Animated skeuomorphic services for the web

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Abstract

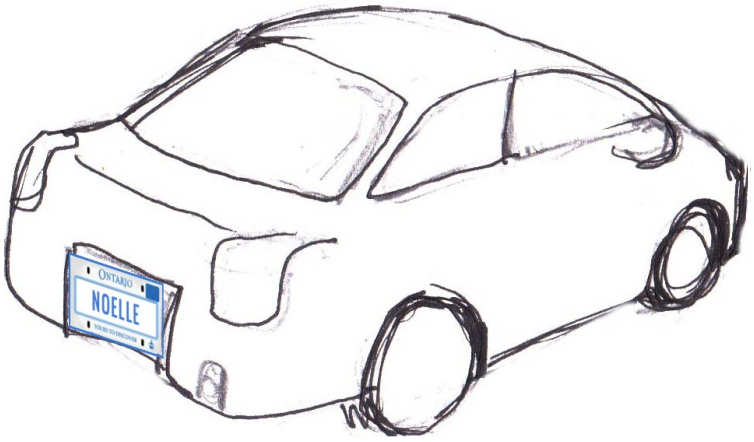
In Ontario, many individuals who speak and read languages other than English or French use government services. This major research project explores how to make services more accessible for populations who speak and read English as a second language. Following an analysis of services currently available, participatory design methods with Chinese speakers who do not read or speak English showed how written language can be augmented or replaced with animations, sound, and representations of physical objects (such as automobiles, forms, drivers licenses, and license plates) to deliver services to audiences from diverse linguistic backgrounds. Initial prototyping suggests that 'realistic' or 'visual' representations can effectively augment or replace written language when the aim is to convey something that is concrete, such as an automobile or license plate. When the aim is to convey something that is slightly less concrete, such a car or home, outline drawings can be effective. However, certain aspects of government services, such as legal disclaimers or privacy information, are more difficult to convey without written language, suggesting that writing can be minimized, but not eliminated completely.

Acknowledgments

Thanks to my principal advisor Peter Coppin for advice and support, long hours of discussion with good food, and for always being frank. Thank you professor Sambhavi Chandrashekar for your advice and support this past year. Thank you to my manager and co-workers for their encouragement, help and understanding. Thank very much to Hong Zou for being my Mandarin interpreter and helper; thanks to Karman Chan for doing the same in Cantonese. Thank you Zheng Yang and Ambrose Lee for translation help. Thanks to all my classmates who helped me to think through and test my idea and for all your help and support along the way. Thanks to Larry Kwok for always being my go-to study buddy, listener, and steam valve, to Sarah Crosskey for making me feel like the one with the plan, to Jan Derbyshire for being able to talk about the hard stuff, and to Spirit Synott for your warmth that always makes me smile. Thank you also to Jutta Treviranus who encouraged me to plunge into the world of Inclusive Design. Lastly, thanks to my family: Jesse, Lauren, Joy and my Mom and Dad for always believing in me and making me feel loved for who I am. You are my foundation.

Dedication

To my family



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Introduction

My primary research question is: How can realistic visuals and/or animations paired with narration be added to online services to make them easier to use for people who don't speak English as a first language?

This project aims to make online services more accessible for populations who speak and read English as a second language (ESL) by replacing words with images, narration and animations in online forms. I hope to gain insight into how best to provide access to services such as these for people who have trouble reading English.

Inspiration

As a user-experience professional and designer, I have always looked for ways to use visuals that will improve the accessibility of my designs. I have a particular appreciation for the use of icons because they successfully represent many concepts and can be understood without the use of language. I was inspired by Nigel Holmes's *Wordless Diagrams,* which demonstrates just how much can be communicated with diagrams. This led me to think that if such complex ideas could be conveyed through sequential images, then many other things could be adapted to work the same way, including government transactions.

I had a hunch that realistic items would allow people to make the connection visually between the actual document like a licence plate and the picture of something that looks realistic. I wondered why I had never typed my credit card number into something that looked like a credit card or my licence plate number into something that looked like a licence plate.

A visual representation of my inspiration timeline can be found on the following page
(Fig. 1).

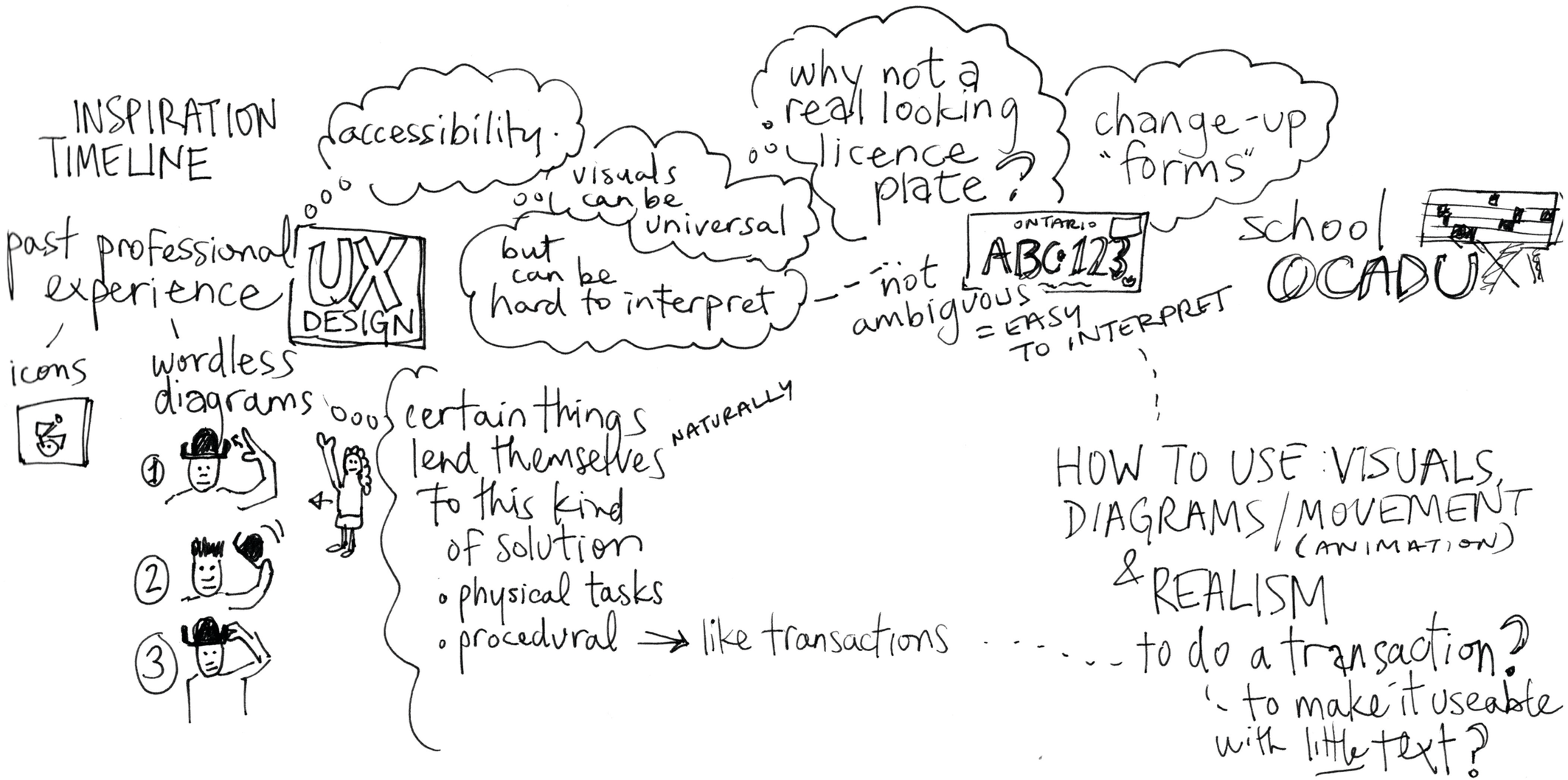

Figure 1 My inspiration timeline

To limit the project to a specific case study, I decided to focus on an existing Ontario government service that is delivered both in person and online in an effort to better understand how people who don't speak English currently receive their services in person. My goal was to note the words and actions used by clients and employees to convey meaning when delivering those services. These findings informed a simplified version of the online incarnation of the same service. With a basic idea of what communication is necessary for these patrons, I employed a novel research method that helped both to test and create a paper prototype of the service during a co-design exercise with the target audience. I then tested, with that same audience, interactive web forms that emulate real-life objects.

Specifically, I examined the licence plate sticker renewal and address change transactions in detail from an online, mail and kiosk perspective and compared these to the in-person service. I chose these transactions because the service locations are conveniently located, serve a diverse population and are both very popular government services that deal with physical products that can be represented visually. These are also transactions I have used personally, and as a user experience professional, I have thought deeply about the ways that they can be made more accessible. The renew plate sticker transaction was redesigned in 2013, and now has much improved readability scores (Grade 7 or 8). However, some phrases such as "identify your plate" are still more difficult or bureaucratic than they might be. Further, I observed that even without a language barrier, the online transactions are not easy to use; in fact, several of

my co-workers have recently failed to complete their online address changes using the current interface.

As a user experience professional that works for the provincial government, I know all too well that the Government of Ontario's online transactions can be overly complicated and that some include what may be unnecessary steps. My analysis of all the ways the service can be delivered helped me to decide what to include and exclude from the transaction, and to find the essential parts of the form / transaction in order to make them visual.

In Ontario, there are two official languages, English and French. Services offered by the Ontario government are offered in these two official languages and obtaining service in another language can be difficult, if not impossible. It is even more difficult to get services in other languages online than it is in-person where at some counters there may be a speaker of your language by chance.

According to the 2011 Census, 45% of Toronto residents had a first language other than English or French, and Statistics Canada (Statistics Canada, 2012) has identified about 160 mother tongues in the Toronto Census Metropolitan Area (Toronto, 2012). With 1.8 million Torontonians speaking a language other than English or French at home, it is likely that many individuals are having trouble accessing services online. The online process to change an address is long and wordy and requires a tenth-grade reading level, or often

more, to understand. It would be advantageous if systems did not require the use of language at all or at least required it only minimally.

To illustrate, examples of reading level scores from two pages of the current online address change service are shown in tables 1 & 2 below:

Gunning Fog Index	11.58
Coleman-Liau Index	15.49
Automated Readability Index	16.72
SMOG grade	8.08
Flesch–Kincaid grade	17.49
Flesch Reading Ease	15.07

Table 1. Readability test scores for the start page of the online address change service. Scores represent the number of years of schooling required to understand the text in question.

Gunning Fog Index	13.90
Coleman-Liau Index	13.70
Automated Readability Index	15.84
SMOG grade	11.41
Flesch–Kincaid grade	16.49
Flesch Reading Ease	25.11

Table 2. Readability test scores for the second page of the online address change service. Scores represent the number of years of schooling required to understand the text in question.

