"Which Brew Are You Going To Choose?"
An Interactive 'Tea-Decider-er' in a
Teahouse Shop Window

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ABSTRACT
We describe the design of an interactive shop window created and installed for use in an independent teahouse. Using cameras to track the gestures of customers on the street front, the system allowed visitors to interact with an animatronic character who helped them choose a 'brew' from over 80 unusual tea varieties. In this paper we describe how we worked with the business owners, observing their practices to develop an understanding of how they helped customers choose one tea out of a large array of appealing possibilities. We describe the design process we undertook when creating the window, and examine the functional, aesthetic, technical and commercial factors that pose challenges when creating a bespoke piece of interactive art for a functioning real-world business.

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General Terms
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INTRODUCTION
Collaborating closely with an independent local teahouse, *Quilliam Brothers – Purveyors of Finest Tea[1]*, we built an interactive shop window (see Figure 1) that used responsive digital interaction technology to address a concern common to many retail establishments – how can a customer be guided towards identifying the most personally appealing option when confronted with an exceptionally large product range?

The shop window installation (which the Quilliam Brothers affectionately dubbed the *Tea-Decider-er*) was intended to

Figure 1. The interactive shop window. The Victorian man asks of passersby, "Which brew are you going to choose?"

allow visitors an entertaining and accessible way of making an informed product choice out of the Quilliams' vast and varied menu of over 80 tea selections. In their teahouse, the Quilliams engage customers in face-to-face dialogue, drawing upon their personal expertise to assist patrons in navigating the menu possibilities. In this project we explore how interactive technology inspired by the communicative, dialogical style of their daily practice could be used to support an alternative form of personal recommendation experience situated in a streetfront setting – one which facilitated the process of product exploration and personal choice through engagement and interaction with a responsive animatronic character. The installation consisted of life-sized animatronic set pieces, as well as projected digital imagery, dynamic sound, and responsive lighting effects.

Our interactive window display engaged passersby in a simple narrative, finding out information about a visitor's individual tastes and preferences and suggesting a particular tea that s/he might like to try. The digitally augmented

experience was crafted to complement the teahouse's Victorian aesthetic and convey the Quilliams' welcoming, witty, friendly demeanour when engaging potential customers in the process of having a personalized recommendation made just for them. In doing so, the streetfront encounter helped reinforce the accessible, warm, stimulating atmosphere and values potential customers would encounter when they entered the shop to participate in the Quilliam Brothers' teahouse experience.

When pedestrians approached the *Tea Decider-er*, an animated life-sized Victorian shopkeeper used a comic-book style speech bubble to engage them in a conversation that began with the query *"Which brew are you going to choose?"* He went on to ask them several questions about their tea-related preferences, which they could answer by indicating towards signs marked 'YES' or 'NO' (their gestures being tracked by cameras unobtrusively placed inside the window frame.) After asking a series of several questions in a dialogue interspersed with friendly chat and banter, the Victorian man grandly announced he was ready to prepare the ideal tea he had specifically chosen just for them. A brief course of amusing animations and projections then ensued. Animatronic shelves physically rotated an array of jars across an industrialized conveyor belt, dynamic lighting effects flared and shimmered across the backdrop of the scene, and projected animations danced upon a cutout cardboard teapot. Finally, the man revealed the recommended tea selection – a detailed description of which was projected inside the window display as well as upon a physical ticket that the customer could take away with them, to inform the process of placing his or her order.

In this paper we will describe how we created an animatronic character who made product recommendations, and explore how the design of the interactive installation took inspiration from the Quilliams' philosophical and aesthetic vision of the teahouse space. We will relate the work to examples of how other technically mediated recommendation systems have been approached in the past, and describe how our interactive system was inspired by observing and investigating how the Quilliams helped customers identify appealing selections out of their large menu containing many possible choices. Using the example of our teahouse installation as an illustration, we will examine how the design requirements of an art piece such as an interactive shop window must necessarily balance the need for functional, aesthetic, technical, and commercial consideration. Finally, we will discuss the window's deployment in the Quilliam Brothers' real-world teahouse shopfront setting.

