

# **Chewing it Over: Multitasking While Eating with a Wearable Chin Interface**

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## **1 INTRODUCTION**

Many people multitask in their daily lives. This can especially be seen when people are eating. Observing common food courts or dining halls will show many people looking at their phones, even when they are dining with other people. Multitasking has a bad reputation for making each task worse because of spreading one's resources too thin. Studies have shown that if gestures during multitasking are meaningful, it can lighten the cognitive load and improve performance and learning across all tasks [6]. Multitasking can also occur when something is occurring outside the primary focus of attention. This kind of multitasking through computers is called peripheral interaction in "the way we fluently divide our attentional resources over various activities in everyday life" [4]. To fluently divide attention, tasks need to be easy to switch between, like taking a bite of your food and navigating content on your phone. This study investigates a wearable novel interface using chewing as the primary interaction method to engage in other tasks while eating.

This study investigates three research questions: How does interacting with the chin interface differ from regular multitasking while eating? How comfortable are adults interacting with a novel interface while eating? How does the level of focus affect which chin interface adults prefer while eating? To investigate these questions, I conducted an experiment with four participants in my art studio. The goals of the experiment were to observe the participants interact with the chin interface, ask about their experiences in semi-structured interviews, and find out if the cognitive load of interacting with content through the chewing interface was too much to become stressful. This study also was interested in discovering if there were other health related benefits to wearing the interface, such as slowing down the process of eating or making the user more mindful of what they were eating.

This study is relevant because many Americans have access to computers and extra screens to easily set up peripheral displays of content for learning or self-improvement purposes. Dourish wrote of a trend in computing that "allows computation to be made ever more widely accessible to people without requiring extensive training, and to be more easily integrated into our daily lives by reducing the complexity of those interactions" [7]. A 2018 US Census report found that 92 percent of American households have a computer which could consist of a desktop, laptop, tablet, smartphone, or single board computer [11]. A study by the Pew Research Center found that in 2015, 66 percent of Americans owned at least two of the following digital devices: smartphone, desktop, or laptop [3]. The same study found that 36 percent of Americans owned all three digital devices [3]. This means two thirds of Americans have extra digital devices with screens in the home that could be used to display information peripherally and ambiently. Future developments of this chin interface may allow the model to be downloaded and 3D printed in the home, use a mouse as the chin switch, and allow for custom peripheral interactions to be crafted for eating.

## 2 BACKGROUND

Previous studies in HCI have also investigated monitoring chin movement. Zhang and Amft presented a demo at UBICOMP 2016 that involved 3D printed eyeglasses that sense jaw movements through vibrations in the skull [17]. Their study was related to measuring the number of chews and easing the burden of users who must annotate their food intake for health purposes. Koizumi et al. investigated eating experiences using the Chewing Jockey, a wearable jaw sensor that augments food texture by introducing sound through a bone conduction speaker during the eating experience [10]. Their study focused on improving the dining experience by making the sound of chewing food louder to make food more delicious. Koizumi et al. were interested in how the Chewing Jockey affects chewing speed like our study, but they were also interested in dietary applications of making it sound like you are still chewing the food when there is nothing left in your mouth [10]. Sugita et al. explored a wearable head mounted display for chewing control and diet gamification [15]. Their study focused on increasing the effect of satiety on chewing to raise the number of chews per bite for dietary purposes. The Sugita et al. study also used visual and audio feedback, but their study gamified the chewing experience by displaying the number of chews desired for the remaining foods in the test [15]. These experiments all involved wearable devices like our chin interface, but the studies were oriented toward the process of eating and not multitasking like the focus of our study.

More studies that monitor chewing detection were recently conducted. Papapangiotou et al. developed commercial smart-glasses for chewing detection for health purposes [14]. The authors also developed an app that sensed the chewing sounds and automatically logged the start and stop times of the meal session. Papapangiotou et al. were more interested in using commercial smart-glasses for eating detection rather than the eating experience or multitasking which concerns our study. Another recent study was conducted by Kleinberger et al. exploring auditory seasoning filters and how they affect flavor perception, eating behavior, and appetite [9]. The authors identified that there is a gap in the research area as many of the chewing studies have only explored altering the food texture experience while eating [9]. Kleinberger et al. amplified the sound of eating sour cream and onion Pringles chips and found participants experienced increased crispiness as well as increased flavor intensity [9]. The Kleinberger et al. study is closely related to our pursuit in this research as it focused on the eating experience rather than dietary applications.

Chen et al. get closer to pursuing eating and multitasking by looking at hand movements and the first bites to distinguish between different types of food [5]. The authors identify that gaps in research for wearable food intake sensors remain in the areas of social acceptance, being lightweight and easy to use, and being inexpensive [5]. Chen et al. found that measuring movement of food from hand to mouth and the action of the first bite can distinguish between different food types. This is of interest to our study as meaningful gesture can be attached to each food, leading to more successful multitasking opportunities if paired with the right content. Another recent development of technology for eating and multitasking is Doritos Silent [13]. Doritos Silent is a software that can remove the crunching sound of chips while on voice chats, Zoom, or playing video games. In contrast to the other technologies that tried to enhance the sound of eating, Doritos Silent quiets the sound of eating so you can multitask without annoying others on a call, and so others can focus more on the conversation with you. No studies have investigated how playing back related music, reading about the food you're eating, or typing out how you want the food to affect you while eating makes the experience different than regular multitasking, affects comfort while eating, or affects focus while eating.

### 3 METHODS

#### 3.1 Approach

This is a basic qualitative study. Merriam and Tisdell define qualitative research as “the belief that knowledge is constructed by people in an ongoing fashion as they engage in and make meaning of an activity, experience, or phenomenon” [12]. This study explores participants’ interactions with wearable chin interfaces to find out about their experiences. I approach this research from an interpretivist stance, meaning I aim for experimental results which yield transferability, not generalizability. As an interpretivist, I also recognize that research is inherently biased, and my values can inform my research. As a practicing artist who developed the chin interface as a wearable for performance, I have my own attachments and experiences with how it should be used. One of the purposes of this basic qualitative study is to understand how people other than myself experience wearable chin interfaces and compare them with my own auto-ethnographic experiences for further development of multitasking peripheral interfaces. My research interest is to eventually develop multiple peripheral interaction stations within a living space to engage with curated content throughout the day as a Ubiquitous Computing self-help environment. These research questions help answer if the wearable chin interface is a viable candidate for inclusion in that environment.

#### 3.2 Experimental Setup

The study was conducted in my art studio with participants sitting at a table (pictured in the appendix A.6). Four friends were selected as participants because of their proximity to my art studio, free time to give to the study, and willingness to participate in the study. The participants were given a choice of either raisins or baby carrots to eat while using the wearable chin interface to interact with related content. Two participants chose carrots and two participants chose raisins. If the participants chose carrots, they were given an individual bag of Nature Made Organic Baby Carrots from the packs for kids. If the participants chose raisins, they were given a box of Sun Maid Raisins. The free snacks were the only incentive offered to participants in the study.

I developed the first iteration of the chin interface for an art series called “Chin Music” in 2018 [2]. In the “Chin Music” series, I used a one-button mouse zip-tied to a neck posture corrector to play back midi scores of related music to what I was eating. For example, I played back the main theme from “The Magnificent Seven” while eating a piece of beef jerky to feel more like a cowboy. Surveying literature on multitasking and peripheral interaction in the Fall of 2023 led me to find chin interfaces as viable in HCI research. For this experiment, I redesigned the chin interface in the free online 3D modeling program Tinkercad and printed multiple iterations on my own 3D printer until the final design was found. I used microswitches connected to the Switch 2.0 Accessibility Switch from Ablenet and a Roland TM-1 Drum Trigger Module to turn chews into signals my laptops could recognize. Additional programming for the experiment was done using Max MSP.

For this experiment the two wearable chin interfaces were tested in three different iterations. A one-button chin interface was used in the first iteration to play back music notes from a related midi score with each chew. The one-button chin interface was also used in the second iteration to advance one-word slides of a related script in rapid serial visual presentation (RSVP) style. I previously investigated RSVP using hypnotic scripts through peripheral interaction during everyday activities as part of my MFA thesis [1]. For the third iteration, a three-button interface was used to navigate and select keys from an onscreen keyboard to type out how the participant wanted the snack to affect them. The three-button interface consisted of the same main key as the one-button interface, but instead caused the cursor to move from left to right 150 pixels. The two additional keys in the three-button interface were select and back, to the right and left respectively.