This project aims to develop a prototype of a novel interface for an existing online service. The redesigned interface is expected to rely less on written language than existing services by leveraging pictures, spoken narration, and animations to convey meaning. I expect this approach will be more useful to individuals from a wide range of cultural and linguistic backgrounds.

The exploratory design prototype proposed in this paper (Fig. 2) exemplifies the following ideas: That realistic or skeuomorphic[1] backgrounds on online forms increase usability and comprehension for people who don't understand English when the corresponding items are uniform, as government documents are. That pairing realistic and abstract line drawn visuals with English narration and simple English text and numbers will allow people with many different language backgrounds to comprehend and use the same service. That it is important to choose words and images carefully so that only the most relevant pieces are presented, because maximizing simplicity serves to increase overall comprehension and more words or images increases the chance of misinterpretation. Some parts of the transaction were not suited to being presented visually so text that is difficult or impossible to replace visually is discussed in the results section.

Research was limited to five Chinese speakers, and responses were interpreted from Chinese to English for me. To ensure that design direction was clear, classmates who speak both languages interpreted feedback. Despite the limitations outlined, the participatory design method was very successful in eliciting copious feedback and the examples of visual designs presented here

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[1] In this document, I use the term "realistic designs" to refer to "skeuomorphism." Skeuomorphic interfaces are composed of elements that resemble features of the physical world.

were well received by game participants who thought it was something “everyone could use”.

Figure 2 An image showing the final design. Some form fields have been filled in, some not. Skeuomorphic forms are used for the licence plate, odometer, insurance, drive clean, driver's licence and envelope. Green arrows appear when a step of the application has been completed. Long orange arrows and text appear when audio narration of those words is spoken. Clicking on the ? will repeat the last phrase spoken.

In order to describe the process that led me to the design pictured (Fig. 2), this report contains the following sections. Section 1, Analysis and Related Work, describes the current situation of both the application in question and of the research informing my approach. Section 2, Method, gives an overview of the game session processes. Section 3, Results, discusses the results of the participatory design game sessions, Section 4 Prototype Design, describes the design of the low / high-fidelity prototypes and improvements made as a result of research and testing with the same audience as the game sessions. Section 5, Scope and Limitations provides information on the specific limitations of this study. Section 6, Recommendations, describes useful design tips for low-text interfaces gleaned over the course of the study. Finally the last sections conclude this work and summarize questions that still remain unanswered.

Analysis and Related Work

This section outlines the analysis that informed the design of my prototype, and the strategies I used to gather feedback during research.

First I present opinions on skeuomorphic designs and examine the ways that interaction designers and form designers have employed realism to increase the perceived usability and intuitiveness of their interfaces. I then summarize the methods used by others to teach low-literacy and culturally-diverse audiences that I applied to the design of my prototype(s). Issues considered include when to use different visual representations and when and how to use animation and audio (narration). Finally, I outline best practices for research with an audience that does not speak my language and consider the limitations imposed by cross-language research methods.

Realistic Interfaces

By looking beyond web forms to the world of software application design, I found a wealth of realistic designs from which to draw inspiration.

A well-known example of skeuomorphic design is the notepad application for the iPhone. The notepad's interface mimics the physical appearance and behavior of a paper notepad, as does the icon that represents it. (Fig. 3)

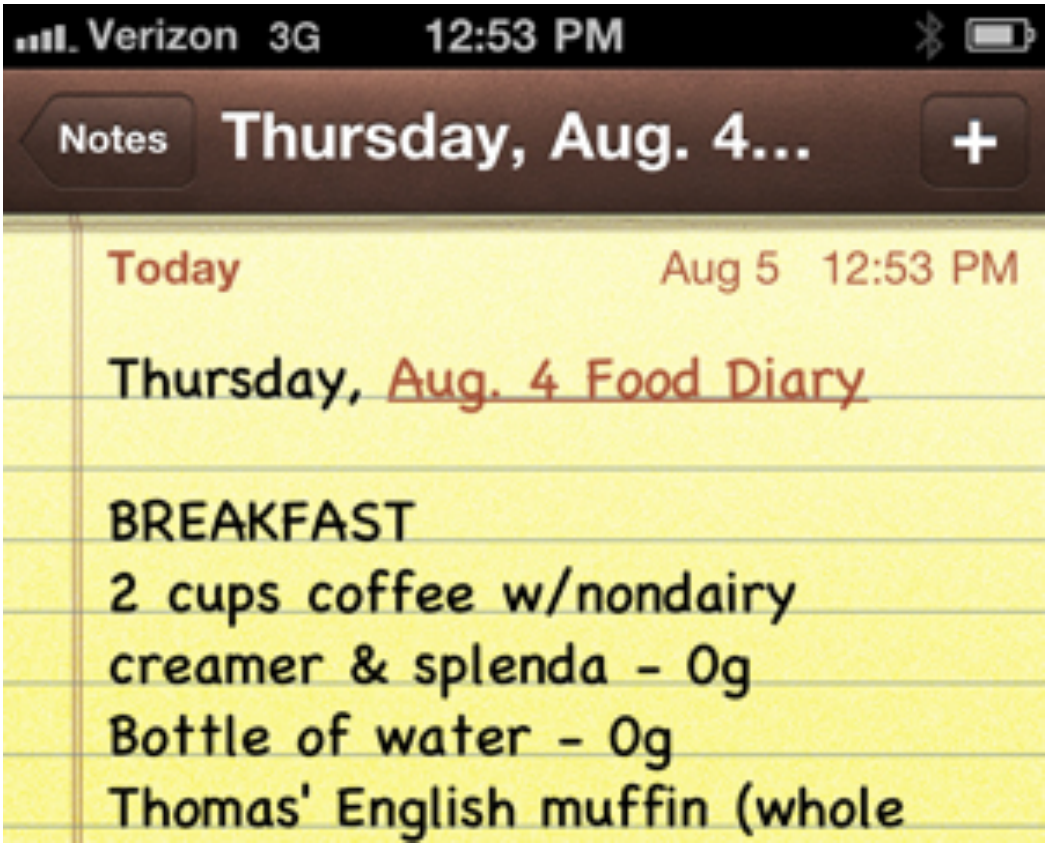


Figure 3 iPhone's notepad app circa 2010

http://uk.queryclick.com/seo-news/skeuomorphism-and-flat-design/

Figure 4 Virtual DJ Pro. Screen shot of the Pioneer cdj interface – http://chris-dodge-ma-page.blogspot.ca/

Figure 4 shows a skeuomorphic design for a DJ mixer application that emulates the visual appearance and interactive behavior of a physical Pioneer DJ mixer. A user who is already familiar with the behaviors of a physical DJ mixer can draw upon their knowledge (their "mental model") to interact with the DJ mixer application.

Inspiration from the field of form design

In my professional experience, I have encountered several strategies for presenting forms to users. Some innovative examples that have inspired me include: contact forms that resemble paper envelopes or letters, and forms that use an entire paragraph of text, with blanks in some spots. To fill out the form you 'fill-in-the-blanks' to complete a 'note' that is sent to a site owner. The fill-in-the-blanks convention was first introduced on Jeremy Keith's Huffduffer.com. It

was then used by Luke Wroblewski on a car dealer contact form where it increased the number of transactions by 25-40% (Christiansen & Wroblewski, 2010). The success of these approaches suggest that skeuomorphism can increase form usability and improve form completion rates.

Problems with Realistic Interfaces.

Although the field of user interface design has successfully adopted skeuomorphic design strategies to emulate physical (non-software) products such as tape recorders or calculators, it is also known to hinder usability when used in an arbitrary way or solely for design aesthetic (Weyenberg, 2011). In particular, Apple Inc., under the leadership of the late Steve Jobs, was so enamoured with skeuomorphic designs that nearly every native iPhone application was skeuomorphic. However, common sense would dictate that one style of design cannot fulfill all needs. The notepad metaphor, for example, only helps the beginner to recognize the application on a list; it offers no other advantages for usability. Unless the design offers a way to help the person use the iPhone, it becomes an entirely aesthetic choice. Some, including Johnathan Ive, head of industrial design at Apple, is of the opinion that skeuomorphism looks outdated and that interface design has reached a point where skeuomorphic “tricks” are unnecessary (Wingfield & Bilton, 2012). Ive has now embraced a flat 2D design aesthetic that represents a clear change in design direction.

One concern that I tested was an assertion from Luke Wroblowski, that forms still need to act like forms to be usable (Christiansen & Wroblewski, 2010).

Successful Visual Communication: Methods to use with Low-Literacy and Cross-Cultural Audiences

In order to make use of visuals in the most optimal way, and understand when to use audio or graphic text, I drew from the following research.

Use narration and animation / visuals together

My decision to use audio narration and short animations simultaneously is informed by the multimodal principle in Clark and Mayer's (2011) seven theories of multimedia learning. Clark and Mayer claim that learning comprehension is increased when information is presented using two “channels” of input simultaneously: auditory and visual (p78-79). Additionally, Clark and Mayer’s (p.91-110) “temporal contiguity principle” suggests that people learn more effectively when aural and visual materials are shown simultaneously, rather than sequentially.

Clark and Mayer’s (2011, p.133) “redundancy principal” warns against presenting spoken narration with printed text simultaneously. However, they also note an exception to this principle: When brief chunks of text are placed next to objects in order to highlight actions. Clark and Mayer found that such text placement is particularly useful when words are presented in a language that is unfamiliar to the learner (2011, p.142).

An analysis of the services, an interview with staff who deliver it in-person, and a participatory design game were used to discover some key English words that are often used by ESL clients in the context of using government services. In the final design prototype these words are combined with animation and narration (Clark & Mayer, 2011).

Visual styles: Increased Photorealism with Deeper Interaction

When searching for the best way to represent the concepts in my visual application, I found the following very helpful. Figure 4, a graphic by Liesbeth Zikkenhelmar, from the book *Visual Interaction: An Introduction to Information Design* studies correspondences between visual elements and their referents. (p.35 Mijksenaar 1997). Here we can see that drawings or cartoons are suited to refer to more abstract concepts, and that photographs (and by extension skeuomorphism), are well suited to refer to concrete objects.

