CPSC 344/544 Supplementary Material:
Examples of Task Examples

Task Examples (also known as *User Stories*) are related to another HCI construct: *Personas* or *Cast of Characters*. As employed in CPSC 344, we define a Task Example (TE) as a *design independent task description* which includes rich detail about the user(s), environment, constraints, objectives, even emotional outlook on the task. Thus, a TE can be seen as including the *persona* (the rich detail without the task itself) but goes further.

A task example combined with a design becomes a *scenario*. You can thus "run" your task examples on different design alternatives, as one way of comparing them.

The following are several examples of task examples that illustrate the variety with which they can be constructed and used. While all were done in a research context, they were all carried out in support of a kind of design that might well occur in industry as well. They are presented in a case-study format, so you can see how they emerged from or supported the project or design effort they belong to.

Compiled: November 2013 – Karon MacLean

I. Radiologist Scrolling Tasks

Source: MSc student Louise Oram, MacLean's research group, c2013 [1]

In this project, a major medical imaging company suspected that radiologists using their products were experiencing inefficiency and poor ergonomics when viewing and annotating massive volumes of radiology images, particularly CT scan stacks. The workstation setups that radiologists use haven't really changed for 20 years, beyond vastly improved graphic displays. Then, the imaging task was to view single x-rays. Today, the viewing and annotation is very different but the manual support for it is largely unchanged. The company asked an academic team to get involved, and the first step was to study practicing radiologists and understand their daily tasks, what they consisted, and where the "pain points" were.

Purpose of Stories*:* A set of 6 task examples were developed to: encapsulate these tasks, verify with radiologists as part of our task analysis, and then analyze for key "pain points" in the tasks pertaining to manual elements of interaction. For example, scrolling of image stacks emerged as a micro-task that dominated al of these practices, and thus scrolling became the focus of the design of a new input device which was then tested in task re-enactments drawn from these examples

Special Comments: These task descriptions are light on user detail, even though there is considerable variation in the context / role in which a radiologist works – e.g. research lab, private clinic, emergency room; varying degree of experience, and particular specializations. This is a function in part of the focus of this observation/analysis task, which was relatively low level, looking at the mechanics of the tasks.

Task Descriptions

1. Identifying or finding a specific piece of anatomy

The radiologist looks for an object or area of interest in one anatomical plane, looking through several slices to find and properly identify it. If unsure, or things are unusual, then s/he may look at the area in another plane (or several other planes if they are available). Can cross-reference a point between different planes, to see the location in other planes. Additionally, they may adjust the window/level to get better contrast between the object and its surrounds.

2. Defining the edge / size of something

The radiologist may want to know the size of an object, or if it is encroaching on the area of other anatomy. Window/level may be used to get better contrast of the object to its surrounds. After looking at the object in several planes, they choose a specific image, or multiple images, to outline, circle, or measure the diameter of the object.

3. Tracking / connecting objects

The radiologist follows a part of the anatomy through several slices to check for abnormalities. The radiologist moves back and forth through the image slices while watching the area of interest. If they feel they have missed something, or loose track of the object they may slow down and watch more carefully for a subset of the image slices. This is repeated as many times as needed for different anatomical parts, usually by organ system but sometimes by area (such as in the brain).

4. Comparing two images (old and new)

The goal is to look for interval change: differences between the sets of image. Do new objects appear, have old objects enlarged? The radiologist brings up both sets of diagnostic images and looks at the same plane and area in each image side by side. They scroll back and forth in each set of images, comparing the areas of interest (can link the two images so they scroll together, but the slices may not land at exactly the same spots). They may re-measure objects that were found in the first diagnostic to see if they have changed in size.

5. Identifying the makeup of something

The radiologist may want to know what something abnormal is composed of. They look at the item in several planes, and see the attenuation of the item. They may adjust the window/level to get the best contrast with the surrounds, or to see colour differences within the object. To know the density of the item from the imaging they can select part or all of it and see the density number.