If a participant chose raisins or carrots as their snack, then the content across two of the iterations of the experiment would change. If the participant chose carrots, the first iteration would play back the midi score of the Looney Tunes Theme Song. The second iteration with carrots would involve playing back a script about the health benefits from eating carrots [8]. If the participant chose raisins, the first iteration would play back “I Heard it Through the Grapevine” inspired by the California Raisins connection. The second iteration with raisins would involve playing back a script from the Sun-Maid website about the 1 oz. box (6 pack) product and their answers to frequently asked questions [16]. The third iteration for participants who chose carrots or raisins was to eat their snack one last time and type out how they wanted it to affect them in a few words.

### **3.3 Data Collection**

To collect data, I observed participants during their interaction with the wearable chin interfaces across the three iterations of the experiment and made notes. I conducted semi-structured interviews before the first iteration and after each of the three iterations of the experiment so participants’ experiences of the three stages would not blur together. All experiments were audio recorded using the Voice Memos application on an iPhone 14. Each experiment and interview lasted between 18-22 minutes. Because of scheduling issues, I had to perform the first 3 participants’ interviews back-to-back, so I was unable to transcribe them before the next experiment as is recommended practice. I was able to transcribe the first three participants’ interviews and code them before interviewing the fourth participant. I transcribed the interviews in Google Docs by listening to the audio files and typing what was said verbatim. The transcription of each interview took about 2 hours. As I was transcribing, I made notes about participant responses in the Microsoft application OneNote. I then imported the Google Docs of the transcriptions of the four interviews into NVivo 12 Plus for data analysis. I stopped collecting data because of practical reasons due to time limitations and the due date of this project, but now I have a foundation to build future larger studies on with IRB approval.

I asked 12 main interview questions with some probing sub questions attached to answer my research questions related to multitasking while eating, comfort level, and level of focus (for full list see appendix). To break the ice with the participants I initially asked them about their experience with wearable technology. Then I moved into questions about what participants usually do when they eat, what they think about, and their normal eating speed. These questions were aimed at the multitasking while eating aspects of my research questions. After participants put each of the interfaces on, I asked them what they experienced putting it on, how easy/hard it was, and how it affected their posture. These questions were aimed at the comfort level aspects of my research questions. After each of the three iterations of the experiment I asked participants to describe their experiences, say if it was enjoyable or stressful, and describe how it changed their focus during the eating experience. These questions were aimed at getting information to answer all three research questions. To close the experiment, I asked participants to rate the iteration they were most and least comfortable with and why, if they would be comfortable wearing it, and if they could envision incorporating it in their daily routine. This batch of questions were meant to address the multitasking and comfort level research questions.

### **3.4 Data Analysis**

To analyze the data, I used inductive coding with the help of the software NVivo 12 Plus. Since this was a basic qualitative study, I was seeking to understand “(1) how people interpret their experiences, (2) how they construct their worlds, and (3) what meaning they attribute to their experiences” [12]. I wanted to understand how people make sense of the wearable chin interface as a multitasking aid while eating. The inductive coding process produced 45 different codes. Nine of those codes were referenced in each of the four participants’ transcribed interviews. The main themes the coding

produced were time, behavior change, focus, multitasking, not mindful eating, effort, and thinking. These main themes are analyzed in the preliminary findings section.

## **4 PRELIMINARY FINDINGS**

### **4.1 Time**

One of the themes developed from the inductive coding process was time. Time was related to how much faster or slower participants were eating compared to their regular multitasking. P1 enjoyed the music iteration with carrots and said, “I do feel like I was more mindful of my eating while I was using it, which was interesting. I feel like I took longer to eat a carrot than I normally would.” Here we see more time spent on the task of chewing did not equal frustration, but instead prolonged enjoyment. Time could also be seen as a constraint as P2 said during the music iteration with carrots, “I started chewing trying to understand like what it was supposed to interact with or like the pace that I should chew in order to hear the music and I was like, ok, and I finally got the rhythm down and I was like, ok.” P4 also found the music constraining to time spent chewing by saying, “I kept thinking about the rate I was chewing and the sound of the clicking was a very front and center reminder of how fast or slow I was chewing.” As will be mentioned in the limitations subsection, knowing what the song was a P2 and P4 did may have affected their ability to enjoy the chewing with music experience as P1 did. Interestingly, P2 and P4 were least comfortable with the music interface, whereas P1 was most comfortable with the music interface. P2 and P4’s responses may show that feeling regulated or restricted by the playback of the music having to meet certain tempo requirements makes the experience more stressful and uncomfortable than regular multitasking. Future versions of this study should experiment with random note production to see if that creates a more enjoyable experience for eating multitaskers.

### **4.2 Anticipation**

A subcategory code of Time I identified from the interviews was anticipation. Even though the music iteration did not produce comfortable experiences for P2, P3, or P4, the reading text iteration did. About the chewing and reading RSVP text iteration P2 said, “this one was a little bit more interactive because I was reading and uh, so as I was reading I found myself chewing more just to see what the next word was.” P2 was excited to see what the next word of because he was not familiar with the script of nutritional benefits of baby carrots. In contrast, he was familiar with the Looney Toons theme song from the first iteration, and this caused him to try to meet the next note in a way that was on tempo creating stress and discomfort. About the chewing and reading iteration P4 said, “I found myself trying to eat faster to read faster, more so than the song.” P4 was trying to chew at a rate of their regular reading speed (impossible with this interface) because they were engaged with the script about raisins. P4 was locked in a state of anticipation, trying to get more information from each chew, but unable to reach the speed they wanted. Even though P4 was not able to reach their normal reading speed, they still rated their experience with the reading iteration as the most comfortable of the three. Future versions of this study should keep anticipation in mind when designing the interactive elements.

### **4.3 Mindfulness**

Mindfulness, or taking the time to focus awareness, was also experienced by some of the participants as part of the three iterations. P3 stated that the chewing and reading iteration “was a little more interesting to me like reading about the food I’m eating and I liked the descriptive words of um ‘made with goodness’ and ‘California sunshine’ it just makes you think about the flavor and the taste of what you’re eating a little bit more and think of it in a positive way. Here we see a

positive response to a script describing the raisins P3 was eating. The words of the script transferred to the experience and caused the focus of the participant to become more mindful of the food and its taste. Of the music and chewing iteration, P1 stated “Well I feel like it easily, I didn’t have to do anything, I could just chew on the carrots. I do feel like I was more mindful of my eating while I was using it, which was interesting.” Here we see mindfulness was found from not having to stress about the task, P1 could just chew and play music, not having to devote thought to anything else. In this experiment, mindfulness was discovered when the words related to the food being chewed in a meaningful way and when the unknown activation of a score of music was being played.

#### **4.4 Not Mindful Eating**

All participants noted that they usually are multitasking while eating and not focused on the food or practicing “mindful eating.” P2 fell into not mindful eating in the reading iteration when he said, “I almost didn’t associate the reading with the eating at all. I was just more focused on the reading, so the eating was just kind of something that needed to happen to read the next word.” Here the task of playing back a different word with each chew was so absorbing the participant forgot they were eating. P3 responded to the typing iteration by saying, “I really had to think about my chewing and think about where my head was and making sure that my chin wasn’t hitting the wrong thing. Um, I had to be way more conscious of how I was eating to make sure I was getting the word I wanted typed out.” Here we see too much awareness falling into the category of not being mindful and very stressful. This is not the normal multitasking experience people perform while they eat as it would be too taxing to continue to engage in. The typing iteration may require too much focus to be considered comfortable multitasking.

#### **4.5 Focus and Thinking**

P1 was the least comfortable with the typing iteration because “it took the most effort cause you also had to think about what you wanted to type vs the other ones you were just consuming.” For a multitasking experience to be successful, effort between the tasks needs to flow fluently. The typing iteration caused too much focus to be spent on the task. Of the music iteration, P3 said, “it was just a little bit - a lot - or I guess it was just more thinking involved than normal eating.” For P3, the music iteration caused the most thinking, more so than even normal multitasking and eating. For P4, the reading iteration was the most comfortable because, “I also wasn’t having to focus as much, like the third one.” Here we see focus again being a negative in the practice of multitasking and eating. For these participants, focus seems to be something not usually active during their normal multitasking eating experiences. Or if it is active, participants don’t seem to be aware of where their focus is.