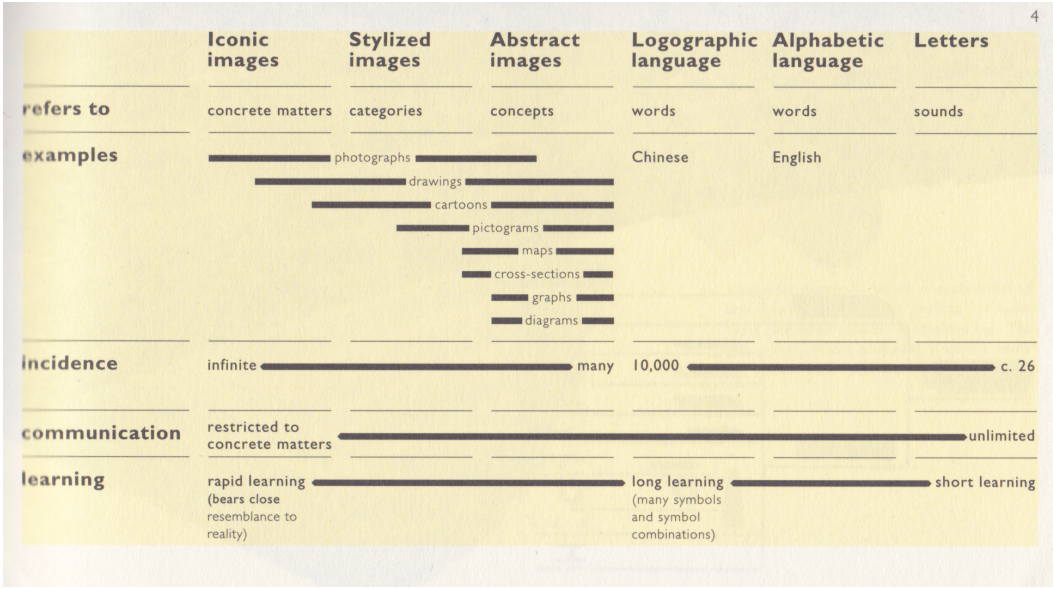


Figure 5 Liesbeth Zikkenhelmar, from Visual Function (Mijksenaar 1997)

In addition, Medhi, et al. (2007) suggest that line drawings are one of the most effective ways to present information that is more conceptual. For example when the visual represents *any* car, home, or person. Medhi et al. also suggest that the use of realistic items can be useful when providing more specifics, for example representing a service location by showing a photograph of the building in which it is located. A combination of concrete and abstract graphics was found to be much more successful than the use of more complex abstract graphics (Medhi, Prasad, & Toyama, 2007) (Medhi, Sagar, & Toyama, 2008) (Gray, Brown, & Macanufo, 2010). In my designs, I chose to use realistic photographs to depict government-issued documents such as an Ontario licence plate or insurance document, and also tested a generic looking odometer.

Written numbers are recognized

During tests done with illiterate and semi-literate audiences Medhi et. al. (2008) also found that numbers were recognized. While the goal was to eliminate as much text as possible, numbers were used in the design of the prototype.

Working with English as a Second Language (ESL) Participants

My approach to designing and testing interfaces that could serve the needs of ESL clients was informed by *Teaching Patients with Low Literacy Skills* (Doak, Doak, & Root, 1985). For example, when language compression is difficult for an

audience, Doak, et al. (1985) recommend utilizing family members who speak English to help craft messages. Doak, et al. also advises designers to consider how cultural practices can vary among diverse groups. For example, some cultures prefer to receive small chunks of information at a time. Other cultures seem to prefer that information be conveyed through stories. Additionally, Doak, et al. found that other cultures rely on family networks (Doak, Doak, & Root, 1985).

As a general strategy, Doak, et al. advises designers to work with bilingual members of an audience to gain insights that reveal how to present information to them. For example, a designer can ask a native language speaker to write instructions in their own language for use with other individuals familiar with that language. It can be advantageous to involve family and significant decision-makers with certain cultural groups.

In “Methodological Challenges in Cross-Cultural Qualitative Research,” Squires suggests that when doing qualitative research with others who don’t speak your language, you are more likely to ensure the validity of your data if you have interpreters who are skilled enough to explain abstract concepts and ideas in both the language of the participants and the researchers (Squires, 2009).

In order to properly involve the audience in the creation of the design and to understand the needs of my proposed participants, I enlisted the help of three students in the INCD program that speak Chinese.

I drew inspiration from alternative means of communicating with people whose first language is not English; of special interest to me for this project were the strategies employed during in-person official transactions that can be translated to the online space such as the use of actual objects, the drawing of pictures, or the use of simluation (e.g. driving) which might inspire animations or visuals.

In order to use realism appropriately and effectively, and for maximum comprehension, this project involved the users in the co-design of the system. Building with the input of users and verifying results with them, helped me to refine an interface that minimizes the use of graphical text.

Analysis - Current Services

Before the participatory design sessions of the prototype with native Chinese participants, I analyzed the currently-available services online and offline for address change and the mail-in process. I was able to get a holistic view of what is required in each case and to find potential areas for simplification of the process.

Results of the service analysis

Key parts of the existing transaction process were identified (Fig. 6):

- Privacy and collection of information statement
- Car
- Sticker
- Licence plate

- Odometer
- Insurance
- Drive clean (optional: dependent on vehicle type and year)
- Address (for delivery of sticker – may not need to enter if current information is correct)

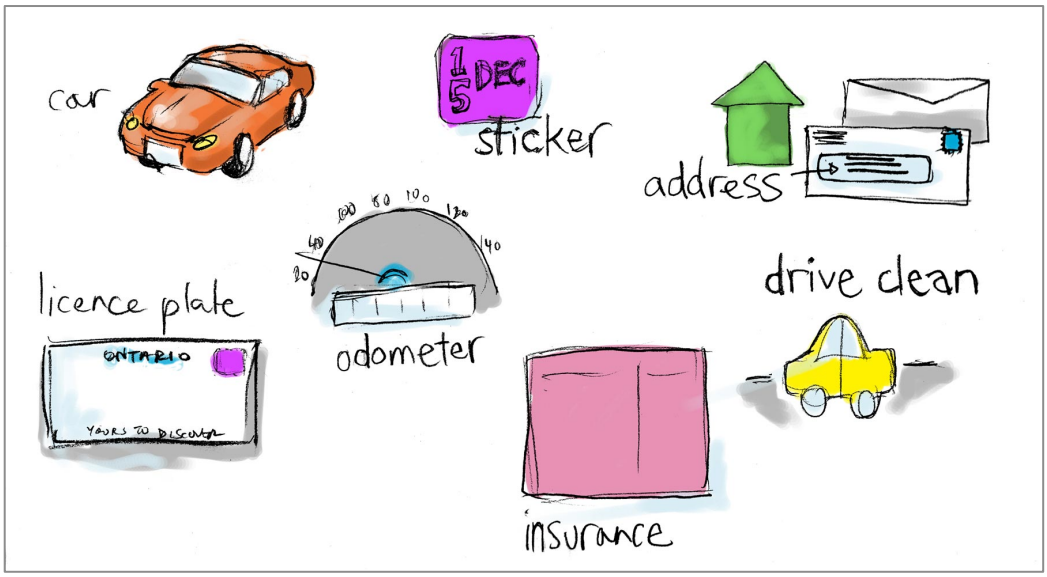


Figure 6 Essential (visual) elements of the renew plate sticker service

Upon review of the current transaction processes available, I realized that the online address change service is vastly different and more complex than both the in-person and mail-in processes; I also saw an opportunity to fold address change into the design of the renew sticker process. Luckily, many of the key pieces of the renew licence plate sticker are either standard documents or well suited to the idea of a text-free or low-text interface. Unfortunately, as I discovered, some text is hard to replace with visuals.

Difficult text: Mandatory privacy and collection of information

All government transactions contain mandatory privacy and collection of information disclaimers. While many people choose not to read legal disclaimers on the paper forms, the government is required to present them to everyone. In the online service, users are presented with what looks like a “wall of text” that is written in legal language. A page of legalese could prove to be an insurmountable barrier; when faced with an English-language legal document they do not understand, most non-English language readers are likely to back out of the transaction.

Since most, if not all of the legal disclaimers used by the Ontario government are standard for online information collection and privacy, it may be possible that another ministry has a Chinese translation that could be available for reference. Future work could include locating standard collections of information contracts that have been translated by others within government.

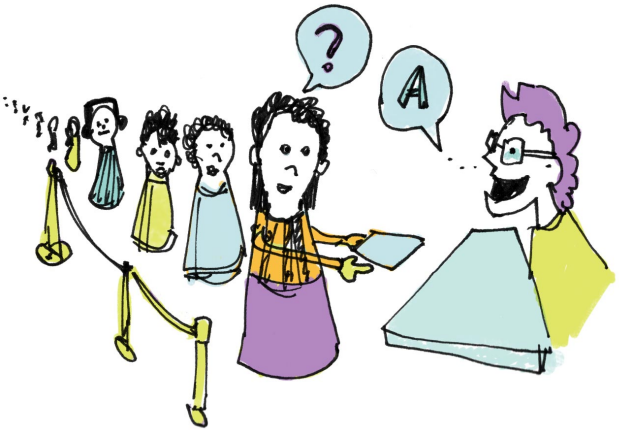
Preparing visuals for the game and gathering input on imagery

In order to gather input on what images might be best suited to the main concepts presented in the renew licence plate sticker transaction game session, I enlisted the help of my classmates. Together, we played a game similar to the one I intended to play with my game participants. The game involved one person trying to get the other to guess a concept or phrase by drawing on paper. They may combine that with pre-made drawings, sound effects and “animation,” which is emulated by moving the drawings by hand. The exercise was done in groups

of two (one person in-class, the other online). The in-class person did the drawing and animating; the person online was the guesser. If a drawing seemed to do very well at conveying a message, I would give it to another drawing classmates to see if was as effective with another guesser. The terms I tested were: “licence plate number,” “address change,” “moving house,” “new address,” “old address.” I took the drawings I gathered from the in-class game and made copies of most of them and then printed them out for use in the upcoming game session. (Fig. 7)

Figure 7 Sketches done by classmates in preparation for the game sessions - these combine pre-made drawings with realistic (printed) elements and their own drawings

Analysis - interview



The in-person service is unique in that it serves (largely in English) a multi-lingual population. People with low-literacy skills in English are able to go in person and complete these services successfully almost all of the time. How were in-person services so effective and how could their practices be translated to online services?

In order to determine the needs of the diverse clientele in Toronto and to understand how the in-person service is able to deliver the renew sticker service to ESL clients, I interviewed one staff member that worked as a service counter employee for two years, serving an estimated 20,000 customers. The employee worked at the 777 Bay location, which is unique due to its status as the largest centre in Toronto and because it offers every available service, it is located downtown and is busy.

The interview was one and a half hours long and took place in person at the residence of the employee.

Despite being the only interview I conducted, many of the ideas I collected helped to inform what was presented in the game sessions. I was also able to gather insights into how best to serve ESL clients in-person and incorporated these ideas into the design of the interface.

Interview Insights

Most receive personal help with forms

The interview revealed that most non-English speakers come to the service centre with someone who speaks their language. In a busy office like the 777 Bay location, where there are as many as 150-200 people waiting for a service, those who need help with translation often find someone in the office who can speak their language (as long as their language is relatively common).

Experience counts

A lot of the work to determine what service a person needs is done quickly and intuitively by the counter staff at ServiceOntario. By looking at the documents that someone is holding, the service counter person will often know what transaction the person will be doing. Some employees reportedly have experience and intuition built up over 25 years. While their experience is unlikely to be completely replaced by an online service, we can surely take some of that knowledge and apply it to improve the services we offer online.