6. Getting a second opinion

If the radiologist is unsure of something, less familiar with it, or finds something unusual, they may ask the opinion of another radiologist. Another option is to look up papers on the topic to help confirm the diagnosis or learn about more nuanced aspects they cannot remember off the top of their head.

II. Utility of Novel Haptic Display/Controller in a Mobile Handheld Device

Source: MSc student Joseph Luk, MacLean's research group, c2006 [2].

In search of new, more expressive tactile technology to improve interaction with mobile devices, we collaborated with a colleague who had developed a "skin stretch" mechanism which created sensations on the fingerpad not exactly like things you typically feel. We put this into a mobile-phone form factor (Figure 1), and did some psychometric experiments to understand what its key sensory dimensions were. But at this point, we needed to establish a strong link between the different things you could display with it, and some kind of useful application task.

Purpose of Stories: We defined a number of task contexts which could potentially make use of these new dimensions of tactile display. Unlike most of the other examples, these tasks were developed gradually over the course of the research, and refined and presented at the end as a way of explaining to a larger audience (in a publication) what this new technology might be good for – i.e. their role was primarily for communication and envisioning.

Special Comments: These application concepts / user stories are presented here directly as taken from the CHI publication, to show how they were used: first the scenario, then the explanation of how the new technology and its display dimensions could be used to enable that scenario. To fully follow it, you may need to read the full paper *[2].*

Initial Application Concepts (reprinted from [2])

With the piezoelectric skin-stretch technology in mind, we developed several initial application concepts through brainstorming, storyboarding, and low-fidelity form mockups. These informed an iterative progression to four key application areas for further investigation, and mechanical evolution of our hardware platform.

List selection: Ringer mode application

(Figure 2a) Linda is in a meeting and wants to set her phone's ringer mode discreetly. Grasping her phone inside her purse, she explores the ringer mode menu by moving the selection highlight while receiving tactile feedback. Each menu item feels unique, like touching objects with different shape and texture, and she recognizes the sensation of the "silent" menu item because she has used this function before. She selects the "silent" mode and receives tactile feedback as confirmation.

The scenario illustrates one way we can employ *haptic icons* – brief, artificial tactile stimuli – to provide assistance in making selections. A unique tactile stimulus is assigned to each item in a list menu; with repeated feedback, users quickly associate functional meanings to abstract haptic icons.

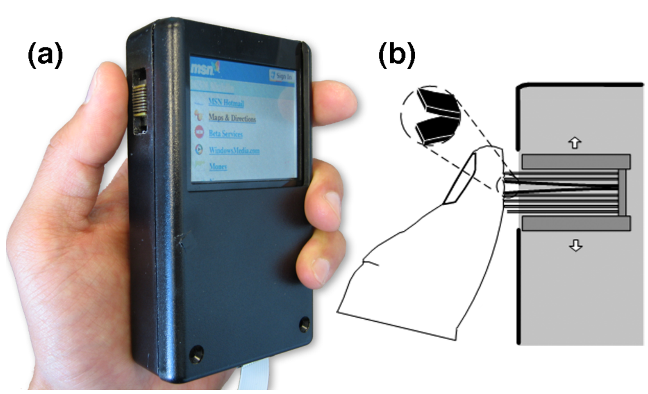

Figure 1. (a) Photograph of the hardware prototype. (b) Diagram of the bending action of the piezoelectric actuators, causing lateral skin stretch.

