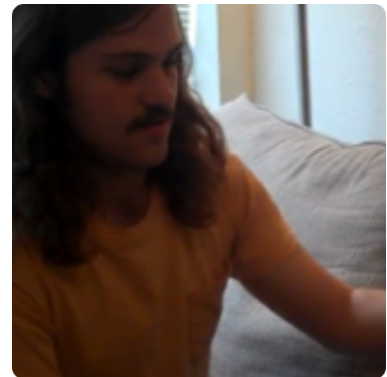
June

Gender: Female
Age: Mid-50s
Race/Ethnicity: White
Occupation: Corporate manager

Optimus Prime

Gender: Male
Age: Early 30s
Race/Ethnicity: White
Occupation: Electrician

Sally

Gender: Female
Age: Early 30s
Race/Ethnicity: White
Occupation: Owns real estate business
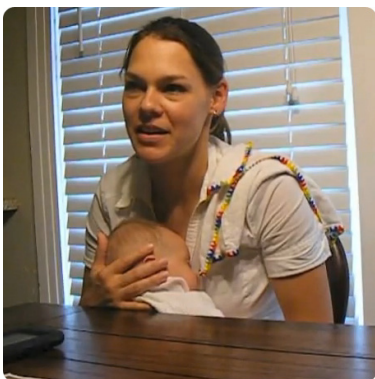
Susie

Gender: Female
Age: Early 30s
Race/Ethnicity: White
Occupation: Advertising account executive

List of Interruptions

The interruptions listed here are only those portrayed in the photos taken by study participants. The report also discusses some additional interruptions that participants described during the interviews, but that took place outside of the weekend when they were taking pictures.

See Chapter 2 for a discussion of positive, neutral, and negative experiences and the distinctions between other-initiated, self-initiated, and intermediate interruptions.

Ancient Augustus

Number	Interruption	Prior Activity	Positive Negative Neutral	Other Intermediate Self-Initiated
1	Wife (bringing in mail)	Working on a document	Neutral	Other-Initiated
2	Wife (talking to him)	Repairing an instrument	Neutral	Other-Initiated
3	Dog (wanting to play)	Deep thought	Neutral	Other-Initiated
4	Commercial (distracting/abstract)	Watching television	Negative	Other-Initiated
5	Wife's cell phone (had to locate spouse)	Watching television	Negative	Other-Initiated
6	His cell phone	Watching television	Neutral	Other-Initiated
7	Dog (wanting to play again)	Watching television	Neutral	Other-Initiated

Cassandra

Number	Interruption	Prior Activity	Positive Negative Neutral	Other Intermediate Self-Initiated
1	Carter (Dog)	Watching television	Negative	Other-Initiated
2	Carter	Watching television	Negative	Other-Initiated
3	Daughter	Watching television	Neutral	Other-Initiated
4	Daughter (texting her)	Watching television	Negative	Other-Initiated
5	Mother (calling her)	Watching television	Negative	Other-Initiated
6	Laundry	Unknown	Negative	Intermediate
7	Daughter's Father	Unknown	Neutral	Other-Initiated
8	Carter	Watching television	Negative	Other-Initiated
9	Carter and the neighbor	Watching television	Neutral	Other-Initiated
10	Carter	Watching television	Negative	Other-Initiated
11	Daughter	Bedroom	Neutral	Other-Initiated
12	Daughter (scaring her)	Watching television	Negative	Other-Initiated
13	Friends stopping by	Watching television	Neutral	Other-Initiated
14	Carter	Watching television	Negative	Other-Initiated
15	Carter	Watching television	Negative	Other-Initiated
16	Daugther (scaring her)	Watching television	Negative	Other-Initiated
17	Carter	Watching television	Negative	Other-Initiated
18	Friend	Grading	Neutral	Other-Initiated
19	Daughter's television volume	Unknown	Negative	Other-Initiated
20	Laundry and multitasking	Unknown	Neutral	Intermediate