RELATED WORK
Shop windows have historically been used both to display wares, and also to serve as stylistic picture frames [16] or staging prosceniums [5] within which retailers can fashion an appealing visual enticement. This method of presentation tempts customers not only through the appearance of the

goods, but also through the fantasy of owning or experiencing them. Storefront window displays allow merchants to reach out to the public, enticing passersby to notice and engage with their establishment by visually communicating what kind of products and experiences a customer would likely find inside. Large scale, high definition displays and real-time, gesture-based interactive technologies seem naturally appropriate mechanisms for extending the power of computing into the public domain of the physical retail world. Numerous studies [8, 9, 14, 15] have evaluated and explored how technology can be used to bring digital content into the streetfront. Such approaches frequently propose the integration of large scale, collaboratively controlled screen displays [9, 15], presenting a high-tech medium which business owners could readily use to display their products in an enticing way. By exploiting the interactivity these technologies provide, however, the shopfront window location could also be used as a site for more complex retail tasks. Using responsive technologies to allow the customer to interact with the displayed shop window content facilitates the use of the shopfront as a site that enables pedestrians to independently browse and explore the shop content, identifying and examining products that have particular personal appeal [14].

Existing research into how customers use digital technologies to explore product inventories often focuses on online browsing and shopping [4, 7], revealing that customers relish the ability to feel empowered by having a range of product choices literally at their fingertips. Access to digital resources provides a wealth of data, including user reviews, product information, and sales rankings, which customers find particularly reassuring when being asked to make a choice about aspirational goods (such as wine) that may carry a connotation of complexity or exclusivity [7]. McCarthy and Wright describe an online wine-shopping experience in which an automated system presented them with a series of personalized recommendations from which to choose. They relate how the recommendation put them 'at ease', even promoting a sense of feeling 'looked after' [7, p134]. Gonzalo *et al.* describe how a recommendation system implemented within a physical wine shop also used technology to provide social support for consumer decision making [6]. We suggest that exotic teas share many of the unfamiliar and aspirational qualities of wine, and propose that a digital recommendation system might similarly help consumers navigate the product domain of tea in an informed and confident fashion.

Asking someone to interact with a recommendation system in a streetfront shop window, however, requires them to behave conspicuously in view of others, using gestures or other visible actions to interact. There is much literature in HCI research addressing this type of challenge, including notable works by Benford *et al.* [1], Reeves *et al.* [10], and Sheridan *et al.* [12], that explore participation in the context of performance-based public interactions, as well as

specific discussion suggesting the use of digital characters or artificially intelligent mannequins [11] as a means of engaging customers with conspicuously situated interactive shopping systems. This type of research focuses on making public interaction accessible, personable, and fun. We chose to implement our recommendation system using the character of a Victorian shopkeeper, in the hopes that by making the narrative of the interaction playful and relaxed, we could tempt pedestrians to engage with the installation.

REQUIREMENTS GATHERING: 'CHOOSING A BREW' WITH THE QUILLIAM BROTHERS

We approached the Quilliam Brothers with our proposal to design an interactive window for their teahouse during a significantly transitional phase in their business development. For several years the brothers had been curating a selection of over 80 tea varieties that they personally researched and sourced through firsthand visits to numerous international tea-producing regions. The teas had previously been distributed and sold through a successful online business, but when we first encountered the brothers it was a month before the long-awaited opening of their first physical premises, situated on the corner of a University campus.

While this was to be their first teahouse, their business plan had a well-established conceptual design, drawn from their successful online retail brand. Their marketing imagery and language was playful, often using clever drawings as well as wordplay and wit to entertain the customer with humorous banter and silly whimsy (exemplified by their naming our recommendation system the *Tea Decider-er*.) Designing an interactive technology that provided a playful way for customers to explore the vast and varied tea dataset provided an interesting creative challenge, and as part of the Quilliams' vision for the teashop included building a community that encouraged and promoted academia, DIY culture, art, and research, they seemed natural partners for a venture that would use locally developed bespoke technology and interactive art to engage the public with their teahouse and their product line.

A theme for the window installation was mutually agreed upon at the outset of the discussion. The Quilliams' marketing made use of the tag line *"Which Brew are you Going to Choose?"* which we used as the starting point for the window design, building a display that would allow passersby on the street a fun and friendly way to identify a tea they might find appealing out of the vast array of possibilities the brothers had on offer.

Before developing the specifics of our design, we needed to understand how the Quilliams' existing practice helped customers explore the product selection, how they interacted with customers and made recommendations, and how customers felt about having such a large number of interesting and exotic products available to try.