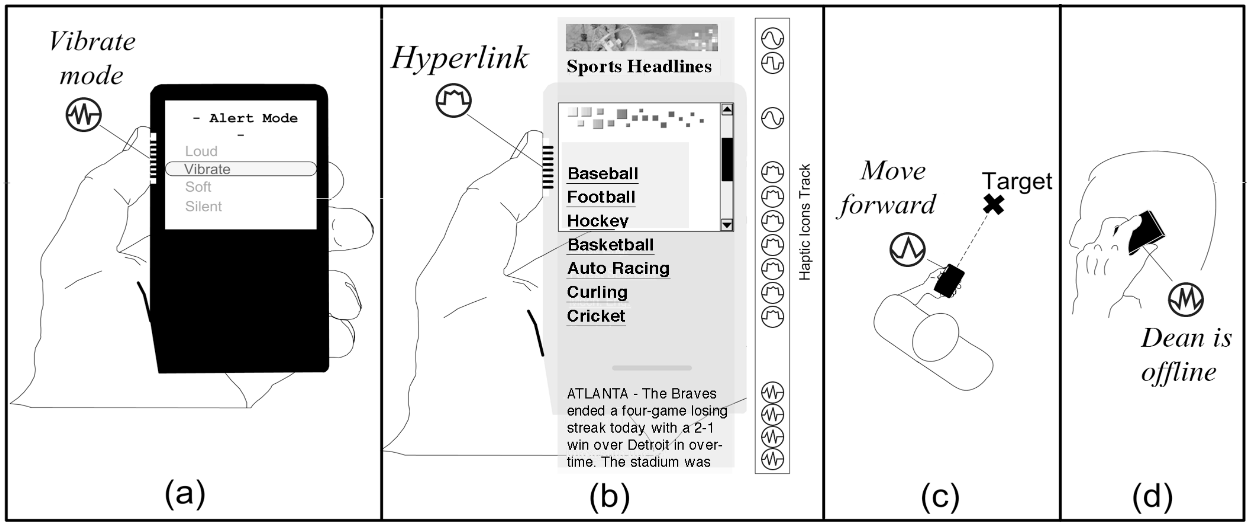

Figure 2. Storyboard sketches for initial application concepts. (a) List selection, (b) Scrolling, (c) Direction signaling, (d) Background status notification. The figures shown as callouts represent haptic icons.

The piezo tactile display technology described previously is capable of displaying small simulated surface features, such as bumps and gratings, with arbitrary motion relative to the user's finger. It promises a rich vocabulary of haptic icons, which are later characterized in this paper.

By mounting the tactile display on a slider that is also sensitive to thumb pressure, it becomes an input device. The user can select items in a vertical list menu by moving the display up and down. As the selection highlight is moved, the haptic icon associated with the selected list item is felt. Kinesthetic awareness of finger position allows the user to operate the device without looking, and to make a selection using the tactile display.

Scrolling: Browser application

(Figure 2b) Bob checks the sports news and scores many times each day. He didn't like using his old mobile phone's browser for this because he had to scroll around a lot to view content, which made him often lose his place.

Bob accesses a sports website using his new haptically-enabled phone and scrolls down into a news story. He feels the sensation of his finger sliding over a textured surface while the text of the story moves up the screen. As he continues to scroll, he feels the headline of the next story (a distinct bump) and some links (each vibrates gently as it is highlighted). All the stimuli move smoothly past his finger in sync with the scrolling movement. Having scanned the page, Bob scrolls back up and quickly locates his area of interest (his home team's standings) aided by the memory of what that part of the page feels like.

Small-screen mobile devices typically require more scrolling and/or selection actions to navigate a *deep* rather than *wide* information layout. Both place demands on the user's visual attention. Haptic augmentation as vibrotactile feedback has been shown to improve performance in a handheld scrolling task. However, a compact multiple-element tactile display offers additional capabilities such as smooth *tactile flow* rendering (a sensation moving across the skin).

Different page elements, such as headings, images, and links, can be rendered as haptic icons that are played when the user scrolls over them. Thus, each page has an associated "haptic map" that reflects its structure. Users learn to recognize familiar pages and can quickly scroll to desired sections or links. Improvements in scrolling efficiency would encourage user behaviors such as scanning to understand page structure and context, and increase the amount of information that can practically be presented on a page.