#### **4.6 Behavior Change**

Some elements of the experiment caused participants to change their eating behaviors in different ways. Of the typing iteration, P2 said “I would just have to really slow down to make sure I wouldn’t hit the wrong keys.” For P2, speed of chewing was dictated by the position of the cursor on the onscreen keyboard. P2 continued by saying, “I found myself eating more carrots than I would just to try and get to the - get through to the next row.” Here again the typing iteration caused the most change in behavior as the participant was eating more than they normally would in order to complete typing the word. Another example of behavior change came from P4 when they said, “I’m consciously altering the way I’m chewing so that I can get my word. Um, and I definitely was hesitating on chewing so I could get through stuff and then I would speed up the chewing to try to get to the other letter.” Here again, the typing iteration caused the most change to chewing behavior. Interestingly, the typing experience was not entirely negative for P2 and P4 as they both ranked it as

the 2nd most comfortable iteration. This shows future studies could investigate typing out specific words or phrases to alter the chewing during a meal for any number of applications.

## **5 LIMITATIONS**

Some limitations became apparent during the experiments with participants and the transcription process. Since this was my first qualitative experiment, there were some things I did not consider when planning the experimental setup. Listening to the audio files of the interview led me to see I was not providing participants enough time to think about questions. Sometimes I would jump in to help them think more quickly in the direction I expected their answers to go by asking leading questions. I could have had a set procedure for when each participant was to open their snack bag or box, so the instructions were consistent during each experiment. Another thing I missed was considering the hunger level of participants as that could affect the speed and amount of what they ate.

During the first three experiments I told participants to chew for an untimed period that ended up being around one minute. After learning the general length of time from the first three experiments, I told the fourth participant to chew for about 1 minute for the first two iterations and that I would check on them when the time was up. This prevented many of the uncertainty questions generated in the first three experiments about how much they needed to chew. If this concern was removed from the experiment in the future clearer multitasking data may be produced. Another lost data opportunity was tracking the exact amount of food each participant ate during the experiment. Another opportunity for data that was missed was not screen recording the third iteration involving typing to see where mistakes and corrections were made using the interface for mouse movement and onscreen keyboard selection. The last limitation to note is that for participant 1 during iteration 1, I did not describe what the song was (Looney Tunes) and that participant was the only one to feel most comfortable with the music portion. The other participants were told what the song was and that made the experience more stressful for them because they felt they had to chew at a certain tempo to recreate the song as it was in their memory. Future studies should not reveal the midi song to see how this affects the level of comfort across all three iterations.

## **6 DISCUSSION**

Now I will discuss the preliminary findings and how they might answer the three research questions in this study. The first research question was, how does interacting with the chin interface differ from regular multitasking while eating? This question can be answered by looking at some of the initial findings on Time and Focus. Some of the iterations created stress by constraining or regulating the pace of chewing to produce the desired interaction. It was found that if the iteration required too much focus, it caused stress that was different from each participants' regular experience multitasking while eating. The second research question was, how comfortable are adults interacting with a novel interface while eating? This question can be answered by looking at some of the initial findings on Anticipation and Mindfulness. Participants were more comfortable with reading text because they were anticipating the next word. Participants were not comfortable with the music iteration because they were aware of when the next note should be and were struggling to play it in time. Participants comfort with the interface was also enhanced when they were made more mindful about the taste of the food but was lessened when they were made too conscious of their chewing. The third research question was, how does the level of focus affect which chin interface adults prefer while eating? This question can be answered by looking at the initial findings in the sections on Not Mindful Eating and Behavior Change. When participants were too focused on what they had to do for the interaction, they became more stressed and uncomfortable than they normally feel while multitasking. The typing iteration caused the most focus, but was not the least enjoyed iteration, so there are more things to investigate in this area.

Overall, these findings show that multitasking while eating using the chin interface can be more comfortable in some multitasking interactions than others. The music iteration, which I expected to be the most enjoyed as it was the original incarnation of this interaction from my arts practice, was the least enjoyed by participants. Participants found the reading application to have the most application for their daily lives, which is probably the best iteration to incorporate into a peripheral interaction method in a ubiquitous computing environment. The contribution of this work is opening a research area not directly related to diet, but more tied to multitasking and peripheral interaction applications. More work should be done pairing positive scripts about the food being eaten being activated by each chew as P3 had an extremely positive response and mindful eating experience during that iteration. Since these tests can be performed using computer mice or space bars on keyboard as chin switches, amateur researchers could continue to investigate these avenues for self-programming and knowledge seeking purposes. In my next iteration of this experiment, I plan to use more of a mixed methods approach by collecting more quantitative data about amount of food eaten, click rates, and time spent per task to bolster the qualitative data.

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## A APPENDICES

### A.1 P1 Interview Transcript

R: The first iteration is going to involve playing a song back, ok? But first I am going to ask you a few questions.

P1: Ok

1

R: Do you have any prior experience with wearable technology?

P1: I don't think so.

R: Ok, what about, like, your smart watch?

P1: Yes.

R: How often do you wear that?

P1: Every day.

R: And what do you interact with it for?

P1: Exercise, and uh, calender notifications, and messaging.

2

R: Ok. And then, what do you um, usually do when you eat? Are you multitasking? Are you focused on the food? What would you say normally you do?

P1: Normally, multitasking.

R: And what sort of multitasking would you be doing?

P1: Either social media for fun, or emails for work.

3

R: Ok. So what are you usually thinking about when you eat? Those same things? Or,

P1: Yes. Not the food usually.

Putting on Interface 1

R: Let's go ahead and put the first one on here. Ok, so it is velcro. So this side goes down, put that around your neck and squeeze it tightly.

P1: Is this right? Or under the chin?

R: Yep, you want it to be comfortable. It can be, yeah, where it's under the chin like that.

P1: Where is the velcro thing again? (Removes it and looks at it)

R: On that side, yeah. Oops, your hair is getting in it a little bit.

P1: Oop

R: I ordered some button things for it. Okay, let's see. Do a little test here.

P1: Maybe a little tighter.

R: A little tighter.

P1: Is that enough tightness?

R: There we go. Try it now. Up, put your chin up more. There we go. Now...

P1: (Can hear the clicking of the interface) I see.

R: Ok?

P1: Ok. Yes.

4

R: So first, what was it like putting that on? Was it easy or hard or...? What was it?

P1: I would say, medium.

R: Ok.

P1: Because it was a little challenging to get it tight enough.

R: Ok. And how about how has it changed your posture?

P1: I feel like I am holding my head higher.

R: Ok.

P1: Just to make sure I am doing it right.

R: And um, ok. We are going to do the first test here. So, try not to click it for a sec.

P1: Laughs.

R: Laughs. (Hear typing in keyboard).

P1: Take a carrot out?

R: Yep, get a carrot out. Ok...and ready. Hold on, let me get the right script going. Don't do it yet. I know you're hungry.

P1: I am. (Laughs) My stomach is growling.

R: Ok, go ahead.

P1: (Chews Looney Tunes melody starts at 3:58) Should I do more carrots?

R: Yep, you can keep eating.

P1: (continues to chew Looney Tunes melody). (Chews slowly) Keep eating?

R: Yep. You can have one more if you want. But that's all we need.

P1: (Chews more. Stops chewing at 5:13) Ok.

R: Ok. Take this out of here. (Removes cord from switchboard). Ok.

P1: That was oddly satisfying (laughs) to have the music with it.

5.

R: (Laughs) Yeah? Good, ok. So, just describe your experience with the interface while your chewing was also playing music.

P1: Well I feel like it easily, I didn't have to do anything, I could just chew on the carrots. I do feel like I was more mindful of my eating while I was using it, which was interesting. I feel like I took longer to eat a carrot than I normally would.

5. B.

R: Ok. And, do you think it was more enjoyable or more stressful.

P1: More enjoyable.

R: Ok.

5 C

R: And how do you think the music changed the eating experience?

P1: It was kind of exciting to continue to chew to see what was gonna continue to play, like what the melody was gonna turn into.

R: Ok. Alright, good. A third of the way through. The next one - you can keep that one on.

P1: Oh, ok.

R: Ok, so this one's gonna play back text about the health benefits of carrots...

P1: Ok.

R: As you eat, so...Ok, you can go ahead and start.

P1: Ok

R: Have a few.

P1: Starts chewing (7:00) Is that the end of it? (7:44) Mm.

R: It froze....(starts working again)

P1: I think it froze again. (keeps chewing) Another carrot? Or is that good?

R: You're good.

P1: Ok. (stops chewing at 8:25).

6

R: Alright, so describe your experience with the chin interface while reading about the snack's nutritional information.

P1: I feel like it was very informative and I chewed at a pace to be able to read along with what was coming through.

6 B

R: Ok, and do you think the experience was enjoyable? Or was it stressful?

P1: I wouldn't find it particularly enjoyable or stressful. It was kind of just educational. I guess I wouldn't call it relaxing, so I guess I would call it more stressful than enjoyable.

6C

R: Ok. Ok, and then how did seeing the text play back change the eating experience?