Personal Observation

As the teahouse opened in June, and we were scheduled to launch the window installation in early September, we were eager to observe how the business evolved and formed its identity during the first weeks of its opening. Taylor (the first author of this paper) made a conscious effort to become a 'regular' customer from the outset. She made the teahouse a regular part of her workweek, often taking friends there for breaks or casual work meetings, and getting to know the environment firsthand. This allowed her to authentically experience what it was like to be a customer in the shop, and by bringing a number of other individuals along to share the experience, she was able to closely observe how the Quilliams engaged other customers in the process of exploring the menu, choosing a tea, and enjoying the selected product. Through Taylor's personal immersion in the teahouse culture, we were able to obtain a situated, firsthand understanding of the teahouse experience.

During this time, Taylor made a point of engaging with the brothers and the staff as much as possible. As a general rule, she would try to take the suggestions the servers made, in the interests of being open to the ideas they, as professionals, suggested she try. However, through this practice of acceding to suggestion, she became aware of how her own firm preferences and beliefs about what made the best or most appropriate tea choice at any given time strongly influenced how satisfying she found the servers' recommendations. As an example, she had a mild dislike for milk in her tea, making it slightly offputting when a milky tea was suggested.

Experiencing this conflict between suggestion and ingrained preference as a genuine customer made it clear how important it was that some degree of customer preference be allowed to shape the recommendation process when making a guided tea selection. Tea is a very culturally significant item in the United Kingdom, where this research was conducted. Many people describe growing up drinking tea in their family homes since childhood. British people are passionate about tea, both in terms of what kinds they like, and how they like it prepared. In discussion with friends, colleagues, and fellow tea-drinkers at the teahouse, Taylor identified several aspects of personal preference which tea-drinkers reported feeling strongly about:

- firm opinions about caffeine, either wanting a strongly caffeinated beverage (often in the morning) or wanting to minimize or avoid it entirely so as to avoid its stimulating effects

- visceral responses to 'flavoured' teas, either favouring the sweetened flavours, or finding them repugnant

- many people either did or did not like milk in their tea, as a blanket rule and practice, regardless of what type of tea was to be served

Despite well-intentioned suggestions by Quilliams staff, a substantial subset of people often appeared very hesitant to step outside of the comfort zone formed by their usual choices with regards to these particular preferences. As this was observably important to many tea-drinkers, we built the ability to make choices regarding these preferences into our recommendation system.

Taylor deliberately made an effort to taste and try as many of the teas on the menu as she could. She enjoyed personally experiencing each flavor, making tasting notes of each menu item that would later help populate the database of descriptive adjectives that was used when constructing a computer-assisted method of helping a customer select a tea. Making sense of the teahouse through firsthand exposure and lived experiences [7] allowed our understanding of the teahouse experience to benefit from personal reflection. Following a similar approach to the longitudinal, immersed method of designing-from-within such as that practiced by Boehner *et al.* [2] and Taylor *et al.* [13], this manner of practice allowed us to craft a recommendation system informed by our own authentic experience engaging with and becoming part of the actual use context of the teahouse environment. By becoming customers, and understanding how we as customers made choices, we could use that knowledge when designing a recommendation system for customer use.

Interviewing the Quilliam Brothers
To obtain information about the recommendation process from the perspective of the Quilliam Brothers themselves, we interviewed Patrick Quilliam, particularly inquiring about which salient details he liked to identify about the customer and his/her preferences before making a recommendation. He emphasized that it was important, as a server, to establish an understanding of what the customer was accustomed to (generally he would like to know if the customer tended to drink basic, breakfast tea, or if s/he had different preferences, or even no preferences at all – many clients might enter the teahouse with a blank slate of expectation – perhaps they were routinely coffee drinkers!)

Once he established their normal preference, he then tried to determine if they wanted to be adventurous and try something different, or whether they would prefer a selection that was similar to what they already knew they liked. Even if the customer preferred something as simple as plain "builders' tea", Patrick and his staff could still use their expertise to recommend an appropriate black tea blend, querying the customer as to how s/he enjoyed the strength of the tea (lighter and crisp, or darker and more tannic?) and whether or not s/he preferred to take his/her tea with milk.

If the customer had indicated s/he was open to a more adventurous recommendation, Patrick and his team had a wide range of possibilities they could offer. In this case, they would encourage the customer to elaborate on the

kinds of flavor profiles s/he might enjoy, or regions of production s/he might like to explore (many of the more unusual teas could be described as fruity, smoky, or nutty, or could be considered appealing due to their exotic origins from all around the world.)