One effective strategy

One of the employees found it effective to iterate the design of a simple address-gathering card (Fig. 8) because it sped up the process of acquiring the address change service. The text is printed inexpensively on the back of official forms that are used for signatures. The language used was modified over time to best serve those who have trouble with English. In the games sessions, I showed this card to each of the participants to see what they could read. Any words they couldn't read were spoken, again to see if they understood.

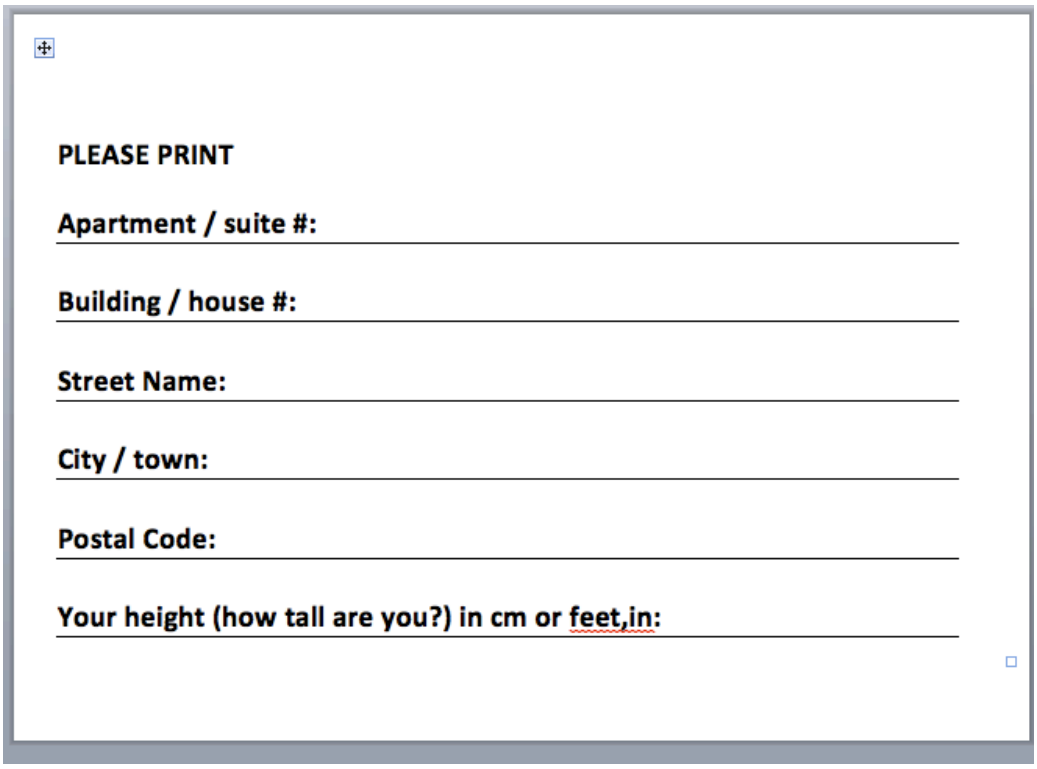


Figure 8 Address information card. Designed and iterated by ServiceOntario staff

Another adaptation

The employee also indicated that pointing at physical documents like his own driver's licence is a strategy that has proven effective.

Some terms benefit from being "broken out"

In the address card example, the address has been separated out into house number and street name. It might not occur to an English-speaking person that "address" is a complex word. Breaking it into two simpler concepts (Fig. 8) proved useful in this context. It seems there is value in closely examining the words we use online in order to ensure they are as simple as possible. Understanding which terms are successfully understood during in-person services provided a useful way to find key words in this study.

Figure 9 House number and street name are separate concepts

Method: Game Sessions

Target Audience

After doing the analysis of current services and conducting the interview, I conducted game sessions with five separate individuals. Selected individuals speak Mandarin or Cantonese Chinese and have low English-language proficiency (both written and spoken). I focused this study on adult Mandarin and Cantonese Chinese speakers in the Greater Toronto Area. To recruit participants for the study, I enlisted the help of classmates who speak either Mandarin or Cantonese. Two of my classmates served as hosts and interpreters for the game sessions.

The Chinese community was chosen because it is one of the largest language groups in the Greater Toronto Area; according to information published by The Toronto Star newspaper, over 7% of Toronto residents speak Chinese at home (Fig. 10) (Farley & Listar, 2007). The community is well represented downtown making it easy to access participants. Chinese was also chosen because the language is very dissimilar to English grammatically, and does not use the Roman alphabet.

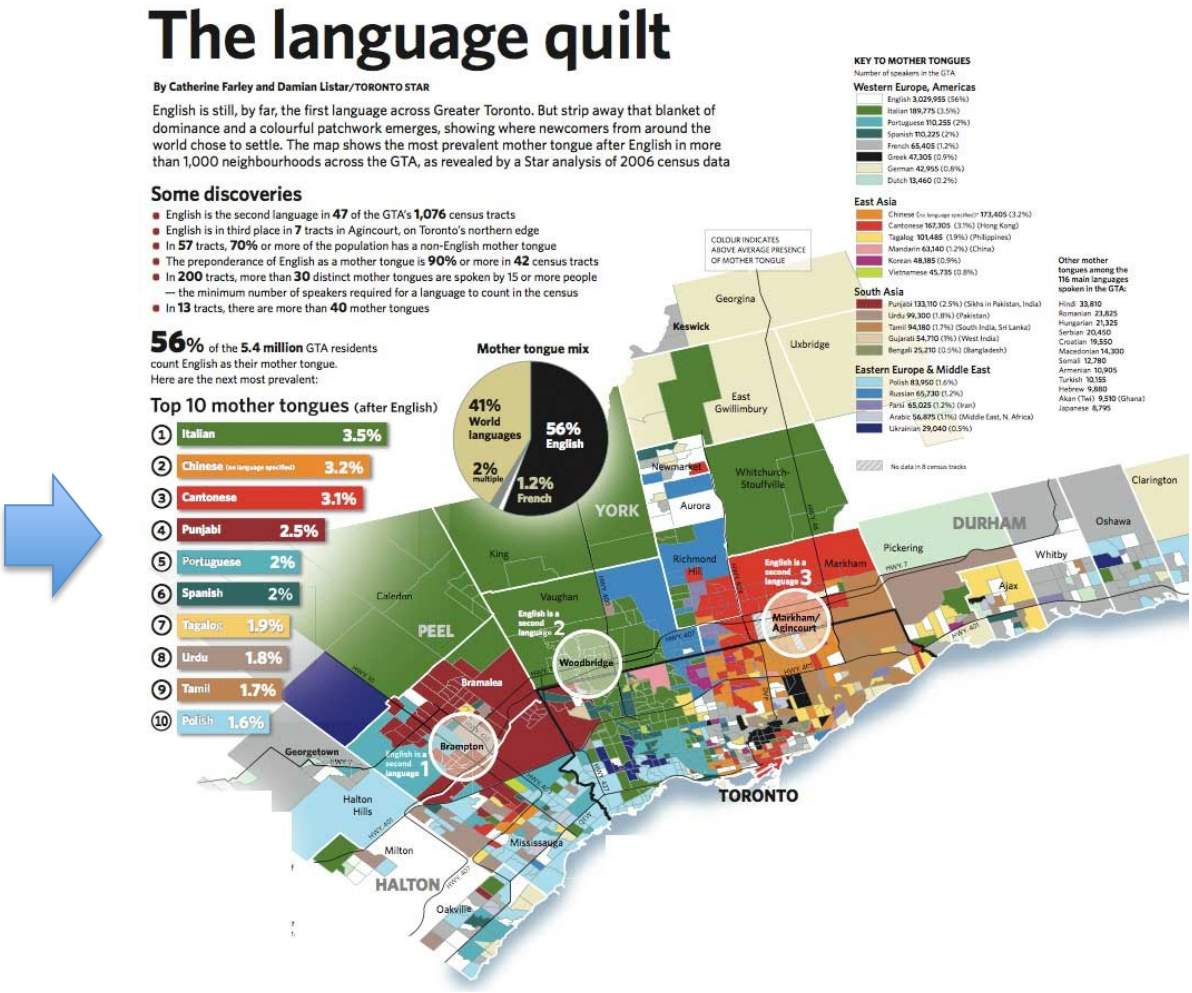


Figure 10 Map of Toronto's dominant languages (excluding English) by neighborhood (Farley & Listar, 2007).

A screening questionnaire was used to ensure participants qualified for the study. All of the participants were over fifty years of age. All participants were women; men were not excluded from the recruitment process but were either unable to attend, or did not qualify for the study because they were able to read English. Participants who have very little understanding of spoken or written English were selected in order to get a better idea of what might work for an application without

language, or with minimal language. All of the women could read and write in their own language (Cantonese or Mandarin).

All participants had varying levels of English knowledge (Table 3, p. 34-35). Some could not read very simple English presented, but understood those words when spoken. All indicated they had trouble reading English in the screening questionnaire.

Technology

All participants own a phone or computer that connects to the Internet and use the Internet to perform tasks such as emailing, Skyping and shopping or banking in their own language. Despite some use of computers, several participants found using the mouse or track pad challenging and had trouble clicking on objects and acquiring the correct targets. This may have been due to their unfamiliarity with the particular computer and mouse used for the study.[2] Three of the five participants reported that they rely on family members to complete government transactions, while the other two go in-person to the closest local office.

Cultural Differences

Recruited participants displayed a desire to have someone they knew present at the session, and a preference to be in a familiar location such as the house of a friend or relative. At the outset of my research, I wanted to conduct tests with

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[2] While low-income levels may contribute to restricted access to technology, an audience who is not technically literate is not considered here.

participants at school, but found that insisting on these criteria made it impossible to find anyone who was willing to participate. The tests were therefore all conducted at the homes of my classmates who were also the recruiters and interpreters.

Gamestorming

Gamestorming, a portmanteau of "game" and "brainstorm," describes the use of improvisation to come up with novel games to explore ideas and brainstorm in a playful way. Grey, Brown & Macanufo (2010) authors of the book *Gamestorming* define it as "... games that encourage engagement and creativity while bringing structure and clarity". Gamestorming does not generally have a fixed set of rules; as a method, it is always undefined. The book in question offers a multitude of games to use as a starting point; I chose to make up my own game.

Testing with paper drawings

The style of game I chose for the session is similar to the practice of usability testing with paper prototypes of web sites often used by user experience professionals. I made minor changes through the addition of motion, sounds and spoken words, to simulate animation. The game sessions lasted approximately one hour and used a paper prototype. The low-fidelity prototype consisted of sketches of key aspects of the renew sticker service, such as envelopes, houses, moving trucks, cars, and arrows for pointing.

The sketches I created with the help of my classmates in advance of the session provided the basic starting point from which I simulated animations.