P1: I was more focused on reading than enjoying the carrot.

R: Ok, and like how different than like your usual multitasking is it? Or what's different about it?

P1: Hmm, I am focused on something other than eating, so it's very similar to that where I am not focused on the food and am more focused on whatever I am looking at.

R: Ok. Alright. Now you can take that one off.

Putting on Interface 2 (no issues, more comfortable)

P1: Ok. Is it the blue one?

R: Yep. So yeah, the main chewer one is that orange one in the center.

P1: Ok.

R: And you can just do a few test chews and see where it goes.

P1: Ok. (sounds more comfortable and confident here.)

R: So it scans each letter. This row also includes the colon, apostrophe, and enter. And the last row goes until the period. Then it goes space bar, delete, then it starts back up with the Q row.

P1: Ok.

R: Ok. So, if you can, while you're eating...

P1: Mmm hmm

R: Or, you don't always have to be eating, but you can just try and type out, you know it could be one word, or or it could be a sentence -

P1: How do you make a letter stay?

R: Um, so select is this one over here. So you can just -

P1: (clicks the interface)

R: Yeah, turn your whole chin, like turn - you can turn your face

P1: Oh, I see

R: Yeah, like that.

P1: And then so I have to go through?

R: Yep, you just gotta rotate through each one and then what happens is - yep, good.

P1: Ok.

R: And then if you need to go back, that goes back a little bit like that, but that's... I don't - I haven't been able to figure out the coding to reverse it yet.

P1: Ok.

R: But that's what it will be eventually. But that's if you just miss one key you can -

P1: Yeah.

R: - use that other one.

P1: Ok.

R: So...

P1: And I'm supposed to type about the carrot?

R: You can just type out like uh you know one word about how you want the carrot to affect you.

P1: Mmm hmm.

R: So, it could be like "positive" or "health" or something that we saw over here like "eyesight" or dental things.

P1: Mmm hmmm.

R: Whatever you want. But you can do it while chewing a carrot or just move your chin up and down or both in between.

P1: Ok. Ready?

R: Go for it.

P1: (starts chewing 12:19). It's not selecting it. (12:29)

R: Is it not selecting it?

P1: Mmm mmm

R: Try a quicker up and down on that.

P1: (Tries multiple clicks to select.) It selected the "e" before.

R: Let me see, oh, it's cause we clicked off of that (the Word document)

P1: Oh, ok.

R: There we go.

P1: Ok, back in business now. (starts chewing again 12:58 - 29 second delay) (Laughs)

This is a gross carrot.

R: Laughs.

P1: (continues chewing) Ok. (14:06)

7

R: Good, ok, so describe your experience with the chin interface while you typed.

P1: A little bit challenging because it's restricted in going through each um area

R: Mmm hmm

P1: So to get the word you have to go back through everything. But, otherwise an interesting thing.

7B

R: Ok, and um, was the experience more enjoyable or more stressful would you say?

P1: Stressful.

7C

R: Ok, and then, how do you think typing changed the eating experience?

P1: Mmm, I tried to eat faster so I could type faster.

8

R: Ok. Ok, good. So now just some overall questions. So which of the three versions of the interface were you most comfortable with?

P1: The music.

R: And why?

P1: The music I didn't really have to do anything but focus on chewing. And by chewing and eating it I got like a lovely music out of it. The other one I had to do some work for, I had to either read or I had to type.

9

R: Ok. Ok, and then which of the three versions of interaction were you least comfortable with and why?

P1: Probably the typing cause it took the most effort cause you also had to think about what you wanted to type vs the other ones you were just consuming.

10

R: Ok. And um, is there any place where you would be comfortable wearing this you know?

P1: I'd wear it in my office. And I would do it in the house.

11

R: Ok, and um can you see it ever being incorporated into a daily routine of yours or anything like that?

P1: Potentially, I could see the middle - well one, I find the music one enjoyable. So I could see that being a - if I had a goal of trying to slow down my eating, cause I do tend to eat fast, that I could just chew and enjoy the music. The middle one with the reading, I could see that if I was like really on my weight loss journey and it was telling me positive things.

R: Mmm hmm.

P1: Or even showing me pictures of people who are healthy who eat carrots. I could see that being like further enhancing it. And the typing one I feel like I can't chew fast enough to type at the pace I'd want to type at.

12

R: Ok. Last question. Is there anything else we should discuss, or that you think I missed, or that you want to say?

P1: The only thing I would think about with the typing one is the old like - what was it - T8 texting where you hit the same number like a certain number of times to get the letter you want. But has less numbers to choose from. Maybe a quicker way to type.

R: Ok. Alright, that's it.

P1: Ok.

R: Thank you. How long was that.

P1: Very interesting.

R: Okay, good 18 (minutes).

## A.2 P2 Interview Transcript

Putting on Interface 1

R: Ok, so you can go ahead and put this first one on. So, you want to place it so - I just ordered some buttons that'll snap these shut - but basically, you want to put it on so that it rests under your chin and so you have the ability to chew and with each chew do that.

P2: (Producing music from test chews.)

R: This is the side that velcros and there's the velcro piece.

P2: Ok.

R: It goes just like that. Ok, let me see, see if you can raise your chin up. Yeah, put it a little bit lower on you. Let's do this a little bit lower, right there. Alright now, where's the clicker? So raise your head up a little more. Ok, yeah, go down a little bit more. Ok. Let it sit and rest here. Ok, now try and find it -

P2: (Chews producing consistent clicks)

R: That's what we're looking for. Ok, that in a comfortable spot?

P2: Yeah.

R: Ok so this first one - we're gonna have you go ahead and open that up. And -

P2: (opening carrot bag). Ok.

R: This is the only carrot associated song I could think of was like the Looney Tunes theme song, right?

P2: (laughs)

R: So this is that, that's what's gonna play back when you start chewing. And just uh take note of your experience, what you're thinking about, what you're feeling. Ok? Um, and we'll go ahead start.

P2: (Starts chewing at 1:48).

R: Here are some napkins.

P2: (continues chewing)

R: (3:06) You can stop whenever you feel comfortable.

P2: Ok. (Stops at 3:22) Should I take this off, or?

R: Uh, you can leave that on cause we're gonna use it for the next - I'll just unplug it from this so we can get a little feedback. Ok, so I'm gonna ask you a few questions about that now.

P2: oK.

4

R: Alright so, just what was it like putting on the chin interface and getting it into position?

P2: I think getting it into position was a little bit more difficult uh, just to - and even just like when I started chewing trying to understand like what it was supposed to interact with or like the pace that I should chew in order to hear the music and I was like, ok, and I finally got the rhythm down and I was like, ok. Um, yeah.

R: Ok.

P2: A little cumbersome at first, but once I figured it out it was - it made more sense.

4B

R: So like, on a scale of easy hard, you said it was a little difficult?

P2: Uh, you know what, I'll give it like, if I go to 1 to 10, 10 being easy and 1 being hard I'll go with a 6 or a 7.

R: Ok.

P2: Yeah.

4C

R: And um, how has it changed your posture?

P2: Oh, (laughs).

R: Or has it?

P2: Um, I guess I'm not aware of my posture when I eat, but I did have to like kind of situate myself in - in a way to try and get my chewing to work with the device. So, it made me more aware of my posture? (laughs)

5

R: Ok. And then, just describe your experience with the chin interface while you were chewing while it was playing back the music.

P2: Um, yeah, I had to just figure out my head position to get it to touch the device just right in order to get it to play the music, so then after hearing the music for a little bit I tried to adjust my chewing in order to get the music to play at the same tempo and speed that I recognized it from my memory. So, I guess it regulated my chewing.

5B

R: OK, and um, did you enjoy the experience or was it stressful?

P2: I thought it was a unique experience that was unlike anything I've been through. Neither stressful and just oddly unique. (laughs)

5C

R: And um, how did hearing the music change your eating experience?

P2: Um yeah, like I said, I was just trying to adjust my chewing so that the tempo and speed of the music would line up with what I recall the music sounding like because at first I was like, man, that doesn't sound normal at all and then I picked up the pace of my chewing and I was like, ok, ok, I recognize the song. Cause you told me what it was beforehand, but I was like, I don't know what this is. (laughs)

R: (laughs) Ok, cool. Alright, let's move to the next. Ok, so this is just some health benefits about, um, eating baby carrots. So each chew goes slide to slide plays a different word in the uh sentence of the article. So go ahead and grab a baby carrot and start rolling.

P2: (grabs baby carrot starts chewing 7:36)

R: (8:32) You can stop whenever you feel comfortable.

P2: Alright (stops chewing at 8:58)

R: OK, let me go ahead and take this out of here. Ok. So, some more questions now.