By first narrowing down a customer's general comfort zone and interest area, then using their specialized expertise and knowledge to highlight suitable options from the extensive menu, the Quilliams explained that their playful, dialogical recommendation process was part of what they felt made their teahouse experience feel personalized, friendly, and accessible. We wanted to build this intimate sense of friendly dialogue into the window installation, envisioning the process of designing the narrative of the window encounter as akin to outlining a simple theatrical scenario to inspire an improvisational activity that would draw pedestrians and passersby into a whimsical encounter with the main character featured in the window installation, the animatronic Victorian man.

DESIGNING THE INTERACTIVE WINDOW DISPLAY
Numerous factors came into play when identifying the requirements and goals of the shop window design. We were significantly aware that this form of research-in-the-wild carried with it the responsibility to serve the interests and the needs of the business owner first and foremost, and knew we must be sensitive to any interference our presence and activities could have upon the day-to-day practices of the commercial enterprise. With this in mind, we had to simultaneously consider the functionality we wished the window application to provide, the aesthetic values we wanted to convey, the technical challenges posed by the logistics of the physical shop environment, as well as the implications our design would have upon the commercial operations of the business. The remainder of this section explores how each of these considerations shaped the finished design of the installation, and the behaviours we crafted for the animatronic Victorian man character.

Functional Goals
During the initial phase of the design process, we worked with the brothers to identify the functionalities we hoped that a successfully designed shop window would be able to provide in order to complement their business practices.

Product Recommendation
Our primary task was to design a way for a customer to express his/her preferences so that the Victorian man could make an informed suggestion of a tea that the customer was likely to enjoy. Based on the actual practices described by the Quilliams' staff, as well as our own observations and understandings obtained through firsthand experience as regular customers of the Quilliams' shop, we devised a strategy that we hoped would result in satisfactory recommendations. Our recommendation system design took a three-pronged approach that attempted to:

- account for customer preferences

- leverage the Quilliams' expertise

- introduce playful randomness to engage and maintain customers' interest, and further the lightheartedness that the Quilliams' wanted their business to convey

In implementing the recommendation system our main task was to translate what we had learned about the Quilliams' practice of engaging customers in face-to-face dialogue in order to identify and deliver personalized suggestions into an algorithmically driven process that the computer controlling the Victorian man character could undertake. The first step in developing the recommendation algorithm was to create and populate a database that contained all of the Quilliams' available teas. Each tea in the database was then tagged with five to seven textual descriptors. Primary descriptors obtained from the Quilliams' menu included whether it was heavily caffeinated or lower in caffeine, whether it was a 'flavoured' tea or a more traditional option, and whether the Quilliams recommended that it be taken with milk. These descriptors allowed customers to identify which teas best suited their preferences in terms of the characteristics previously identified as being divisive amongst tea-drinkers. The second level of tags in the database related to more subtle and descriptive taste information. This level of information was obtained from the extended descriptions the Quilliams made available, as well as from the personal notes and observations made by Taylor through her firsthand tasting and research.

We then had to compose a series of questions that the Victorian man could ask of visitors who interacted with the window. The responses would be used to filter the teas in the database, selecting or rejecting each tea as a potential recommendation based on the tags identified by the question and its response.

We wanted the Victorian man's behaviour to adhere quite closely to the Quilliams' dialogical strategy of product recommendation, but after some experimentation with the camera-tracked gestural interface, we decided to minimize the complexity of the interaction by structuring all questions in a yes- or-no format. For example, the Quilliams had reported that they first wanted to know what kind of tea a customer drank at home, in order to determine how adventurous of a suggestion s/he was likely to accept. We chose to streamline this process, making the Victorian man's first question a direct inquiry, such as: "Are you feeling adventurous?" or "Do you want something fancy?" Based on the answer to this question, his subsequent questions would then follow, helping narrow down the range of possibilities and eventually identifying a tea selection. Using a combination of user preferences, questions based upon the Quilliams' expertise, and finally an element of randomness to keep the experience from becoming repetitive or predictable, we established a four-step questioning process, that relied upon Quilliam-esque

wordplay and wit to entertain the customer during the process of identifying and selecting a recommended tea.

Deepening Product Awareness
We discussed a second functionality with the Quilliams: the ability to highlight one recommended item for consideration by the customer. By using the Victorian man to suggest one specific menu item to the customer and emphasizing that it had been selected *just for them*, we hoped that the installation's design would encourage the customer to reflect more deeply on the details and characteristics of the individual tea they were being asked to consider. By featuring for consideration a single option likely to be suitable (out of the 80+ possibilities available on the menu) the Quilliams hoped the customer would take the time to find out about a specific product, deciding if it would be the right choice to try.