Direction signaling: Assisted navigation application

(Figure 2c) Mary is looking for a toy shop at a large, crowded shopping mall. Her location- and orientation-aware mobile device helps her find the shop with an active map and directions. The device also provides haptic feedback so she doesn't have to constantly look at the screen, keeping her eyes and ears on her surroundings. Mary holds the device discreetly at her side, with her thumb

resting on the tactile display and pointing forward. The tactile display repeatedly strokes her thumb in the reverse *direction (towards her back), indicating that the device is pointed in the opposite direction from her destination. As she turns around, the sensation gradually weakens, then begins to build again in the opposite,* forward *direction; she is now correctly oriented. Mary starts walking while continuing to hold the device. The stroking becomes faster, indicating that she is approaching her destination.*

Any application that assists the user in finding a spatial target could utilize an expressive tactile display to convey a *direction* cue. On a macro scale, this includes vehicle-based or walking navigation tasks, where the user must travel to a destination. On a small scale, the user could receive haptic assistance to orient a mobile device camera so image-recognition software can read a barcode or scene.
Applications in between include finding wireless access points or other active distributed information devices, or people in a search-and-rescue scenario.

Vibrotactile stimulation at distributed points of the body has been considered for navigation, but in a non-intrusive handheld form factor, the display of *tactile flow* can be used to indicate 1-D direction. Other parameters (e.g. speed, amplitude, and wave shape) add information dimensions.

Display of background status information and alerts

(Figure 2d) Albert always feels in touch with his friends because they all share presence *and location information with each other via their mobiles, with status notifications as they become busy or free.*

Albert is composing a text message to a buddy. His fingers are busy entering text, but occasionally he places his thumb on the tactile display to move the cursor, and feels a subtle repeating haptic icon that indicates his friend Steve has come online. Albert can continue with his task, aware of the status change.

Later, Albert is on the phone when his friend Dean goes offline. Albert feels a different haptic icon and is aware of Dean's status without having to interrupt his conversation or to remove the phone from his ear to look at the display.

Haptic alerts are commonly used on mobile devices, signaling events such as incoming or dropped calls. Simple, high-amplitude signals such as vibration can be perceived through clothing and on various areas of the body, but more expressive tactile stimulation requires direct contact with sensitive parts of the skin, such as the fingertips. Therefore, it is best suited to situations where the device is being actively used and held in the hand, where the haptic feedback provides background status information. If the active application also makes use of haptics, the stimuli used for background notification must be distinct from the foreground application's haptic signals. Examples such as this underscore the importance of designing haptic icons in the larger context of their anticipated usage, and employing empirical data relating to their group perceptual characteristics.

III. Music Listening Practices

Source: MSc student Thomas Hazelton, MacLean's research group, c2010 [3, 4]

In a preceding project, the technical feasibility of sensing interruptions to someone doing something immersive (like listening to a podcast or music) via a physiological sensor was verified [5]. Next, we wanted to explore how people might like to use this sort of technology, together with tactile display, to improve their experience with interruptions and recovery therein.

Purpose of Stories: To this end, we constructed a number of *scenarios* to *present to a series of focus group participants, as the basis for group discussions and brainstorming*. These were formulated as 'As is / To Be" scenarios – how it works now, then, how we anticipate this practice might change as a result of the technology. We wanted to know whether participants found these ideas interesting, or would suggest others that they wanted more.

Special Comments: These are scenarios, not task examples (they assume a design / level or capability of technology). However, in comparing the *As Is* and *To Be* versions, you can see the task is being 'run' on two different 'designs'; or in some cases, different ways of coping with the situation given current design.

"As is" Scenarios [describes a problematic situation, using current design]