In order to gather inputs and feedback on concepts for the prototype, I moved the paper drawings and made sounds to simulate animation, and spoke instructions in English. These were trying to communicate parts of the renew sticker process to participants. Interpreters told participants what transaction they were about to complete and then participants would watch me “act out” an animation for the service and speak any necessary English words. Generally I started with visuals only and increased the amount of information I gave when the participant was having difficulty understanding how the visuals related to the service. I added to the prototype during the “game” by drawing ad lib in a style similar to the game of *Pictionary* where participants try to draw pictures to have teammates guess the meaning of them. If this failed to convey the message, the intended action was revealed to the participant. Then they drew something they thought might elicit the correct response, using a method similar to the one I employed. Participants also offered suggestions in their language about what could be added and I would then make changes in response to their suggestions.
An interpreter who spoke Chinese was present in order to confirm whether the participant had guessed correctly, to take note of their guesses and to tell them the correct answer relating to the exercise.

Along with the game, participants were presented with a high-fidelity prototype of an interface to interact with on a computer. The test was to see if they would

enter the correct information in the form. This test was observed and videotaped. If the participants did not enter the correct information, they were then asked what they thought the interface was asking for, they were told the answer and then asked how they might improve the interface.

Iterative design

Over the course of the game sessions, the fidelity of the design was improved. Simple changes were made between the two concurrent sessions (3&4), and more major ones between the other sessions in order to iterate the design and test new ideas. I gave a lot of weight to the feedback given during the game sessions. To make this exercise participatory, I took participants' suggestions and incorporated them into the design updates. The resulting design was then used in the next game session.

As a result of the rapid iteration, there was much less interaction with the paper prototypes in the final session. More of the test focused on the low-fidelity and high fidelity versions. Also, from Session Three onwards, I showed the high-fidelity designs when they would naturally have appeared in the flow of the application. The graphic below (Fig. 11) shows the items tested at each game session and highlights items that were iterated during the design process.

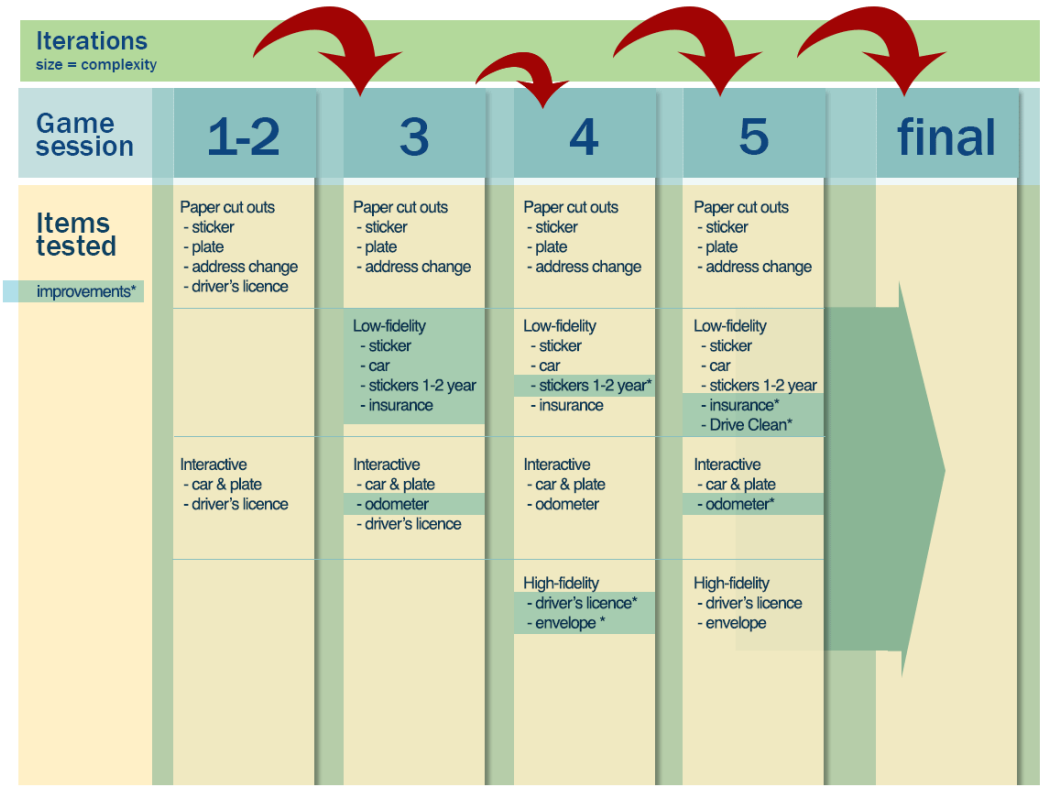

Figure 11 Chart showing the stages of testing and iteration

Testing the address card for comprehension

In order to test if the participants could use the address card discovered above, I first asked if they could read any of it. If not, I spoke the words and pointed at the place where they would enter the information on the paper. As I did this, I covered the English (printed) words. When simple (one or two word) instructions were spoken in English, most of the participants understood what I was saying.

Results: game sessions

The results section will address the test of the address card that was used to get an idea of what basic terms were understood by the game participants. A section outlining conclusions from the games sessions that may be useful for others hoping to build visual and / or low-text interactions follows this. Lastly, the final design prototype is presented with details on how each screen is intended to function.

Results of address card test

Table 3 shows how each participant did in reading tests done with the adapted address card. Results of the reading test show that though participants report not being able to read English, many simple words were still recognized in text. With the addition of English narration, most terms are understood.

Word					
Name	Spoken	Spoken	Read	Read	Read
House #	spoken	spoken	Y	Y	Y
Building #	n	n	Read	Read	Read confusing
Street name	Spoken	Spoken	Read	Read	Read
City	N	N	Read	Read	Read
Apartment #	N	N	Spoken	N	Read*

					confusing
Suite #	N	N	N	N	Read
Postal code	N	N	Spoken	Read	Read
Height – how tall are you?	Motion	Motion	Drawing	Drawing	Read

Table 3. Results of the reading test done with the adapted address card

Design considerations for low-text interfaces

Simple drawings and realistic elements, together with animation and narration, can be combined to create low-text interfaces. Simple line drawings successfully conveyed meaning when dealing with an object like a car or house / home. Two of the participants, who did a session together, noted that the drawing could be very simple: when I drew a person motioning with their hand at their head they understood the concept: "how tall are you?" they suggested the very simple outline drawing could be even simpler just a "stick figure," but that "the whole body should be shown." Animation worked well to convey the actions “moving” (house) and sending an envelope. Spoken words were useful in conveying meaning to those who did not read English. Most were able to understand simple spoken words. Further study should be done to determine where and how (for what duration) graphic text should accompany the audio narration.

Cultural differences: recognizing the importance of family

The first two participants did the game session together, they were both seniors who did not speak or read English and felt more comfortable doing this together.

They offered each other help. Family members and friends often help each other with tasks like these. My classmates both indicated that the family does most of the transactions for family members who don't speak English; they also said that having family members present was something these participants preferred. One participant said she would use the application "if my daughter was there to help me."[3] It was necessary to hold games sessions at the homes of friends and family members in order to recruit enough willing participants for the study. Using an environment where participants were comfortable was key to encouraging participation: participants were very relaxed, quite talkative and engaged during the games.

Choose simple and unambiguous words

When I first said the words "licence plate number" the first word "licence" was heard and focused on, leading the participant to believe that I was speaking about the driver's licence. When I then shortened it to "plate number" it was no longer misconstrued. It is clear that choosing words that are not ambiguous is of paramount importance and is another reason to conduct tests with your target audience. Doak, et al. (1985) recommend speaking at a normal pace, and found that speaking too slowly could influence comprehension because words said together are interpreted together. I may have spoken the words licence and plate

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[3] A classmate who speaks native Mandarin interpreted participants' responses. In the following text, the items in quotes refer to the interpretation of the Mandarin speaker.

too slowly; this could have contributed to the fact that “licence” was interpreted separately from “plate.”

Recognized images

The following drawing created by my classmate Ambrose Lee correctly conveyed the concept "moving" to all participants when it was physically moved across a piece of paper (Fig. 12).

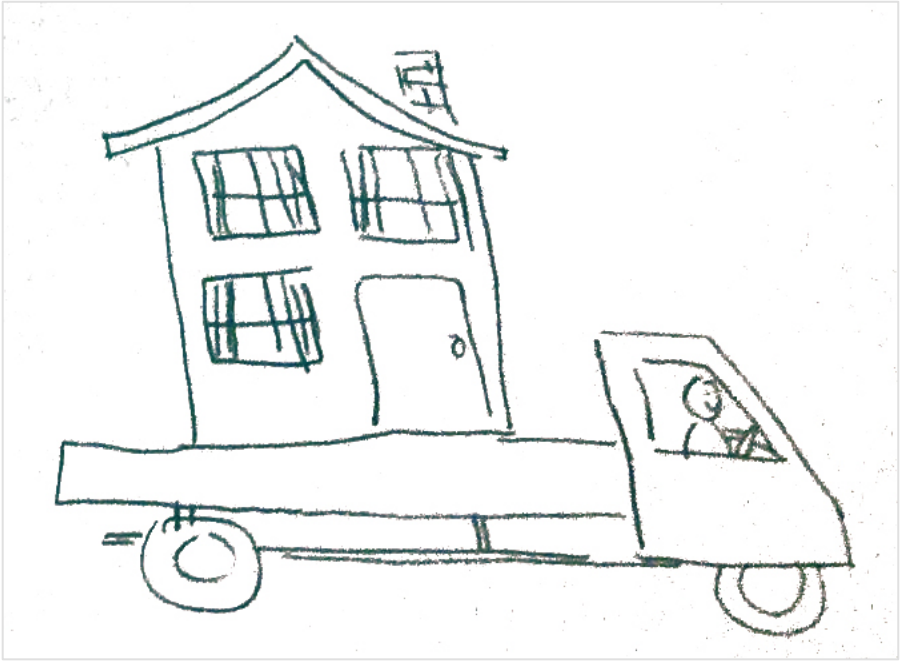

Figure 12 Particularly successful image for the concept of "moving." Drawing by classmate Ambrose Lee

The drawings of the car, houses and trucks that were very simple (see figure 8 above) conveyed more meaning to the participants than pictures that showed more detail.

Seeing both houses and moving the truck brought the concept to light for two of the participants, others needed only the truck and the animation (The animation implying the action – moving). When I added houses to the truck image, this caused some confusion in Game 3, proving that adding more images does not generally increase comprehension, but rather introduces more opportunities for misinterpretation. (Medhi, Prasad, & Toyama, Optimal audio-visual representation for illiterate users of computers, 2007).

Drawings of envelopes were recognized, but using a physical envelope to signify "address" had more success with the first two participants. In subsequent designs, I used a realistic looking envelope for the interface that asks users for their mailing address.[4]

The "?" is interpreted as a question

All participants recognized the number (#) and the question mark (?). A "?" was thought to represent the concept of a "question," rather than "help" as I had in mind. The interpretation of the participants was that by pressing on the image of the question mark, it would speak the question. Coincidentally, I thought that audio speaking the question would be helpful and my design did speak the

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[4] Cultural difference: According to one participant, the order of information in an address and where it is found on an envelope are different in China.

question when the button was "pressed." This would be a good method of providing a phrase that a user wants to hear again.