Communicating Values and Ideals
In addition to the practical tasks of product recommendation and product education, the window display also offered a communicative functionality, encouraging customers to playfully engage with the shop's concept and merchandise, and using the personable character and witty dialogue presented by the Victorian man to help reinforce the branding of the shop as a positive, intellectually stimulating space. Expressing the style of a shop and contributing to its appropriate atmosphere are two of the main functionalities any shop window, digital or traditional, should provide [14].

In representing the concept *"Which Brew are you Going to Choose?"* we wanted the shop window design to convey the whimsical, light-hearted sense of welcoming that the Quilliam extended to their customers. While exotic, unfamiliar teas could be seen as exclusive or aspirational goods, the Quilliams wanted their customers to feel relaxed, making the process of exploring the menu and experimenting with different flavours fun and accessible. In describing the *"Which Brew"* tagline, Patrick Quilliam explained that the brothers deliberately chose this friendly, colloquial form of address to help put customers at ease, avoiding any preconception that selecting one tea out of a list of possibly unfamiliar choices might be a daunting or socially awkward process:

"It's ultimately just become the best way to [...] entice people in, because we've got loads of teas, but we don't want it to be a threatening thing. Just choose whatever brew, and it's fine!"

The narrative we designed for the shop window encounter was inspired by the verbal wit and linguistic humour of the Quilliams' written menus and social media communications. We took inspiration from the Quilliams' cheerful banter when scripting dialogue for the friendly well-spoken, solicitous Victorian man character who helped customers select an appropriate choice of tea.

Figure 2. The Quilliam Brothers' temporary window display (left) provided aesthetic inspiration for our finished design (right.)

Aesthetic Considerations

Quilliam Brothers' Teahouse is located in a spacious, sunlit building that was intentionally reclaimed and renovated for the purposes of creating a cultural meeting space. The Quilliams proposed the teahouse concept as a social community gathering place, offering an alternative to the many late-night drinking establishments prevalent in the surrounding area. Much of the Quilliams' aesthetic design for their teahouse renovation reflects the history of the building, originally built as a turn-of-the-century general store, and closed for over 70 years since its last incarnation as a bookshop in the 1940s. Dark wood, authentic brass fittings, and vintage styled china teacups conjure Victorian sensibilities, intentionally juxtaposed against the steel ductwork and bare ceiling beams left exposed during the renovation process.

Becoming familiar with the Quilliam Brothers during the early days leading up to and during the opening of their business, it was clear that aesthetic considerations factored heavily into the presentation of their brand. In addition to the carefully crafted appearance of the shop, the brothers' also developed a highly stylized 'voice' (referred to by Patrick as their 'collective design brain') that they intentionally used to characterize their social media presence and inflect the wordings and descriptions found in the printed menu and the stylish hand-painted wall art they used to decorate the shop.

Designing within such an already aestheticized business practice meant that there were already well-defined visual and cultural vocabularies within which our creative choices should reside. We were able to draw inspiration from the choices that had already been made to define the teahouse's branding.

Referencing the Existing Visual Style

We were able to refer to a previous window display that had existed during several months leading up to the shop's opening, created by the Quilliams for the purpose of camouflaging the interior of the building during the extensive construction and renovation process (see Figure 2.) In early discussions with the brothers, we agreed to incorporate specific elements of the Quilliams' established style into our own design, particularly the use of two-dimensional artwork, obviously hand-worked textures, paper, dark wood, and brass. By prominently including similar materials and stylistic elements in our own design, our concept, which, while reflecting our own artistic sensibilities, would be suitably coherent with and complementary to the Quilliams' space.

They were particularly supportive of our desire to visually integrate digital technologies seamlessly into a traditional, vintage aesthetic. Our design, while facilitated by modern technology, had to complement the Victorian aesthetic of the Quilliams' premises. We were very careful that the projected and animatronic elements would not overshadow the deliberately hand-crafted aesthetic evident in the set pieces and set dressing elements. Many of the set pieces – the two-dimensional jars rotating on an electronically driven automation chain, (Figure 3), the hand-painted illuminated lightbox and signage (Figure 2) and the large white teapot upon which dynamic projections were generated and displayed (Figure 3) – were digitally designed, fabricated and laser cut out of modern materials such as acrylic and card, however the detailing and finishing of each machine-cut item was done by hand. In total, nearly 40 hours of hand-painting and finishing work was required to realize the aesthetic of the window dressing. The virtual, projected content was carefully integrated with the physical materials. Computers and projectors were either hidden or disguised, and any exposed cabling was carefully painted or otherwise textured to resemble vintage copper and brass piping elements.