1. John is listening to a Podcast of a talk show while he works in the garden. He is deeply immersed in the show. His neighbour suddenly interrupts him to borrow hedge trimmers, causing John to become startled and remove his headphones. After retrieving the hedge trimmers for his neighbour, John puts his headphones back on to find that he has missed an important part of the show. He iteratively rewinds and plays back the Podcast in order to find his place. Eventually he recognizes some of the content and begins listening to his media again from that point. Due to his neighbour's interruption, his level of immersion in the show is reduced to almost nothing.
2. Theresa is listening to her portable audio player while waiting for a bus on a serene corner of her neighbourhood. Her player is in her purse. Once on the bus, she can no longer hear her music due to a raucous group of passengers. Frustrated, she reaches for her player in her purse to adjust the volume, which involves unlocking her player using its touch screen interface. The raucous passengers exit the bus a few stops later, and Theresa wants to reduce the volume of her player, again requiring her reach for it and unlock it.
3. Susie is riding her bicycle and listening to music using her portable player. Her player is mounted on her arm and set to shuffle mode. After an upbeat song that she was enjoying ends, an economics lecture that her professor had put online for the class unexpectedly begins. Susie becomes annoyed at this change and wants to return to listening to music. She thus stops her bicycle, removes her player from the arm mount, and presses the "forward" button on the player until she finds a song she likes. She then resumes cycling.
4. Mario is cleaning his kitchen, listening to a Podcast on an engrossing but complex lecture. A certain fact that he hears excites him, and he decides that he would like to return to that part of the Podcast in the future to jot down some notes in preparation for an essay. He pauses his player to preserve its current playback location, and searches around for a pen and paper. After finding them, he writes down the name of the Podcast and the time at which he paused it.

5. Monique is resting in bed, listening to calm, ambient music on her iPod to block external distractions. She drifts off to sleep, and the iPod continues to play. After waking up refreshed 4 hours later, she discovers that her player is out of batteries.
6. Steven is walking around town on a beautiful day listening to his portable audio player. He is in a good mood and the song that he is playing is matching this mood perfectly. He retrieves his player from his pocket in order to mentally note the name and artist of the song in order to return to it another time, but after returning home, he can't for the life of him remember these details.
7. Brian is going for his daily morning run. As he warms up, he prefers to listen to relatively slow-paced, happy pop. After his warm-up, however, he much prefers driving, intense, Euro-infused electronica. Knowing his preferences, Brian makes an appropriate playlist of music ahead of time, but on his run, he discovers that the lengths of the songs in this list do not match up with the schedule of his exercise routine, requiring him to manually advance through the playlist after his warm-up and before his cool-down.
8. Mark is listening to music in his car (using his portable player connected through the auxiliary jack) as he drives to work. He comes upon a messy construction zone that requires him to manoeuvre his car through a series of tight lanes marked off by metal pylons. Knowing he will need his full attention to avoid the pylons, he looks down for his player to turn it off. He needs to unlock it and press the pause button in its touch screen, requiring him to momentarily shift his attention away from the road.

"To be" Scenarios

1. (a) John is listening to a Podcast of a talk show while he works in the garden. He is deeply immersed in the show. His neighbour suddenly interrupts him to borrow hedge trimmers, causing John to become startled and remove his headphones. After retrieving the hedge trimmers for his neighbour, John puts his headphones back on to find that his show has been paused. He presses play and the show begins playing 10 seconds before the point at which he was interrupted.
   (b) John is listening to a Podcast of a talk show while he works in the garden. He is deeply immersed in the show. His neighbour interrupts him to borrow hedge trimmers. Knowing that removing the headphones from the headphones jack automatically pauses the player, John pulls them out. When he returns to the Podcast, he manually skips back 15 seconds using rewind and then resumes listening.
2. (a) Theresa is listening to her portable audio player while waiting for a bus on a serene corner of her neighbourhood. Her player is in her purse. Once on the bus, she can no longer hear her music due to a raucous group of passengers. Detecting her frustration, her player automatically increases its volume to compensate. The raucous passengers exit the bus a few stops later, and the high volume is no longer necessary; detecting her frustration again, the player returns to its previous volume setting.
   (b) Theresa is listening to her portable audio player while waiting for a bus on a serene corner of her neighbourhood. Her player is in her purse. Once on the bus, she can no longer hear her music due to a raucous group of passengers. Detecting the increased ambient volume, her player automatically increases its volume to compensate. The raucous passengers exit the bus a few stops later, and the high volume is no longer necessary; detecting the shift in ambient volume again, the player returns to its previous setting.
3. (a) Susie is riding her bicycle and listening to music using her portable player. Her player is mounted on her arm and set to shuffle mode. After an upbeat song that she was enjoying

ends, an economics lecture that her professor had put online for the class unexpectedly begins. Susie becomes annoyed at this change and wants to return to listening to music. Detecting her annoyance, the player switches to a song it knows Susie will like.
(b) Susie is riding her bicycle and listening to music using her portable player. Her player is mounted on her arm and set to shuffle mode. After an upbeat song that she was enjoying ends, an economics lecture that her professor had put online for the class unexpectedly begins. Susie becomes annoyed at this change and presses the skip button. The player buzzes as if to shrug "oops" and goes back to playing some favourites. It will not make that mistake again.