P2: Mmm hmm

6

R: So, um, yeah describe your experience with the chin interface while your chewing was displaying text to read about the snack's health benefits.

P2: Um, kind of like with the first one, uh, I feel like the first test got me used to the pace and how to better control it, but uh, this one was a little bit more interactive because I was reading and uh, so as I was reading I found myself chewing more just to see what the next word was.

6B

R: Ok, um, how about this experience - did you enjoy it or was it more stressful?

P2: Uh, I enjoyed it. No stress whatsoever.

6C

R: Ok. And um, how did seeing the text playback change the eating experience?

P2: Um, I almost didn't associate the reading with the eating at all. I was just more focused on the reading, so the eating was just kind of something that needed to happen to read the next word. (Laughs)

Putting on Interface 2

R: Ok. Ok good, so you can take this one off now.

P2: Alright.

R: Alright, so this one I forgot about beard interaction, that might -

P2: Beard interaction? (Laughs)

R: That might cause some issues for this. So this one is we're going to type out one word on this screen here about the health benefits. Like one word how you want the carrots to affect you. So like "health" or "positivity" or any of the stuff you saw on here. You know?

P2: Mm hmm

R: Like lower cholesterol, reduce cancer risk. (Laughs) You know anything like that. So basically, this one goes like this. The middle one is for the chewing, ok? And it will go through that first line. The second line goes through all the way to the enter bar. And then the third line goes to the period. After that it goes to the space, to the delete, and then starts over at the beginning. So it just cycles through that.

P2: Ok.

R: So if - to select it's on this side, so you want to turn your head over there, not really try and roll your head like that.

P2: Mm hmm

R: But just like turn like you're looking in that direction, that will select the key.

P2: Ok. (understanding tone)

R: This one - I'm still working on the programming - I want it to go reverse, but for now it just will go back like you're moving the mouse like that.

P2: Okay.

R: But that's really if you miss a key or want to choose a letter on the same row, otherwise it's just gonna, it works on counting, so it will eventually skip that down to the next row and you'll have to rotate anyway.

P2: Ok.

R: Ok, so let's try and see if we can get this to - so probably if you put it lower on you, like, you just want it to be where you can -

P2: Yeah.

R: Like that, over here. Over there.

P2: Alright.

R: Ok, so let's see if we can get that positioned here.

P2: Let's see how it works with this beard.

R: Yeah. Like that. Let's see. See, how's that? See if you can -

P2: Nope (clicks through)

R: Ok, yeah.

P2: Ok.

R: Alright, so let's do that.

P2: Do I have to chew, or do I just move my head?

R: Uh, you can chew.

P2: Ok.

R: With the carrot, and then just one word, it can be a short word. Um, just about how you want the carrot to affect you.

P2: (starts chewing 13:09) (chew until 15:06 then says) Uh, I just realized you said one word or one concept (laughs)



R: Oh no, that's perfect. That's great. That's perfect. Good good good. Alright. So, talk a little bit about your experience typing while you chewed the carrot.

P2: Mmm, I think this one was just, with the beard was a little harder to get used to, but once I figured it out it wasn't that hard. Just uh a little time consuming to scroll through with trying to type out some words, but after getting the hang of it, it was like, ok - I would just have to really slow down to make sure I wouldn't hit the wrong keys cause then I would have to - well, I guess I could - yeah

R: Mm hmm

P2: It wouldn't be so bad.

R: Cool.

P2: Yeah

7B

R: alright, so was it enjoyable or stressful or somewhere in between?

P2: Um, somewhere in between I think.

7C

R: Ok, and uh, I know you touched on it, but just briefly again, how did typing change the eating experience? Like your experience eating the carrot?

P2: Um, I think I found myself eating more carrots than I would just to try and get to the - get through to the next row - just to cycle back through uh to find the the letters that I wanted.

R: Ok. Ok, cool. Alright, we can take this one off now. Now I just have a few more questions.

P2: Alright.

1

R: Then you're all done. Alright, so, um, so do you have um, any prior experience with wearable technology? Like do you have a smart watch or anything like that that you use?

P2: I have a pedometer that I sometimes use, but that's about it.

2

R: Ok. And um, what are you usually doing when you eat? Do you multitask? Watch TV? Eat with other people? Or what's like the most common thing you do?

P2: Um, I'll eat with K or I'll uh be watching something on my phone more than likely.

R: Ok. And, ok.

P2: Working from home however, I will eat and work at my - my desk and just typing away , so sometimes if I'm looking at something - I do actually have baby carrots at home during lunch so,

R: Oh yeah?

P2: oftentimes I'll like slowly chew my carrots while like looking at work and like thinking through something.

3

R: Ok. Ok, and um, so yeah the next one was what do you usually think about while you're eating. So work, or conversation with the other people or whatever's playing on your phone?

P2: Mmm hmm

3B

R: Cool. And are you usually a slow or a fast eater would you say?

P2: Ooo, I'm a fast eater (laughs). Slow eater with the baby carrots while I'm working, while I'm thinging. (laughs)

8

R: Alright, and - so of these three versions of the interactive interface, which were you most comfortable with and why?

P2: I think the scrolling text, just because again, I didn't even think about the fact that I was chewing, I was just more - the the chewing was just letting me see the next - the next word, which I was intrigued to see what was coming next. So, the pace of the words that were displayed just encouraged me to chew more because of my own curiosity. (laughs)

9

R: Ok and, which were you least comfortable with do you think?

P2: I think the first one, the music association. Yeah.

R: Yeah?

P2: Because it was - it was almost stressful to find the pace that - that made the music make sense to me. Otherwise it was just like almost noise that I - I didn't understand.

10

R: Ok. And uh, is there any place where you would feel comfortable wearing one of these things? Like in public, or anywhere you would feel comfortable putting it on and using it?

P2: Sure, why not. If the situation called for it, why not?

R: Yeah? So like at a restaurant or anything like that?

P2: Yeah, I wouldn't care.

11

R: Cool. Ok, and can you see this - something like this fitting into your daily routine or lifestyle at all? Is there a way you would fit it into something that you do?

P2: I could see some multitasking applications to - to using the - the reading function and chewing, like at - maybe having a screen while also doing some other task at the same time, because you're still taking in the - the stimuli, and you're still probably reading that word as you chew.

R: Mmm hmm

P2: So I could - I could see the multitask applications for that. So I could see the - the - the purpose in that. I'm - I could probably read a document while I'm chewing and and looking at some other thing at work, especially during lunch.

12

R: Mmm hmm. And uh, cool, so last one is just is there anything else we should discuss or that you think I missed or that you want to say that you weren't able to say yet?

P2: Nnnnnnno. I think that all covers it.

R: Ok, cool. Alright. We're all done.

P2: Alright.

R: Thank you.

P2: Yeah, not a problem.

R: Let's cut this off.

### A.3 P3 Interview Transcript

1

R: So um, first question is do you have any prior experience with uh wearable technology? So like an apple watch or anything like that?

P3: Yes.

R: And what do you mainly use your apple watch for ?

P3: Um, time, reading text messages, seeing who's calling me without having to pull my phone out of my pocket. Um, mainly just convenience things.

2

R: Ok. And uh, since this is a study about eating, what do you usually do when you eat?

P3: I typically like to watch TV when I eat. And just relax.

2B

R: Ok. and um, do you usually eat alone or with other people?

P3: I eat alone frequently, but I also eat with other people occasionally.

3

R: Ok. Ok, and uh, what sort of things do you usually um think about while you eat?

P3: Um, well, since I'm mostly watching TV while I'm eating, I'm mainly thinking about what's on the TV at the time.

3B

R: Ok. And are you a slow or a fast eater?

P3: Mainly a fast eater.

Putting on Interface 1

R: Ok. Alright, so we can start the first one up. Ok, so you want to get it in a good position. Um, this side has the fuzzy side this side has the connector, ok? And you want it to be under your chin so that each chew you hear the down up. Ok, so let's try and get that on. Let's see. Uh, I don't know what your hair is gonna allow for. Let me try it like that, ok. See how it's sitting.

P3: (Clicks chewer a few times) I think it's -

R: Is that comfortable enough for a few minutes?

P3: Yeah, that's fine.

R: Ok, um. Alright here's your food (raisins). Ok, so just open the box, don't start eating yet.

P3: Ok.

R: Ok so this is going to playback um the song, which is the only sort of raisins related song that I could think about was uh the "Heard it Through the Grapevine" uh which they used for the California Raisins commercials.

P3: Yeah.

R: You remember that? That's what's gonna play back as you chew. Each chew's gonna play back one note in the midi score. K so just spend a few uh moments just chewing and you can go ahead and start now.