Drawing Inspiration from the History of the Site

The character of the building featured prominently in our initial design discussions with Patrick, who made frequent references to the history of the space, describing how the

brothers tried to suggest the aesthetic of a Victorian apothecary in their own visual design, nodding to the historical use of the building as a bustling commercial space, and referring to German styled teahouses in which even now, apothecary-like shops mix bespoke blends to suit customers' tastes.

Inspired by this, as we shaped our concept for the shopfront display's basic narrative, we tried to further their characterization of the tea-maker-as-apothecary. We styled the back wall of the window display as an apothecary cabinet, with rows of antiqued drawers, jars, and canisters, hand-labeled to suggest tea-related ingredients (see Fig 3.)

Figure 3. Detail of the apothecary cabinet, including various two- and three-dimensional hand-painted display elements.

The cabinet contained an animatronic component, as the row of two-dimensional painted tins ran on a motorized track, powered by a Microsoft .NET Gadgeteer. At several points during the narrative, the track of jars rotated, and projected textures flowed down the chute into the waiting teapot, suggesting that items found on the apothecary shelves were being mixed together to formulate the customer's tea.

Driving the Narrative using the Character of a Victorian Man
The narrative of the tea selection encounter centered upon customers' interactions with the animatronic virtual character. The Victorian man served as our interpreted representation of what Patrick Quilliam referred to as the "design brain" inspiring the brothers during as they refined the character and concept of their teashop brand. We asked Patrick to elaborate on this character:

"This man is a collection of ideas from all three of [the Quilliam brothers], but he's become one voice that we use on our Twitter, and our Facebook. [He is] a Victorian man that has come to life in the modern day, who has taken his pickings from the history of design. [...] but he would always go back to his Victorian roots: dark wood, brass, black leather on trimmings, and stuff like that.

He's blustery, and he's trying to get his head round the world here. Things are a little bit weird. He doesn't understand [reality tv], but he's trying his best. But! He certainly understands tea! He knows how people like their tea! So… he's trying to help people know which tea to choose, through these modern ways that he doesn't quite understand."

In response to this, we visualized the Victorian man character as a five-foot-tall, heavily moustached shopkeeper or chemist (see Figure 2.) His arms were movable and controlled by the Gadgeteer, so he could wave and point to emphasize his statements. The animatronic components that facilitated his movements were antiqued with paint, and left intentionally visible at the Quilliams' request, who had expressed their enthusiasm for "all things chained, exposed, and clanking." His dialogue evoked the Victorian sensibilities evident in the Quilliams' Twitter feed and menu text. His speech, however, was not implemented audibly. Instead, he communicated via a projected speech bubble (visible in Figures 1 and 2), the inspiration for which was drawn from the Quilliams' original window design (see Figure 2.)

The man led visitors through a narrative encounter, first explaining how to use the interface to communicate, then proceeding to ask the series of questions used to determine the tea recommendation. At the end of the dialogue, the recommendation was revealed via three display methods: The man announced the selection via his speech bubble, the description of the tea was projected upon the teapot situated inside the apothecary cabinet, and a physical ticket emerged from an antiqued box which stylishly concealed a hidden thermal printer (see Figure 4.) The ticket contained the Quilliams' detailed description of the selected tea, as well as a QR code that could be used to identify the transaction.

Interactive Signage and Legibility Cues
Aesthetic considerations also factored heavily into how we crafted cues that would help lead participants through their encounter with the shop window, as well as provide feedback that would aid in the legibility of the gestural interface. In order to make the interface visually eye-catching, and congruent with a vibrant multi-coloured lighting scheme which the Quilliams used to illuminate the teashop once darkness fell outside, we chose to include brightly coloured, carnivalesque signage to help make interaction with the system more legible, and to convey the desired atmosphere of playfulness, whimsy and fun. Progression through the narrative (from a waiting state, through to choosing and brewing, and finally indicating that the tea selection was 'ready!') was indicated via a hand-painted lightbox (visible in Figure 2) whose illumination flickered and chugged in a manner evocative of vintage lighting. The lightbox not only indicated to the person using the system how far into they interaction they had come, but also provided visual appeal for any observers watching the interaction take place from the periphery.

Figure 4. Detail of the disguised printer and tickets.