4. (a) Mario is cleaning his kitchen, listening to a Podcast on an engrossing but complex lecture. A certain fact that he hears excites him, and he decides that he would like to return to that part of the Podcast in the future to jot down some notes in preparation for an essay. His player detects this excitement and automatically bookmarks the current playback location for future reference. His player confirms the bookmarking action with a gentle kneading motion.
(b) Mario is cleaning his kitchen, listening to a Podcast on an engrossing but complex lecture. A certain fact that he hears excites him, and he decides that he would like to return to that part of the Podcast in the future to jot down some notes in preparation for an essay. Mario pulls out his player and holds down a push button to tag the current playback location for future reference.

5. (a) Monique is resting in bed, listening to calm, ambient music on her iPod to block external distractions. Prior to her rest, she programs in a sleep timer to shut off the iPod after an hour. After an hour passes, the player shuts off.
(b) Monique is resting in bed, listening to calm, ambient music on her iPod to block external distractions. She drifts off to sleep, which the iPod detects. The player then switches off to preserve battery life.

6. (a) Steven is walking around town on a beautiful day listening to his portable audio player. He is in a good mood and the song that he is playing is matching this mood perfectly. The player, noticing that Steven's good mood was preserved throughout the song, catalogues it as a potential favourite for Steven's future reference. Steven, who wants to make sure the song was catalogued, retrieves his player and notices that there is a heart symbol next to the title of the song, indicating that it has indeed been marked as one of his favourites.
(b) Steven is walking around town on a beautiful day listening to his portable audio player. He is in a good mood and the song that he is playing is matching this mood perfectly. Steven retrieves his player from his pocket and adds the current song to his "On the Go" playlist by holding down the centre button.

7. (a) Brian is going for his daily morning run. As he warms up, he prefers to listen to relatively slow-paced, happy pop. After his warm-up, however, he much prefers driving, intense, Euro-infused electronica. Knowing his preferences, Brian makes an appropriate playlist of music ahead of time. On his run, he completes his warm-up and his heart rate increases to the appropriate level for a sustained workout. Despite the warm-up pop tune not yet being finished, his player moves to electronica in response to his bodily changes.
(b) Brian is going for his daily run. As he warms up, he prefers to listen to relatively slow-paced, happy pop. After his warm-up, however, he much prefers driving, intense, Euro-infused electronica. He sets his player's target heart rate to 150. As he begins his run, his player, sensing his resting rate of 60, starts his warm-up track. As Brian runs, his heart rate

climbs to his target of 150, a cue to the player to begin playing electronica. When the shift occurs, the player taps his leg rapidly to indicate that he is ready to begin the bulk of his run.

8. (a) Mark is listening to music in his car (using his portable player connected through the auxiliary jack) as he drives to work. He comes upon a messy construction zone that requires him to manoeuvre his car through a series of tight lanes marked off by metal pylons. Detecting his increasing anxiety, his player turns itself off.
(b) Mark is listening to music in his car (using his portable player connected through the auxiliary jack) as he drives to work. He comes upon a messy construction zone that requires him to manoeuvre his car through a series of tight lanes marked off by metal pylons. Detecting his increasing anxiety, his player warns him that he might want to turn the music off by beeping rapidly through the stereo.

IV. MHIVE: Mobile Haptic Instrument for Vibrotactile Exploration

Source: PhD student Oliver Schneider, MacLean's research group, c2013. Publication pending.

MHIVE (Mobile Haptic Instrument for Vibrotactile Exploration) is a research project exploring a new tool for, and different way of thinking about, designing haptic sensations for specific communicative purposes. Currently, design of haptic sensations tends to be very ad hoc.