P3: (starts chewing at 4:00)

R: You can stop whenever you feel ready.

P3: Ok. (stops chewing at 4:54)

R: You good?

P3: Mmm hmm.

4

R: Ok, save some of those raisins. (laughs) Alright, so now just a few questions about that. So, um first would be um what was it like putting on the uh chin interface? Was it difficult, hard, easy?

P3: It was relatively easy.

R: Ok, and um did it change your posture in any way.

P3: Yeah, it did. Um, I had to hold my head a certain way to make sure it was working.

5

R: Ok. And just talk a little bit about, or describe your experience with the chin interface while your chewing was playing back the music.

P3: Um, I felt like it was interesting.

R: uh huh

P3: Um, I had to like think a little bit more about what I was doing, um, and to keep like having the music play I had to keep continuing to eat um and then I had to think about where my face was positioned to make sure that I was getting the chin piece. Um, it was just a little bit - a lot - or I guess it was just more thinking involved than normal eating.

5B

R: Ok. And um did you enjoy the experience or was it stressful or something else?

P3: I enjoyed the experience. It was different and something new.

5C

R: Ok. And how about the music. Were you able to recognize the song?

P3: No, I didn't recognize the song. I didn't remember the song from the raisins commercials. It's been a long time.

R: Ok. Alright, on to the next one now.

P3: Ok.

R: So keep that one on. Keep it on. Very good. Alright. So this one now is going to play back text. Do you have enough raisins? Or should I get some more?

P3: Yeah, I do.

R: Ok. And it's going to -

P3: They're just stuck together.

R: And it's going to be text from the website, from the Sunmaid Raisins website about why they're good, why they're good for you, and some factoids about it.

P3: Ok.

R: So, whenever you're ready. Go for it.

P3: (starts chewing 8:18)

R: (at 9:11) You can stop whenever you want.

P3: (stops chewing at 9:24)

R: Good?

P3: Mmm hmm.

R: Alright. Ok, go ahead and take this one off now.

P3: Mmm

R: Let's do a few questions then we'll put the other one on.

P3: Okay, I may need extra raisins.

6

R: I'll go run and get a box. Sit tight. Alright so about that. So describe your experience with the chin interface while your chewing was playing back text to read.

P3: I felt like that experience, or that experiment, was a little more interesting to me like reading about the food I'm eating and I liked the descriptive words of um "made with goodness" and "California sunshine" it just makes you think about the flavor and the taste of what you're eating a little bit more and think of it in a positive way. I also liked that the text talked about the caloric intake of the food, especially for someone like me who's watching what I'm eating, it makes you feel good about what you're eating and it also talked about um the minerals and the vitamins and the fiber from the raisins. Um, so the whole thing just made you feel good about what you were eating.

6B

R: Ok, um, did you enjoy the experience or was it stressful?

P3: I enjoyed it.

6C

R: Ok, and um, how did seeing the text uh change the eating experience? Like, were you more focused on reading, or eating, or were you thinking about the food or the text?

P3: Um, I think it was a little bit of both. I think I was mostly focused on what was being shown to me and also the flavor of the food. Those were the two biggest things for me.

R: Ok.

P3: Because like I said, the text played into the experience of eating it.

R: Ok, good. Ok, so, last one we're gonna try and then I have some more questions for you. I'm gonna describe how it works. So this one we're gonna type out, and you can type out one word or a few words or a sentence. Most have done one word about how you want it to affect you. So it could be something you saw here, like something positive. You could just type out "health". Whatever you want. Um, but this rotation circles through the text, ok? So it will go to the space bar, to delete, then starts at the q row goes to the p. Ok? The a row goes all the way to the enter. Then the z row goes to the period. Then it goes to the space bar, delete, and keeps rotating through.

P3: Ok.

R: Ok, to select, you want to turn your head, ok? Don't try and roll it, but try - this is the select, over here on the right, ok? And that will choose the letter, ok? Um, this one is if you miss a letter or the letter is on the same row, this will move back. So this is just mouse movement, it won't pop back like that, so you'll just have to go about it, but since the coding works on steps -

P3: Will like this will go to the delete?

R: It will eventually go back to where it was. No, so the delete you have to go - go all the way through

P3: Through the - ok

Putting on Interface 2

R: til after space. Ok? So let's go ahead and try and get it on and you can test it out a little bit without eating anything. See how it works. Let's see, is that a little high? Let's lower it.

P3: Now it's too low, I can't reach it.

R: Try that.

P3: Ok.

R: Ok, so whenever you're ready, chew some raisins, type out one word and uh, go for it.

P3: (starts chewing 14:36) Oh. No. (laughs). Mmmm.

R: Just hit it on the keyboard if you need to delete.

P3: Ok. (keeps chewing)

P3: Ok. (stops chewing 16:52)

7

R: Ok. Got it? Ok. Um so yeah, describe your experience while you typed one word there. What was that like?

P3: (sigh) It was a bit stressful.

R: Mmm hmm.

P3: Um, it was difficult whereas in the - if I wanted a letter that was on a row I had just already been on, I had to keep going until I got back to that letter. (inhale) It was definitely a little frustrating. Um, and I really had to think about my chewing and think about where my head was and making sure that my chin wasn't hitting the wrong thing. Um, I had to be way more conscious of how I was eating to make sure I was getting the word I wanted typed out.

7B

R: Ok, so - I think you mentioned this - but, did you - was it enjoyable or was it stressful? You said stressful, right?

P3: Yeah, it was stressful.

7C

R: And um, how did it change the eating experience, like with the raisins? Were you focused on the raisins at all during this? Or?

P3: Um, I was starting to lose focus on the raisins and I was becoming more focused on the typing. The raisins kind of became an afterthought. And the only time I would think about them is when I needed to put more in my mouth to keep chewing. Other than that I had lost most focus on them.

8

R: Ok. Alright, just a few more questions. We can take this off. Ok. Alright so, of the three versions, um, which were you most comfortable with and why?

P3: I liked the second experiment the most. The first one was ok, but I wasn't super familiar with the song and it was kind of disturbing me, like I had to keep chewing to keep hearing the song and when you're listening to a song you don't want it to be continuously cut off, um, so that was a little irritating to the ears, I guess. The middle one I liked the most because it was the most - it brought like the biggest relationship to the food for me. Like, I was able to read about it as I was going and it kept my focus on the experiment, but it also kept my focus on the food and what I was doing. And I felt that it was more interesting and that reading the positives about what you were eating just gave me a better experience. The third experiment was very stressful in the typing and with how the cursor was moving around and um so that one took away more from the eating experience.

10

R: Ok. Ok, and where would you be comfortable wearing something like this? Like would you wear it out in public anywhere? A coffee shop? Or in the home? Or is it not your thing?

P3: Me personally, I would probably not wear something like this out in public unless it was sort of like a multi-person experiment and there were other people who were also doing it. Just me and my personality, I would not be comfortable doing something like this in public if I was the only one.

11

R: Um, is there a way, do you think, that this would could be um useful in your uh daily routine? Like could this be incorporated in your daily routine? Somehow? One of these type of activities?

P3: Maybe potentially, I guess the one I could see the most would be the typing one, just because I eat every day and I do typing every day, so that's something that I could see myself doing.

12

R: Ok, and last question. Um, is there anything else that we should discuss that I missed or that you want to say about the experience?

P3: I think everything's been covered.

R: Alright, thank you for your participation.

P3: Thanks for having me.

#### A.4 P4 Interview Transcript

1

R: Do you have any prior experience with wearable technology?

P4: Um, yeah like the smart watches, um, I've used. And then, um, I'm trying to think of what else. I've had a lot of medical procedures where they've done different electrodes and biofeedback and things like that, yeah.

2

R: Ok. And then since this is an eating test, um, what do you usually do when you eat? Like are you multitasking at all? And what sort of multitasking are you doing?

P4: Yeah, I'm usually working, um so I'm typing and reading while eating, I'm sitting at my desk with my computer, or um I'll be watching TV and eating. And then the last one would be looking at my phone and eating.

3

R: Cool. Ok, and then, you're using those things, and then what are the things you're usually thinking about when you're doing that? Is that -

P4: Um, usually whatever is right in front of me. I don't often think about the food, so the food is usually just a means to an end while I'm working. And so my focus is really only on - like if it's work stuff that -

3B

R: Ok, great. And um, are you a slow or a fast eater?

P4: Slow.

R: Slow? Ok. That's the first one of those. (laughs)

P4: (laughs)

Putting on Interface 1

R: Alright, so now we're gonna try and get this on. Ok so you can hear it, we're gonna use this first one for this and this one. So once we get it on we can keep it on for a little bit.