Figure 5. Lights illuminate the frames of the 'yes' and 'no' signs when the user's hand is detected in front of them

Additional aesthetic detail was used to increase the legibility of the gestural interaction. It was important to make it clear what effects participants' gestures had upon the system. Participants answered questions by pointing or waving towards two hand-painted acrylic signs indicating YES and NO. When their hands were detected in proximity to the signs, a border of lights flashed on (see Figure 5) to indicate that the system recognized the gesture. Audible feedback was also employed in the form of an ambient soundscape that was dynamically generated to correspond to user actions. Events such as gestural selection were mapped to synthesized sounds. The audible content helped increase legibility, as well as provided ambient aesthetic enhancement of the participant experience through rumbling, mechanical noises corresponding to the movement of the conveyor belt. A generated teakettle whistle signified the end of the 'brewing' process and heralded the reveal of the identified tea selection. As such, this created a coherent world of sound design following the materiality and aesthetics alluded to in the design of the window display.

Technical Challenges
Many of the technical challenges we faced in designing and implementing the system related to the physical constraints of the shop window setting, which required us, for weather, security and safety reasons, to keep all permanently fixed parts of the shop window technology behind the glass. The only externally placed equipment used was a portable loudspeaker, which we placed next to the window during times when we were nearby to keep watch. Unfortunately the sound component of the installation could not be left permanently active, due to theft or weather concerns if it were to be left unsupervised.

We used EyesWeb [3] to track participant gestures. In order to avoid picking up irrelevant motion data from the traffic going by on the streetfront, we mounted a camera high on the window, and pointed it directly downwards at a marked area on the pavement indicating where the participant should stand. This way, we were able to detect the arrival of a participant in what we considered the specific 'interaction zone' in front of the shop window.

Once a participant entered this zone, we monitored motion in two areas directly in the front-left and front-right of the participant. If a participant's hand moved through these areas (as it would when s/he pointed or reached towards the specially marked interaction targets – hand-painted signs labeled YES and NO) we detected these gestures and registered 'yes' or 'no' events. Participants were encouraged to simply point rather make contact with the window to interact with the system (although if they did touch the glass, the system would still behave correctly in response.) While simple, this strategy allowed us to reliably detect participants' natural gestures, enabling them to answer the yes-or-no questions the Victorian man posed.

As the shop window opened onto the natural lighting of the streetfront, we had to ensure that our technical solution accommodated a wide range of sunlit conditions. The presence of intense sunlight ruled out the use of sophisticated infrared tracking systems such as the *Kinect*, hence our reliance on a simpler, optical tracking system using standard camera equipment. We experienced bright direct sunlight in the early morning, more moderately diffused light throughout the day, and darkness at night.

Commercial Considerations
We had to be certain that the window display we proposed fit well with the operating goals of the commercial establishment. *Quilliam Brothers Teahouse* is incredibly bustling through the day, nearly always operating at full capacity over the lunch hours. To avoid interfering with food and beverage service, the bulk of the set piece (the apothecary desk seen in detail in Figure 3 and *in situ* in Figures 1 and 2) rested upon a plinth already built into the teahouse's interior, already unusable as a service area.

We also had to consider how the mood and culture of the teahouse varied at different times of the day. The teahouse opened for business at 7am, closing again at 1am. Customers had very different ways of using the space as the day progressed. During the daytime, the shop was bustling, noisy, and lively, particularly over lunch. Into the evening, the mood relaxed considerably, volume levels dropped substantially, and mood lighting was used, subtly drifting

through a rainbow of peaceful colours. During the evenings, we designed an ambient display phase [15], which served as a peaceful, passive 'night mode' for the system. The man's speech bubble simply projected an invitation to come join the Quilliam Brothers for a cup of tea, the lighting bars flickered in a peaceful firelight fashion, and the illuminated teapot projected a rotating selection of different tea descriptions randomly chosen from the array of selections. This allowed the window to still be interesting and aesthetically appealing, but much more in keeping with the quiet, calm atmosphere the teahouse took on during the evening hours.

We did not work with the Quilliams to explore how the shop window could assist their business practice from a customer profile tracking or targeted marketing perspective. During the two weeks in which the shop window was installed and active, the Quilliams primarily used the novelty of the system as a way of attracting attention from the local community and their social network. They playfully invited their Twitter followers to come down and "have a chat with the man in the window" and were happy to collaborate with our research team on a promotional event in which the first one hundred visitors to interact with the recommendation system would be able to receive their selected tea for free. This event allowed us ample opportunity to open a dialogue with customers about their experiences with the *Tea-Decider-er*.