Positive reactions to visual interface

The first two participants responded that the realistic interfaces were "easier" and that they could see how they would useful "to anyone," and "to everybody". All of the participants noted that having something you don't have to read was a good idea. After having used the interface, all the participants said that they would try an interface that they were told was easy to use.

Tests with the realistic interfaces clearly showed that they drew upon the users' intuitive sense of what belonged somewhere, and the fact that they could "fetch" their "matching" document and enter information letter for letter made it possible even for those who could not "write" in English to use the form. The participants seemed enthused at the idea that there might be more visual interfaces available in the future and expressed the thought that this would be something that "everyone can use." It is widely known that if an interface just looks easy to use it can make a difference to users perception of how useable it actually is.

This method elicited a high level of engagement

Not all participants decided to pick up a pen, but used the given images quite well and were very animated in their responses. Allowing participants to play the game at locations that were familiar to them and with family and friends encouraged the relaxed and comfortable atmosphere required for this type of participatory design. It is clear that in order to minimize confusion and lead

people quickly to their destinations (transactions), the co-design phase is an essential step in the creation of an image-heavy interface.

Prototype Design

Iterations

Based on the analysis of the transactions, the interview, and the games sessions, I iterated the design of a low-fidelity version of the renew licence plate sticker interface. The low-fidelity interface has some higher fidelity form elements integrated within it where form fields are needed to obtain information from the user.

Three skeuomorphic interactive form elements were constructed using simple HTML, CSS and JavaScript[5]:

- Licence plate interface
- Odometer interface
- Driver's licence interface (Ontario)

In the final design, two more skeuomorphic forms are proposed but were not built; instead they were presented in Photoshop (high-fidelity)

- Insurance
- Drive Clean

[5] The final versions of which can be found in the accompanying CD.

Final Design

Figure 13 The start of the renew plate sticker transaction prototype design, clicking on the arrow will start the application

Car (cartoon style) and Sticker (realistic image)

All participants in the game sessions recognized the picture of an actual sticker for the licence plate. They knew that they were completing the renew plate sticker transaction; they identified it as the thing they were going to get.

Licence plate interface

Using a car provided context

The licence plate interface was paired with a drawing of a car (Figure 13). In game session paper tests, I tried showing only the licence plate, without context and this was more confusing to the non-driving participants. The non-drivers were less sure of what the item was and when told it was in fact, a licence plate, they suggested the use of the car by choosing to place it in the scene.

In first tests, I used a version where the car drove (animated) into the scene – this proved unnecessary, as later tests where it was removed were just as successful in eliciting the proper information from participants.

Licence plate form (realistic image – interactive element / high-fidelity)

When the empty licence plate was shown by itself, the participants recognized it but said, “there are numbers and letters missing,” when shown the car they reacted with a sound of recognition. They indicated the plate should be shown on the car, that they should be able to type it right in the plate on screen. When shown the high-fidelity version, which does show the car and plate, they correctly selected the licence plate to type into and then entered some numbers. Despite the fact that these participants do not drive, they still understood what the object was and that information needed to be entered. The only issue was that the non-drivers did not know what numbers belonged on the plate. After some reassurance, they entered random numbers and letters.

All other participants were able to identify what went into the licence plate and two knew without audio instruction; a third needed an audio prompt: “plate number.” (Fig. 14)

Figure 14 Text shows up momentarily while it is audio narrated (spoken).

Figure 15 The licence plate interface. The area where the letters are can be interacted with – the typeface is a Google web font named "Oswald." It was chosen for its similarity to the font found on Ontario licence plates.

When the user clicks on the licence plate, it animates "towards" them, becoming large enough to take up most of the space in the browser window (Fig. 15). The participants were able to click on the plate and enter letters with little encouragement, showing that the form doesn't necessarily need to "look like a form" to be easy to use. The large interface that takes over the screen leaves little confusion about where information should be entered, and offers accessibility for low-vision users.[6]

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[6] The large plate interface with a font-size of 120px or 7.5em (which is 7.5 times the browser default size) offers the extra advantage of being extremely easy to read.

Stickers 1 year or 2 year

The stickers are made to look almost identical to actual plate stickers. I added the year above the stickers at the suggestion of a game participant number three, who had mistaken the year for the day of the month. The design pictured here (Fig. 16) did very well in tests four and five, causing no confusion. It seemed that, numbers were recognized.

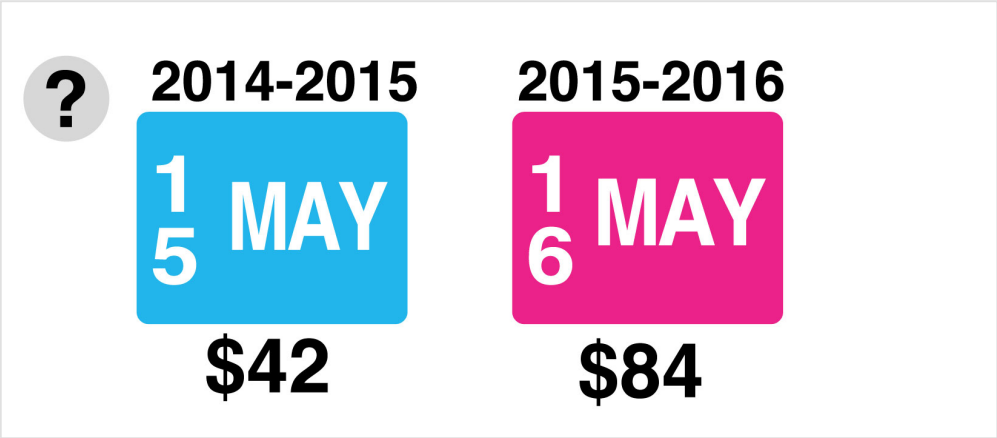

Figure 16 The plate stickers, before selection

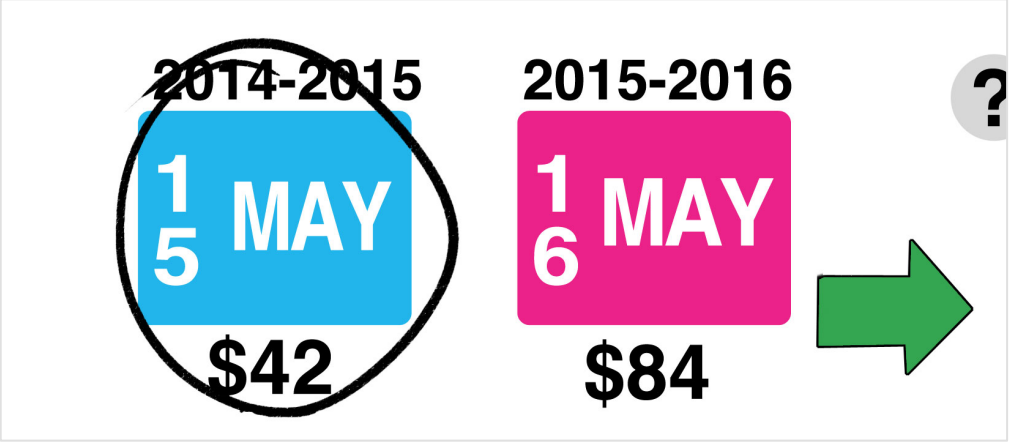

Figure 17 The plate stickers after a selection has been made. After the sticker is selected, the green arrow indicates the user can move to the next part of the transaction

Insurance

This design was not tested with users, but is part of the final design. The skeuomorphic forms were successful during the games, so I extended the idea in the final interface. (Figs. 18,19, 20)

Figure 18 Insurance Form, Step 1. The application speaks the words insurance company and an arrow indicates where the information should be entered.

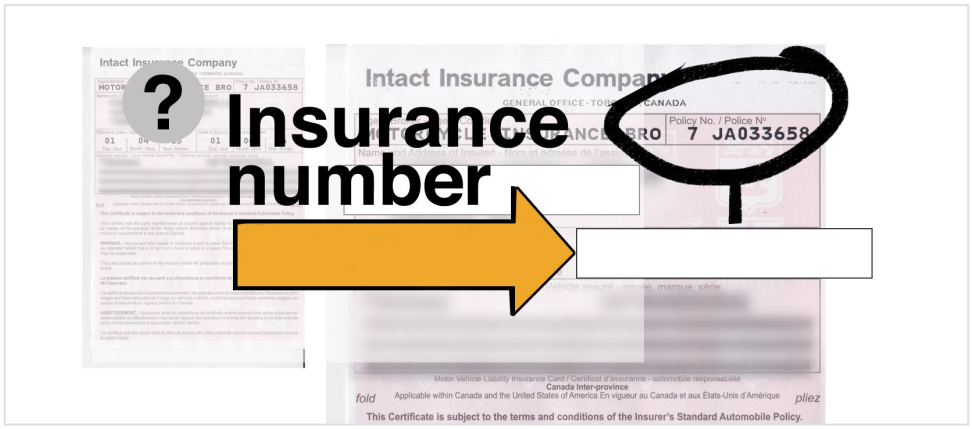

Figure 19 Insurance Form, Step 2. Audio narration speaks "Insurance number" and arrow indicates the area to enter it

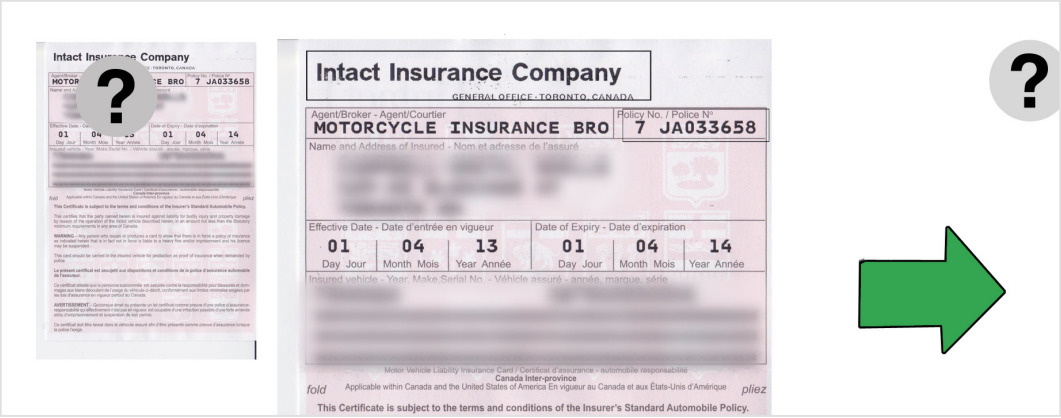

Figure 20 Once completed, the information is reflected on the form and the green arrow indicates the user can move to the next part of the transaction

Odometer interface

Step # 5 of the transaction is the odometer interface. The speedometer was recognized by every one of the participants as being the place that shows how fast the car is going; however,

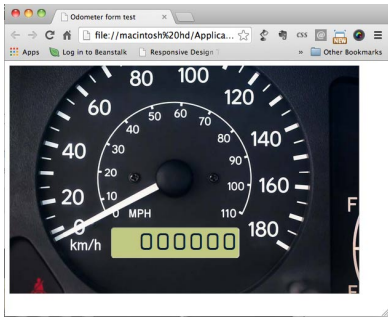

Figure 21 Odometer form interface, version one. Digital numbers.

non-drivers were confused about what would go in the odometer area. A design change from a digital interface (Fig. 21) to a more traditional looking "roller" style odometer (Fig. 22) was used correctly in the final game. The last participant is the only one who tested it, so it is unclear whether the design

update was in fact the reason for her increased comprehension.