Chris

Number	Interruption	Prior Activity	Positive Negative Neutral	Other Intermediate Self-Initiated
1	Friend at the door	Watching television (Friday)	Positive/Negative	Other-Initiated
2	Ceiling fan	Watching television (Bedroom)	Negative	Other-Initiated
3	Toilet	Watching television	Negative	Self-Initiated
4	Mom walking in	Watching television (Living Room)	Positive	Other-Initiated
5	Tux website	Watching television (with brother)	Positive	Self-Initiated
6	Rock Star drink	Watching television	Positive/Negative	Self-Initiated
7	Dog needing love	Watching television	Positive/Negative	Other-Initiated
8	Trash	Commercials	Positive/Negative	Self-Initiated
9	Refrigerator	Watching television	Positive	Self-Initiated
10	Home phone (ringing)	Watching television	Negative	Other-Initiated
11	Paying bill for girlfriend	Watching television	Negative	Other-Initiated
12	Conversation with friend about Homecoming	Watching television (reruns)	Positive/Negative	Other-Initiated
13	Bored listening to music	Watching television (boring show)	Positive	Self-Initiated
14	Phone call from friend who came to the door	Watching television and computer	Positive	Other-Initiated
15	Text messaging girlfriend	Bored	Negative	Intermediate
16	Calling Jerry	Watching television (unimportant)	Positive	Intermediate
17	Checking grades on Blackboard	Watching television (unimportant)	Positive	Self-Initiated
18	Checking Facebook	Watching television	Positive	Self-Initiated
19	Girlfriend (calling)	Watching television (boring show)	Negative	Other-Initiated
20	Text messaging friends	Watching television (Friday)	Negative	Self-Initiated
21	30 minute conversation with girlfriend	Watching television (Friday)	Negative	Self-Initiated

Johnny Longhorns

Number	Interruption	Prior Activity	Positive Negative Neutral	Other Intermediate Self-Initiated
1	Text message	Watching television	Positive	Intermediate
2	Rommate coming in	Some leisure activity	Positive	Other-Initiated
3	Uncloging the toilet	Watching television	Negative	Intermediate
4	Friends came over	Watching television	Positive	Other-Initiated
5	Neighbors wanting to hang out	Watching television	Negative	Other-Initiated
6	Frequent text messages	Some leisure activity	Negative	Intermediate
7	A guitar break	Some leisure activity	Positive	Self-Initiated
8	Roommate brought sand-whiches home for dinner	Unknown	Positive	Other-Initiated
9	Movie break	Listening to music or watching television	Positive	Self-Initiated
10	Remote batteries died	Watching television	Negative	Intermediate
11	Fixed dinner	Watching television or playing guitar	Positive	Self-Initiated
12	Decided to read a book	Listening to music	Positive	Self-Initiated
13	Guitar break	Studying	Positive	Self-Initiated
14	Friend came over to read comic books	Reading a book	Positive	Other-Initiated
15	Went for a bike ride	Some leisure activity	Positive	Self-Initiated
16	Friends came over	Cooking dinner	Positive	Other-Initiated
17	Decided to read a book	Watching television	Positive	Other-Initiated
18	Reading mail	Some leisure activity	Positive	Self-Initiated

June

Number	Interruption	Prior Activity	Positive Negative Neutral	Other Intermediate Self-Initiated
1	Conversation during television viewing	Watching television	Positive	Other-Initiated
2	Conversation with husband while hot tub lounging	Routine weekend activities at home	Positive	Self-Initiated
3	Grocery shopping at Wal-Mart	Routine weekend activities at home	Positive	Self-Initiated
4	Neighbor with a black eye	Going back home from the fitness center	Negative, then Positive	Self-Initiated (since she decided to go and talk to the neighbor)
5	Daughter came home to visit parents	Routine weekend activities at home	Positive	Other-Initiated
6	Daughter interviewing her father	Routine weekend activities at home	Positive	Other-Initiated
7	Going to phone store	Unknown	Positive	Other-Initiated
8	Going to donut shop	Driving back home from the phone store	Positive	Self-Initiated
9	Going to dog show	Routine weekend activities at home	Positive	Other-Initiated
10	Going to Gym	Staying at home	Positive	Self-Initiated
11	Losing the way to the dog show and spending time with daughter	Driving to the dog show	Positive	Intermediate
12	Home laundry	Unknown	Negative	Self-Initiated
13	Laundry for daughter	Routine weekend activities at home	Positive	Other-Initiated
14	Cleaning house	Unknown	Negative	Self-Initiated
15	Daughter's boyfriend coming home to meet her	Spending time with daughter	Positive	Other-Initiated
16	Husband's medicine at a certain time	Unknown	Positive	Other-Initiated
17	Cooking spaghetti	Unknown	Positive	Self-Initiated
18	Washing dishes	Relaxing	Negative	Intermediate
19	Putting spaghetti in packages for kids	Unknown	Positive	Self-Initiated
20	Bringing work at home and doing work during the weekend	Relaxing	Somewhat Positive	Self-Initiated
21	Son calling	Relaxing	Positive	Other-Initiated