DISCUSSION
Through the course of the two-week deployment and the specially scheduled and promoted event, we had many opportunities to observe and interact with members of the public who encountered and engaged with the interactive window in the Quilliams' shop. We solicited feedback, both through casual conversation facilitated by the convivial nature of the teahouse environment (in some cases inviting strangers to sit down and join us for a cup of tea!) and through brief interviews with customers. In general, we tried to be as unobtrusive as possible, since we did not want our actions to infringe on patrons' enjoyment of the shop.

Quality of Recommendations
During our conversations with passersby who tried the system, and in particular with 64 visitors who tried the system during our promotional event, people generally indicated that they found our suggestions relevant. Individuals who reported strong preferences about what kind of tea they enjoyed said they liked being able to narrow down the selection to conform to their general preferences, but appreciated that within those confines our system used the Quilliams' expertise plus an element of randomness to encourage them to try something a little bit different from their usual routine. Visitors who described themselves as having less adventurous tastes appreciated that within the confines of simple black or green teas, our system was still able to allow them to identify an

appropriate selection based on the subtle nuances of intensity or flavour it proposed for their consideration.

As the system satisfactorily allowed visitors to request a recommendation within a certain subset of teas they were likely to enjoy, participants who reported dissatisfaction with the recommendation tended to base their dislike upon the presence of a personally hated ingredient. To one man's chagrin, after indicating that he wanted an exotic, strong, unique black tea he was presented with *Lapsang Souchon* – an unusual tea bearing a distinctive peaty, smoky flavor. He made a great show of telling us we had succeeded in selecting one of his least favourite flavour profiles! In discussion with this man and several others with similar complaints, we agreed that a simple extension of the recommendation system allowing participants to reject the proposed tea, receiving instead a new suggestion, would improve the experience substantially. Participants often suggested that they would be willing to interact with a longer series of questions, saying that they found the dialogue amusing, and they would be willing stay longer in order to enjoy the experience more fully, hopefully receiving a more sophisticated recommendation in response. This surprised us, as we had worried that having more questions might make participants lose interest.

Several participants (including Patrick Quilliam) suggested that the recommendation system might in fact work too precisely and too well, and that allowing for more randomness and uncertainty might be especially enjoyable for very adventurous customers. One of Patrick's requests for a system extension was a random choice function he imaginatively titled a 'brutamizer!' He envisioned an interaction mechanism too fast, wild, and difficult to intentionally control, the inevitable hilarity eventually resulting in a participant being given a completely random recommendation to consider and explore.

Performativity of the Interaction
As we mentioned at the outset, trying to get people to use an interactive system in a publically conspicuous setting like an urban city street can be a challenging task. We worried that people would be too shy to interact with an animatronic man in full view of traffic, other pedestrians, and the teahouse patrons who could see them through the windows from the inside of the shop. In practice, while there were some people who refused to participate, there were many others who were willing and able to take part. Interestingly, we were able to observe varying levels of performativity in participants' interactions, as the nature of the gestural interface allowed visitors to interact using small gestures (simple pointing or small waves) or more broad ones (wide, swinging gestures, often accompanied by exaggerated posturing.) Some participants chose to read the dialogue attributed to the Victorian man out loud, assigning him a character voice and answering him verbally as well as through the gestural interface. Many participants commented upon and reacted to the things he said, often for

the purpose of making friends and observers laugh. Simultaneously facilitating both subtle and dramatic means of public interaction enables participants to engage with the experience, while remaining within the boundaries of their own comfort levels – a strategy described and recommended by Sheridan *et al.* [12] when exploring how to encourage playful participation in public settings.

CONCLUSION

Overall, we received a very positive response to the *Tea Decider-er*, both from the public (via their direct comments as well as mentions on the Quilliams' Twitter feed) and from the Quilliam Brothers themselves. In particular, the Quilliams appreciated how our bespoke design managed to integrate sophisticated digital technology into an aesthetic that complemented the design and atmosphere of their shop, and provided them with a unique way to attract attention and engage with customers. The Quilliams were able to successfully use the installation as a marketing tool, promoting it heavily on their social media feed through a series of teasers leading up to and then announcing the arrival of the Victorian man who promised to help patrons 'choose a brew.' Patrick Quilliam told us that the window's popularity built over time, with people spreading the word about it via social media during the weeks it was installed.

The use of interactive technology on the outside of the shop successfully supported customers in the complex process of navigating the Quilliams' large menu, the dialogical nature of the interactive system and character-driven narrative allowing patrons a unique method of engaging with the establishment in a playful, lighthearted way.

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