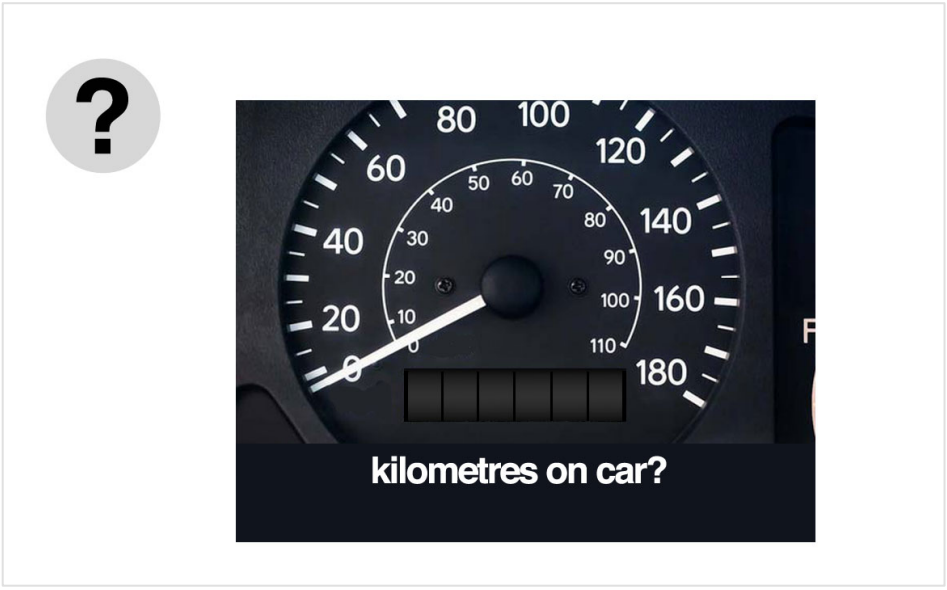

Figure 22 Odometer, final design uses a more traditional dial

Figure 23 When the odometer is clicked on the area to enter information zooms in

When clicked upon the field areas where information should be entered get larger and take up a larger portion of the screen area. Zooming in on form fields leaves little else to interact with. (Fig. 23)

Drive clean

Like the insurance form, the drive clean form design proposes the idea of using a field “close up” (Fig. 24, 25)

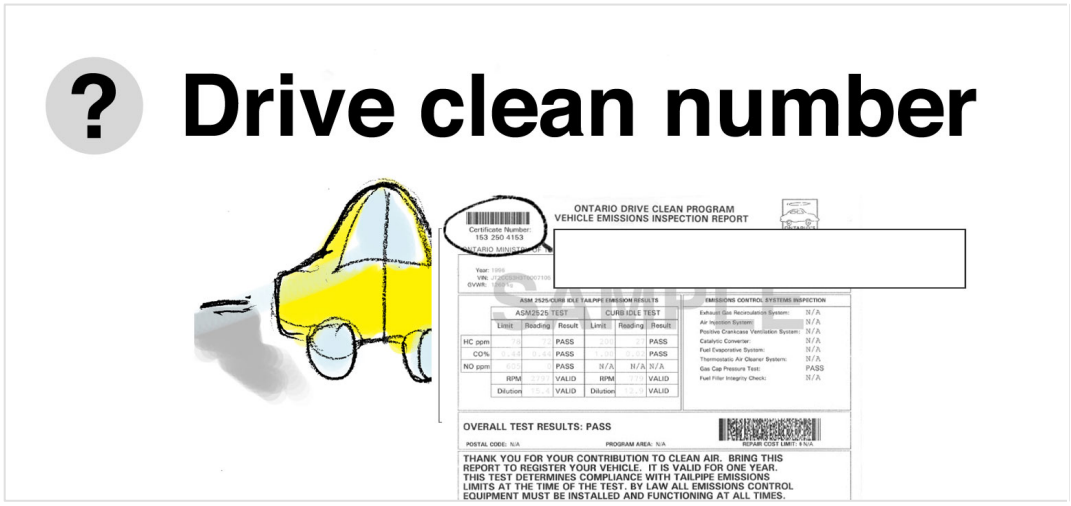

Figure 24 Added during the final design phase, the Drive Clean form works very much like the insurance form

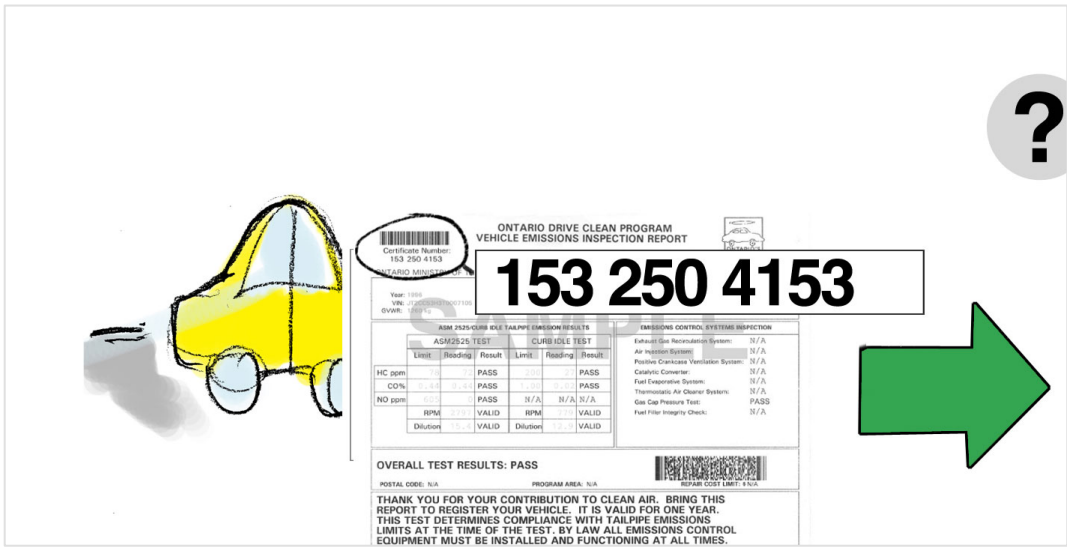

Figure 25 Once the number is entered the next part becomes available, clicking on either the arrow, the graphic “?” or hitting the right arrow key will move the user to next question

Driver's Licence Interface

During the first game, the two participants were able to copy the correct numbers into the address field on the form when looking at a piece of mail for reference. The driver's licence interface was recognized by all participants, and was easily used when I verbally said what belonged in each field and pointed at it with my finger (during the game session). There did not seem to be any confusion about how to interact with the form. For game sessions 3-5, I eliminated this step in favour of using the driver's licence to provide the person's current address.

Screen shots: show "check address" on driver's licence

I experimented with showing the person's current address on an envelope and on the driver's licence. The driver's licence was more successful in relating the idea of "current address" or "address on file," because that where the address on file should appear on your driver's licence.

In the final version, the user is presented with the driver's licence with their name and current address filled in on it. The application then speaks the words "is this where you live? Is this your address?" " YES " an arrow points, "or NO" (Fig. 26)

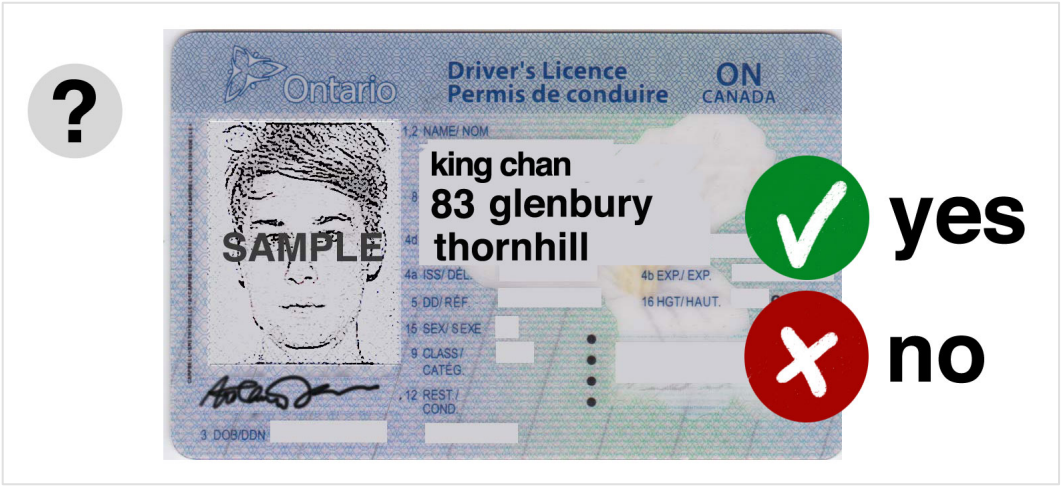

Figure 26 The driver's licence shows the person's name and the address that the Ministry of Transportation has on file

The user's address is confirmed on the licence, A check mark or X are pressed to indicate YES or NO. One participant suggested the words go beside the checkmark and X respectively. If YES, is clicked the address flies over to an envelope to indicate that this is the address the sticker will be mailed to, followed by an animation showing the sticker going into the envelope.

Last, the user must confirm whether the address on the envelope is correct. In either the driver's licence or the envelope, clicking the x or NO will erase the current address and allow the user to enter a new one. Pressing on the green arrow confirms the completion of this step, as per the rest of the application (Fig. 27).

Having the text adjacent to the item when it is time to fill in that information is the best time to show text. Further study should be done to determine whether it is best to have the labels for the required fields visible at all times. Does hiding and

showing the labels help with focus, and reduce errors? Or does it show progress and cause confusion. The reason I decided to use this method was in order to synchronize the text shown with audio narration. An alternative design might show all the labels but enlarge and point at them as they are spoken.