P4: Ok.

R: But basically, we have the straps. This part is the fuzzy side. The connector is right there. You just want to put it up under and situate it so that (clicking starts) when you open your jaw regularly without stressing you hear that (clicking) up down. Ok?

P4: Ok.

R: That's what we're trying to do, so try and get that -

P4: (clicking) Poop, too loose. (clicking) Is that, ok?

R: Yeah, you can just hold your head to where it's down a little bit just so that when you're chewing the raisins you're getting a click each time.

P4: Ok.

R: Alright, so our first one is uh pairing it with um music. So the only raisins related track that I could find was “Heard it Through the Grapevine”.

P4: Ok.

R: Which was the old California Raisins commercial. Right?

P4: Mmm hmm.

R: So, we can open up that (raisins).

P4: Sure.

R: And then, let’s see, you can chew for about a minute or so and then - you can go as long as you want but I’ll check in in about a minute , ok? So -

P4: (starts chewing at 4:03) (laughs at 4:50) It kind of - the depth perception got me. (stops chewing 5:06)

R: And you can stop whenever you feel comfortable.

P4: Ok.

R: Good?

P4: Good.

4

R: Alright, so first one about that is uh, what was it like uh putting the interface around your neck and getting it into position?

P4: Uh, it was awkward. Um, like when I hit it when I was trying to put the raisins to my mouth my depth perception was off.

R: Mmm hmm

P4: Um, and then I felt like I was holding my heck - my head and neck abnormally um to do the clicking.

4B

R: Ok, and then how hard was it just like putting it on? Like on a scale of like 1 to 10 or so? Easy? Medium?

P4: Um 2. I think it’d be - just the adjustments setting was a little tricky at first. But I think it’d be better next time.

4C

R: Ok, yeah and you said it changed your posture a little but?

P4: Yeah.

5

R: Ok, and so describe your experience with the chin interface while your chewing was also playing back the music. What was that like?

P4: I kept thinking about the rate I was chewing and the sound of the clicking was a very front and center reminder of how fast or slow I was chewing.

5B

R: Ok. And what would you say about uh, was the experience enjoyable or was it stressful?

P4: Uh, neutral.

5C

R: Ok. And um, how would you say the music changed the eating experience? Like were you thinking more about the food? Less about the food? In that sort of way.

P4: I think I was thinking more about the food because I wanted the sound to resemble the song. And the chew rate, I couldn’t quite get there, and so uh that was something I was thinking about was like ah well should I chew normally or should I chew to get the song to go.



R: Ok. Ok, good. K we can go to the next one now.

P4: Ok.

R: And you can see you can maybe get that a little tighter. A little bit more up under there. See if that helps a little bit. Alright, so this next one we're playing back um a script that is just taken from the Sunmaid site about their raisins telling you how good they are. So it's almost like advertising copyright stuff. Um so, same deal, go through it for about a minute and I'll check in. But you can go as long as you want. Um, and let's give it - see if it works. Yep, ok.

P4: So am I trying to like read through them quickly or?

R: Whatever pace you want to. So just chew and uh

P4: Oh I have to keep chewing?

R: Yea, h, keep chewing and read about what you're eating as you're eating it.

P4: Ok. (shaking raisins box) Come on. (starts chewing 8:41) Am I doing something wrong?

R: It's just not - just - it was acting up last time too. Let me do this. See if that helps it?

P4: Ok (clicks) That seems better.

R: Let me try this. Over here.

P4: Oh okay (laughs because text goes too fast)

R: Let's try this one too. Um, alright, try it now.

P4: (clicks) That's better.

R: Ok.

P4: (Starts chewing again 9:45)

R: And you can stop whenever you feel ready.

P4: Ok (stops chewing at 10:43)

6

R: Ok so for that one, describe your experience with the chin interface while your chewing was displaying text to read about the snack's nutritional info.

P4: I liked the technology adaptation. And I think it could be useful, especially for folks with disabilities. Uh, I personally was - I read a lot faster than I chew, and so I was like - ugh it's lagging - I was starting to get bored and distracted because I wasn't able to read as quickly as normal.

6B

R: Ok and did you enjoy the experience or was it stressful?

P4: Yeah, I enjoyed it.

6C

R: And how did seeing the text playback change the eating experience or change your focus on food?

P4: Um, I was - I found myself trying to eat faster to read faster, moreso than the song.

R: Ok, cool. Alright, now we're going on to the last one. So you can take that one off.

P4: Ok.

Putting on Interface 2

R: Ok, and this guy now is a little trickier, let me walk you through its controls.

P4: Ok.

R: So, the main thing, just like that one, the main chewer toggles the text (clicking). So it goes from just the letters on the top row - its lagging for a sec, let's see if I can get it - this computer has taken the brunt of it.

P4: Laughs

R: Let's see. Let's shut you down. Don't need my articles up. Alright. Alright (clicking) there we go, so last row goes to the period - I don't know why it's messing up today. (clicking) Let me take this out for a sec. Put it back. (clicking) Ok - oh. Let me turn up you. Ok, that was the issue. Ok, so right, so it goes through three rows. So the last row it goes to the period, then it goes space, delete. Then the q row just goes all letters, next row goes all the way to the enter just in case you need any character here, and last row just to the period, then space bar, delete. K? So those - that's what the chewer button does. Because it toggles through the whole thing for this all you do - you're only able to go back within the same row by using this side, the left button. Ok, but eventually it's gonna get back cause the coding has it - it's all numbered counting coding to bounce around. I still am working on the coding to get it go reverse the whole way back up. That's been giving me problems. And then this right one here is the select. So, you can go through and type out in a slow manner, you know, how to - whatever you want to - and toggle through delete like that. And what we're gonna do is try and type out one word about - one or two words - most people have been doing one word about how you want the raisins to affect you, so it could be positive, or health

P4: Ok

R: or something you saw you know from these slides, right? Or just help, something like that. Um, anything you want. But -

P4: Ok.

R: Basically so for this one you'll be chewing

P4: Ok.

R: until you get the word uh typed out.

P4: Ok.

R: So, you can go ahead and start.

P4: Ok (starts chewing at 15:46) Ooooh (at 16:59)

R: (laughs)

P4: (laughs because she typed two extra rs accidentally spelling fruirr and had to toggle all the way back to delete to correct it) (stops chewing at 17:30)

R: Ok.

P4: Ooh it just fell ( the velcro came undone)

R: Ok, you can take it off and put it down right there.

P4: Ok.

7

R: Ok. Alright, so um, for that one, describe your experience with the chin interface while you typed one word.

P4: Um, it was a little clunky. And um - I was - I really took um - my mind shifted from like just eating and then the other stuff kind of happening in the background to this was like now I'm consciously altering the way I'm chewing so that I can get my word. Um, and I definitely was hesitating on chewing so I could get through stuff and then I would speed up the chewing to try to get to the other letter.

7B

R: Ok. Um, and did you enjoy the experience or was it stressful?

P4: This one was more stressful.

7C

R: Ok, and you touched on it a little bit, but just again, how did typing change the experience of eating the raisins or your focus on the raisins?

P4: Um, this one I had a more active role between the relationship of chewing and the technology, whereas the other the words and the sound felt a bit more passive um cause I was just chewing and things were kind of happening. But this I had to focus on writing out the word.

8

R: Ok. And then which of the three versions do you think you were most comfortable with and why?

P4: Uh the second, the reading because I could still eat the way I normally do and then I could see reading like that for work would be super helpful. Uh, and I also wasn't having to focus as much, like the third one.

9

R: Ok. And, which of the three versions were you least comfortable with and why?

P4: The first one, just because I didn't see the point.

R: Mmm hmm

P4: Um, yeah I don't know how it would be relevant to my personal life.

10

R: Ok. Ok last few here, um, where would you be comfortable wearing something like this? Or would you be? Like in the house, out of the house, not at all, with other people wearing it?

P4: Only at home.

R: Mmm hmm

P4: Yeah, I wouldn't wear it out of the house.

11

R: Ok and then is there any way you can see any of these iterations uh becoming incorporated into your daily routine? Something that you could use it for?

P4: No, I don't know that the benefit outweighs the - you trying to configure it and then still trying to eat the food and not mess up something else or um - The one thing was like with the words I wasn't really comprehending what was being said, I was more just chewing and seeing the words go and so I don't know that the technology would help me still maintain the same level of focus as I do now when I'm multitasking and eating.

R: Ok, and then last one, is there anything else that you want to say, or that you feel I missed or that you want to discuss?

P4: No, you did a good job. Thank you.