Purpose of Stories: User stories (aka task examples) were constructed to describe the range of users anticipated for this system, and what they might do with them. These were then used for a qualitative analysis technique known as "Phenomenology" [6], in which an experimenter explores subjective experience through in-depth interviews, appropriate for an investigation into the more intangible qualities of pleasantness and affect. A key attribute of this methodology is how insights are mined and collated, as well as how they are collected – a topic beyond the scope of the present purpose.

Special Comments: To support the early development of the system that would be exposed to the phenomology interviews, several key attributes of the system and task being envisioned were identified first, along with personas (including work roles) of the anticipated users. The attributes and personas /roles were combined in brainstorming sessions into a series of "user stories", which are very similar to task examples. The system was designed to support these uses/users, and the interviews and their analysis to explore both the value and validity of the tasks, and how well the design supported them. We were interested in both single and collaborative versions of the system, so both kinds of stories are laid out.

Broad themes:

1. Real-time collaboration or sharing of [haptic] phenomena is critical

2. Saving or recording candidate or exemplar sensations is critical

3. There are two stages of workflow (which might manifest in different tools):

- Brainstorming/collaboration/communication; "performing"
- Longer term refining/reviewing of the output and findings from #1; "composing"

4. Two main designs, which are parallel to the two stages of workflow:

- Single output
- Multiple candidate output

5. Other features:

- Ability to detach the factor to fit the environment
- Constant recording/history of the performance
- Single handed would be "handy"
- Easy, intuitive to use for non-experts

Personas

John Coltrane is a senior PhD student studying human-computer interaction. He is currently working on running a study that uses novel haptic stimuli to guide people temporally, specially allowing them to synchronize their gait with a vibrotactile or aural rhythm. He has experience running psychophysical experiments, studies on interaction techniques, and engineering novel input or feedback devices. He is also working on generalizing and commercializing the wrist-mounted guidance device to other, sports-related activities, such as running. He is working with **Nina Simone**, a recent master's graduate from the same lab, on this latter project.

Ella Fitzgerald is a senior undergraduate cognitive science student. She is doing a project that involves coming up with a set of vibrotactile icons to aid a senior researcher in a study. She has experience with music and sound synthesis (*e.g.*, Ableton Live), and some experience with programming (especially scripting languages), but no experience with haptic or vibrotactile devices.

Sarah Vaughan is a performance artist and musician. She likes to work with experimental, interactive installation pieces, often using Max/MSP, Arduino, and other digital tools to develop her pieces. These pieces sometimes involve her as part of the performance, and sometimes they are entirely automated. She wouldn't declare herself a programmer, but rather an artist that uses the tools available to her to pursue her craft. She has experience with sensing, and visual/audio output.

Dave Brubeck is an imagineer at Disney, developing the next immersive experience for one of their rides. ...

Big Company Inc.

Django Reinhardt is a haptic expert working at Big Company Inc. on developing the overall feel of physical devices. He must consider the implications of changing the physical form, which might require massive engineering effort for a small look-and-feel result. Rapport and communication with other members of his company (engineers, executives, **sales**) is critical, and a major barrier in the existing workflow. He has a collection of sample physical controls to aid this communication. Django often works on multiple projects simultaneously, some which take years from start to finish. Specifications are typically described in terms of friction, inertia, and detent, and include tolerances and additional notes.

Billie Holliday is a salesperson for Big Company Inc.. She meets with clients about developing their products, ...

Miles Davis is a manager at Big Company Inc., working with **Django** and **Billie**.

Stories

John and Nina develop spatiotemporal guidance

I - The ad-hoc demo

John wants to demo his haptic interface, a vibrotactile signal on a wrist to tell someone how quickly they should walk to make it to the bus on time. Unfortunately, his demo isn't set up - it needs batteries and the code needs to be uploaded. He grabs HIVE and quickly performs a similar sensation to the visiting scholar, tapping out a slow rhythm and gradually makes it into a fast rhythm, while talking to the visiting scholar. He then also demonstrates a long, steady sensation, to show what he uses in his experiment to tell people to stop walking and return to the experimenter.