Optimus Prime

Number	Interruption	Prior Activity	Positive Negative Neutral	Other Intermediate Self-Initiated
1	On call phone	Getting ready for bed	Neutral	Other-Initiated
2	Decisions	Leaving for dinner	Negative	Other-Initiated
3	Helicopter	Watching football	Neutral	Other-Initiated
4	Movie commercials	Waiting for a movie to begin	Neutral	Other-Initiated
5	Restaurant wait list	Driving to find restaurant	Neutral	Other-Initiated
6	Red light	Driving	Neutral	Intermediate
7	Pee break	Watching a movie	Negative	Other-Initiated
8	Coffee clean up	Leaving for a movie	Neutral	Other-Initiated
9	Kids meal toy	Watching television	Neutral	Other-Initiated
10	Dishes	Leaving the house	Negative	Self-Initiated
11	Idiot Driver	Driving	Neutral	Other-Initiated
12	Rained Out	Watching pee-wee football	Neutral	Intermediate
13	Laundry Time	Relaxing	Negative	Self-Initiated
14	Planting a Tree	Leaving for cheer practice	Neutral	Self-Initiated

Sally

Number	Interruption	Prior Activity	Positive Negative Neutral	Other Intermediate Self-Initiated
1	Making favor bags for son's party	Watching television	Neutral	Self-Initiated
2	Son wanted to cuddle	Watching television	Positive	Other-Initiated
3	Two flies in two separately poured glasses of wine	Watching television	Negative	Self-Initiated/ Other-Initiated
4	Son walking in front of the television with balloons from his party	Watching television	Negative	Other-Initiated
5	Dog wanting to play fetch	Routine weekend activities at home	Positive	Other-Initiated
6	Dog wanting to snuggle	Watching television	Neutral	Other-Initiated
7	Receiving a text from her sister, about their business	Unknown	Positive	Other-initiated
8	Remembering that she needed to do other work related things	Watching television	Negative	Other-Initiated
9	Son playing new drum set too loud	Routine weekend activities at home	Positive	Other-initiated
10	Son continuing to play with his drums	Watching television	Negative	Self-Initiated
11	Son needing help constructing a foam floor puzzle	Watching television	Negative	Other-Initiated
12	Older son wanting help with his Lego set, but changing his mind	Watching television	Neutral	Other-Initiated
13	Dog requesting to go outside, while her son continues to march on with the balloons	Watching television	Neutral	Other-Initiated
14	Husband talking about something unrelated to the show they are watching together	Watching television	Negative	Other-Initiated
15	Wanting popcorn	Watching television	Negative	Other-Initiated
16	Older son deciding he wants help with his Legos after all	Watching television	Positive	Other-Initiated
17	Son wanted to snuggle again	Unknown	Positive	Self-Initiated
18	Younger son and dog play-ing rambunctiously next to her	Watching television	Positive	Other-Initiated
19	Sister coming over to dye her hair	Watching television	Negative	Other-Initiated

Susie

Number	Interruption	Prior Activity	Positive Negative Neutral	Other Intermediate Self-Initiated
1	Alarm clock	Sleeping	Negative	Self-Initiated
2	Gmail	Painting	Negative	Other-Initiated
3	Doorbell	Unknown	Positive	Other-Initiated
4	Facebook	Various	Positive	Self-Initiated
5	Baby	Painting/Various	Positive	Other-Initiated
6	UT Game on television	Painting	Neutral	Self-Initiated
7	Rain	Walking	Negative	Other-Initiated
8	Floor grate (strange noise)	Watching a movie	Negative	Other-Initiated
9	Microwave (cold tea)	Watching television	Negative	Self-Initiated
10	iPhone	Various	Positive	Other-Initiated
11	Cat	Watching television	Negative	Other-Initiated
12	Dog	Watching a movie	Neutral	Other-Initiated
13	Breast Pump	Various	Negative	Self-Initiated
14	Husband	Watching a movie	Neutral	Other-Initiated