R: Alright. Thank you.

#### **A.4 Interview Questions w/ Notes**

1. Do you have any prior experience with wearable technology?

K - wears an apple watch

P - sometimes wears a pedometer

B - apple watch - time, reading texts, who's calling, convenience

Smart watch, electrodes

2. What do you usually do when you eat?

- Hoping for a multitasking answer - on phone or watching TV.

K - Phone, social media, write emails

P - eat, watch videos on phone, will eat and work, slowly chew

B - typically watch TV, relax  
M - Working, typing reading, at desk

2B Are you usually alone or with other people?  
K - with P, in office at work, go out with people  
P- with kelly or phone  
B - eat alone frequently  
M - TV, desk, computer, phones

3What do you usually think about when you eat?  
K - not the food, emails, phone  
P - work, phone show  
B - What's on TV  
M - Whatever is right in front, not often food

3B Are you a slow or fast eater?  
K - fast  
P - fast  
B - fast  
slow

4 What was it like putting the chin interface around your neck and getting it into position?  
K - medium  
P - difficult , trying to understand the pace of interaction  
B - relatively easy  
M - Awkward, depth perception off, holding head and neck abnormally

4B Was it easy/hard?  
P - 6 or 7,  
M - 2 - adjustment setting

4C Did it change your posture?  
K -  
P - Not aware of posture while eat, more aware  
B - Yes, hold head a certain way, make sure it was working  
M - Posture change in head position

5 Describe your experience with the chin interface while your chewing was also playing music.  
K -  
P - had to figure out head position, regulating chewing  
B - interesting, think more about what I was doing, PACE, continuing to eat, face positioning - MORE THINKING

M - Kept think about rate, the sound of the clicking a reminder

5B Did you enjoy the experience or was it stressful?

K - Mindful

P - unique unlike anything

B - enjoyed, different, new

Mindfulness, Novelty

M - neutral

5C How did the music change the eating experience?

K - Exciting - not knowing what was next

P - adjust chewing to the tempo and speed

B - "recognize song?" No, didn't remember

M - thinking more about the food, wanted sound to resemble song, chew rate couldn't get there

6 Describe your experience with the chin interface while your chewing was displaying text to read about the snack's nutritional info.

K - Informative, chewed at pace to read

P - pace and control, more interactive because reading, anticipating next word

B - More interesting, reading about the food I'm eating, LIKED DESCRIPTIVE WORDS, made with GOODNESS< think of flavor and taste (knew the text well)

M - Liked the tech adaptation, could be useful, read faster then chew, started to get bored and distracted

6B Did you enjoy the experience or was it stressful?

K - Not enjoyable or stressful, just educational - more stressful

P - Enjoyable, no stress

B - enjoyed

M - enjoyed

6C How did seeing the text playback change the eating experience (or change focus on food)?

K - More focused on reading

how /what is different about usual multitasking

P - not associating reading with the eating

B - focused on text and the flavor of food (NOT CHEWING), text played into experience

M - Trying to eat faster than read faster, more so than the song

7 Describe your experience with the chin interface while you typed one word.

K - Challenging cause of rotation of text (typed "health")

P - (typed "good vision") \*\*\*looks to be feeling more comfortable, better interaction\*\*\* - Difficult with the beard, not hard, time consuming with scrolling, slowed down pace

B - \*\*had to use keyboard to delete, (typed word “raisins” tried to autocomplete to “raising awareness” interesting), stressful - difficult if you wanted a letter you had been on had to keep going, frustrating, really had to think about chewing, more conscious of how I was eating

M - (tried to get left control to toggle back) “fruit” - clunky, mind shifted from eating more focus, less peripheral, more conscious of the way I was chewing.

7B Did you enjoy the experience or was it stressful?

K - Stressful

P - Somewhere in between

B - stressful

M - more stressful

7C How did typing change the eating experience (eating or focus)?

K - Tried to eat fast to type faster

P - eating more carrots to be able to get to the next row, “cycle back through”

B - “Focused on raisins at all” raisins became an afterthought, only had to think when had to reload

M - active role in chewing and technology, words and sound more passive.

8 Which of the three versions of interaction were you most comfortable with and why?

K - Music - didn’t have to do anything but focus on chewing - less work

P - Scrolling text, chewing fit pace of words

B - scrolling text, music was OK but not familiar with song, was disturbing, middle was most ...listen to text

M - REading - could still eat normally, could see reading for work would be helpful, not having to focus as much

9 Which of the three versions of interaction were you least comfortable with and why?

K - Typing - think about what you wanted to type - others were consuming

P - Music - stressful to find the pace that made the music make sense to me

B - Typing, very stressful in cursor movement, took away more from eating experience

M - Music - did not see the point, don’t see how it would be relevant

10 Where would you be comfortable wearing it?

K - In office, and in the house

P - Restaurant, no worries

B - Probably not wear unless it was a multiperson participation

M - only at home

11 How would you incorporate the chin interface into your daily routine?

K - Potentially - the music enjoyable - goal of slowing down eating, reading if on a weight loss journey tell positive things - healthy pictures, typing can’t chew fast enough

P - multitasking applications, (peripheral interaction)

B - Potentially the typing one, eat and type every day

M - No, benefit doesn't outweigh the setup, chewing and seeing words go

12 Is there anything else that we should discuss?

K - Typing - typing same humber to get the letter you want.

P - no

B - no

M - no

#### **A.5 Rapid Serial Visual Presentation Playback for Raisins (Experiment Iteration 2) [16]**

Made with nothing but grapes and California sunshine, Sun-Maid Raisins' timeless and trusted goodness has been a classically delicious snack for kids and grown-up kids alike since 1912. Are raisins good for you? Yes! Raisins have many benefits! Raisins are a low fat food and provide less than 120 calories per serving. They contribute to our daily intake of fiber, vitamins, and essential minerals. Raisins provide only natural sugars. Raisins make for a great better-for-you snack for kids by helping them reach the recommended five to nine daily servings of fruit. Are raisins grapes? They sure are. Raisins are simply dried grapes. Most raisins come from the Thompson Seedless Grapes variety. Due to the dehydration that takes place in dried fruits, raisins have more concentrated nutrition levels than grapes, making them a natural, easy and better-for-you snack for kids and adults alike. What are raisins good for? Besides being a tasty and better-for-you snack all on their own, raisins are a welcome addition to many recipes. Due to their natural sugars, raisins are a useful component in breakfast ideas, like sprinkling over granola or adding to fruit salads. Raisins are also a popular item in snack and dessert recipes. No matter if you're eating them on the go, as a better-for-you snack at work or school, raisins truly are an incredibly versatile dried fruit.

#### **A.6 Rapid Serial Visual Presentation Playback for Carrots (Experiment Iteration 2) [8]**

Health Benefits: Baby carrots provide similar health benefits to regular carrots. Protects Against Vision Loss: The vitamin A in baby carrots provides carotenoids with antioxidant functions (including beta carotene). These compounds accumulate in the retina and are particularly helpful in preventing vision loss that can occur as you get older. Long-term studies have shown that the consumption of carrots and other foods that contain beta carotene, lutein, and zeaxanthin can help protect eyesight and reduce your risk of advanced age-related macular degeneration (AMD). Boosts Heart Health: Baby carrots contain several phytochemicals with antioxidant and anti-inflammatory effects that may help reduce the risk of heart disease. Studies have shown that polyphenols in carrots can increase bile secretion, which decreases cholesterol and triglyceride levels. Baby carrots also provide dietary fiber which can further help lower serum cholesterol and reduce the risk of cardiovascular disease. While regular carrots come in many colors—each providing different antioxidants—baby carrots only come orange. It is the beta carotene in orange carrots that may be protective against certain types of cancer. For example, one large research review showed that a higher intake of carrots was associated with a reduced risk of prostate and gastric cancers. Preserves Dental Health: Eating crunchy carrots may help you maintain strong, healthy teeth. One study evaluated the rate of tooth loss in an elderly Japanese population. Researchers found that a higher intake of beta carotene was protective against dental issues. This study further suggested that a dietary pattern that is high in carrots, squash, and leafy greens is beneficial for the retention of teeth, regardless of a person's dental care practices. The low sugar content of carrots, along with their beneficial vitamins, may improve gum health and provide protective effects. The

American Dental Association recommends that we consume more vegetables and fewer sugary foods to maintain a healthy mouth. Prevents Cognitive Decline: The same study noting the oral benefits of carrots also found that a diet including carrots may provide cognitive benefits. Specifically, a higher intake of cooked or raw vegetables (including carrots) was associated with a reduced risk of dementia.

#### A.6 Picture of Study Table