II - Collaborative brainstorming

John now wants to generalize his interface to work for a different application area. He wants to represent a variety of sensations for sports and similar activities. He uses HIVE to look at the perceptual dimensions it controls, and uses those to draft a number of sensations, playing around with different sensations. Then, he gets his colleague, Nina Simone, to help him brainstorm the main differences they should have in their display signals. He begins with a random sensation, makes it more pleasant, and then saves it as a candidate. They continue with a physical brainstorming session, and at the end have a number of different candidates.

III - Replaying and grouping of candidates

John and Nina now want to select the best signals that they've brainstormed. They create a number of different signal sets. That is, they select a group of candidate sensations/signals, and decide how those might map to semantic meanings. HIVE is used to decide each of these, but instead of performing in real-time, they are replaying their recorded sensations, and organizing those. When they are finished, they have a 3 coherent sets that they can explore with a user study. They program these directly into their system, as they don't have static icons, but a dynamically change display. When brainstorming, they use the real-time performance feature of HIVE to simulate that aspect.

IV - User study and feedback

During a user study, John finds a clear winner of the three coherent sets. However, participants confuse two signals. As a post-mortem, John uses HIVE to investigate further into what the participants find confusing, and is able to nail down the one perceptual dimension (rhythms are too similar). Some participants suggest alternatives by playing around with HIVE; John saves these suggestions, and fine-tunes them later into a final set.

Ella plans an experiment

I - Recording experiment stimuli

Ella is given a demo of HIVE by her senior researcher, and then uses it to become familiar with the different ways one can control vibrotactile phenomena. She then uses it to create a number of candidates for her study, and saves them for later playback. These are directly used as icons in her study; she replays each one using HIVE, without reprogramming them anywhere.

Sarah creates an art exhibit

I - Environment and art

Sarah is looking to build a new installation downtown outside of the Vancouver Art Museum. She wants to use a tactile display to explore physicality in this installation. She grabs mHIVE (mobile HIVE) and heads downtown, walking around the general area. She uses mHIVE to play several sensations in real-time (purely as performance) as she walks around, paying attention to the interplay between the physical sensation, the environment, and sounds. She attaches the display tactor to several objects (e.g., a bench, a banister) to get a sense of how they might feel if they vibrated. She writes down promising locations and combinations in her favorite note-taking device (might be a physical notebook, her smartphone, or even mHIVE itself, tagging the GPS and sensation alongside a typed note).

II - Visual-haptic notetaking

Sarah has decided to instrument a stairway to detect how many people are walking up and down it, and to display that information through vibrations of a banister as people walk. She wants to combine this with a visual display. She sketches in her notebook, takes a picture of the visual sensation with mHIVE (or her smartphone) and attaches it to her favorite sensations to create multimodal notes.

III - Audio-haptic experimentation

Sarah now wants to look at the interplay between touch and sound, displaying either unified or conflicting messages with these two modalities. She uses her smartphone playing a simple piano app to play music with one hand, and mHIVE to play touch with the other. She comes up with several candidate sensations, recording them with mHIVE (which captures the audio via microphone) for later development when she implements her installation. That work is done at home in Max/MSP.

Django, Billie, and Miles working

I - Conversation with stakeholders

Miles the manager approaches Django the PhUI designer about a new project for a smartphone they're developing. Miles says that BCI wants this smartphone to feel solid, like the iPhone. He also wants it to feel energetic and responsive, with tactile feedback for most button presses. Django pulls out his HIVE and uses it as an elicitation device with Miles, to see if he can create a reasonable sensation. Miles can use the device to make sure Django gets the right idea. Django also pulls out his iPhone to use that as a conversation device, and attaches the tactor to the phone to see how it feels with the phone's form factor. Afterwards, Django reviews the history of commands/notes on his computer, and saves the most important conclusions, complete with typed notes on what they mean.

II - ...

References

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