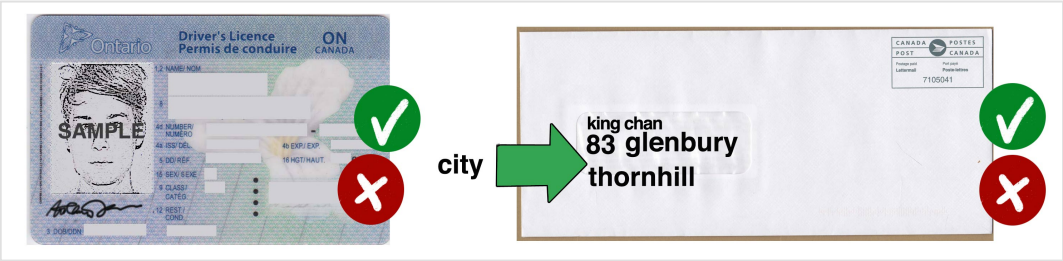

Figure 27 Once the address is confirmed, it animates over to the envelope, and the envelope files away, signaling that the transaction is done and that the sticker will be sent in the mail

Other Design Concepts

Two alternative design concepts I came up with during ideation include a stand-alone application that works in a way similar to the ING[7] application that allows you to deposit a cheque by taking a photo of it. This idea eliminates the form filling altogether. The idea is that you take a photo of the government form you need to fill out and it will prompt you to take photos of all the required information. Using OCR, the text would populate in the correct spots would be acquired and processed. Payment by credit card could also work this way (Fig. 28). The second alternative design concept is an extension of the prototype design proposed in this paper, but instead of being online it has been translated to a paper format (Fig. 29).

[7] ING is now known as *Tangerine* in Canada

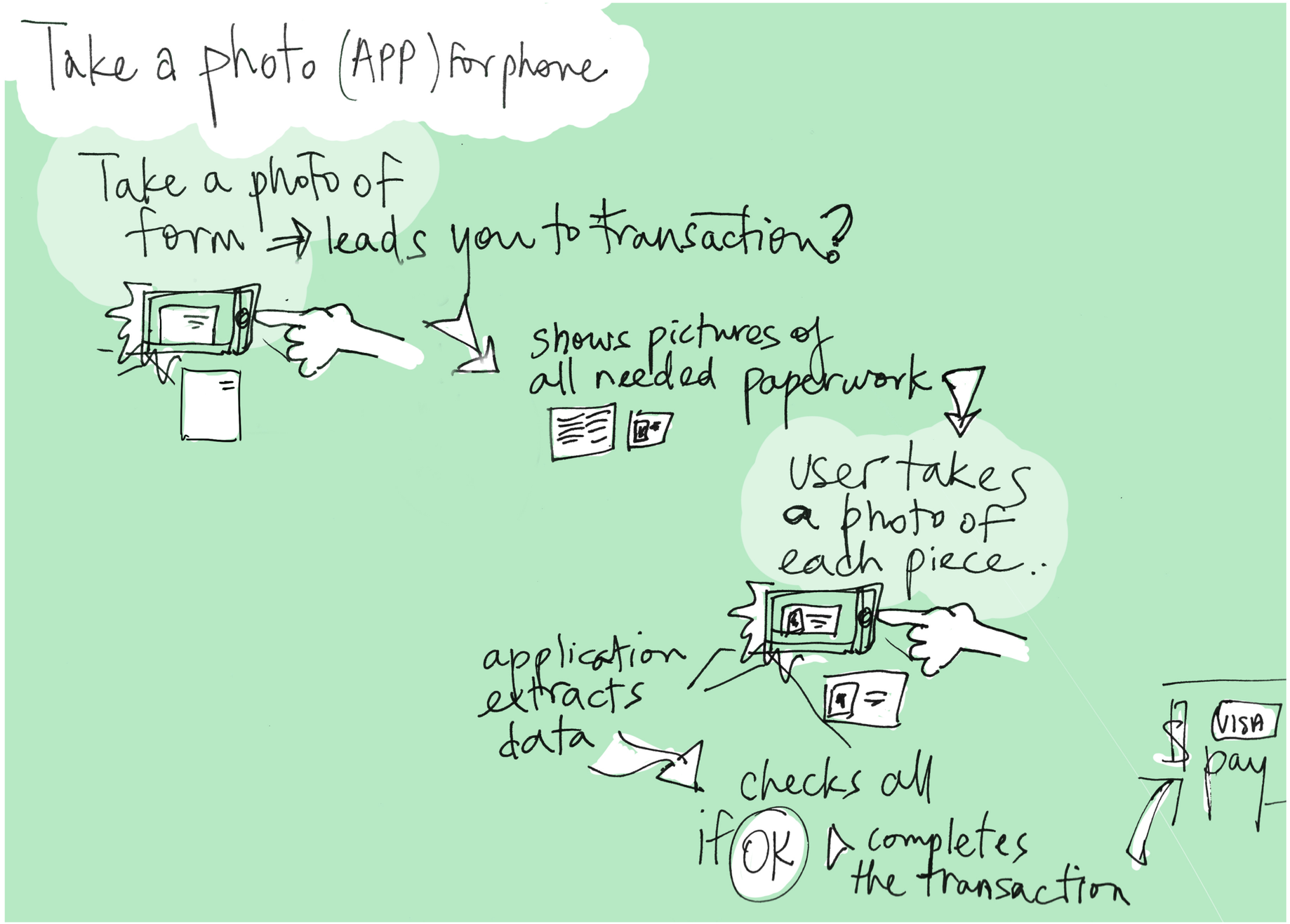

Figure 28 My idea for a photo app would avoid forms altogether – until the payment process

Design Concepts: Visual Paper Form

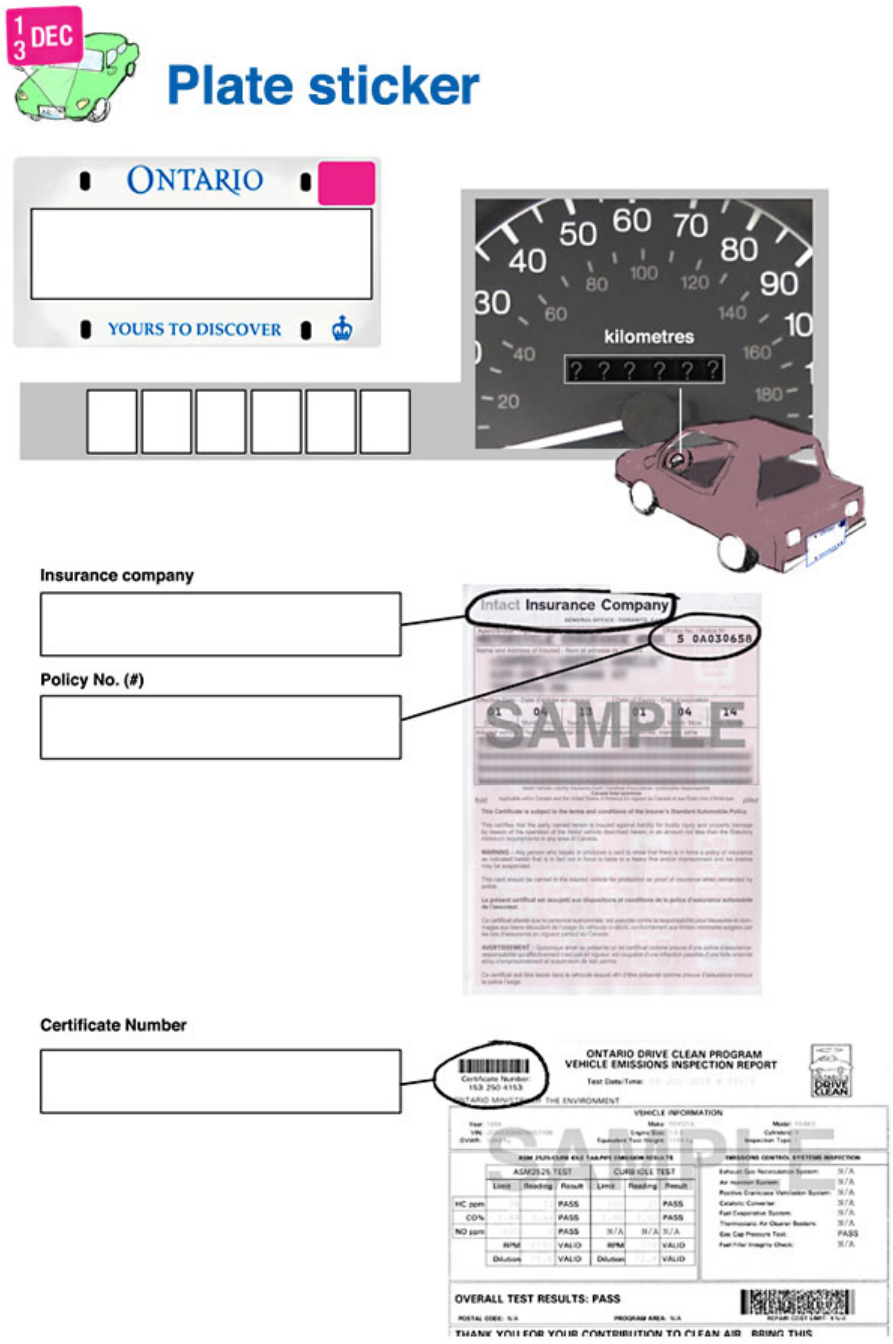

Figure 29 Print version of a visual form

Scope and Limitations

This project is based on my experience as a web designer working for the government for more than twelve years. As the web evolves, I see opportunities to use more animation, audio and visual elements to create more immersive experiences without the need to install third-party plug-ins. I chose to focus on an existing transaction because I like to focus on solving existing problems in innovative ways. Building a better online form was always a problem I wanted to tackle and going to school has afforded me that luxury. This paper studies possibilities available to designers and suggests new ways for us all to think about what online forms can look like and do for us.

Language limitations

Limited to One Language

Due to time and fiscal constraints, I only targeted one language group (Chinese Mandarin or Cantonese). Testing with other language groups would help to confirm that these visuals communicate are not culturally specific.

Researcher does not speak the language of the participants

I do not understand either Mandarin or Cantonese, so I relied on interpretation to gather feedback. I did however attempt to integrate ideas and make changes either in real time by drawing and adapting the prototype on the spot, or in-between sessions by iterating the design.

Responses were translated by interpreters

According to recommendation by Squires found in a paper entitled "Methodological challenges in cross-language qualitative research – A research review," suggests that studies using interpreters should ensure that those interpreters have a high level of vocabulary in both languages, and have the ability to describe concepts or words when they do not know the actual word or phrase. Both of my interpreters first languages were either Cantonese or Mandarin, both are Masters degree candidates in the same program as me. Assignments are in English, and all remain in good standing academically; they must therefore have an advanced knowledge of the language (Squires 2009). Interpretation was done in real-time and translation was done for the recruitment letter and for the screening questionnaire.

Recommendations

The following section outlines recommendations for people who might want to make their own low-text interfaces outlined are some of the findings that came up during the study.

Use few clearly defined words

Carefully choose words, make sure they are not ambiguous, the order and choice of words is also important. In the game session the first spoken was focused upon, make sure the first word is clear and is the main thing being focused on, in this case “plate” before “number”, or “sticker” before “plate”.

When you want users to enter information place text next to the field in question and have the English word spoken at the same time (Clark & Mayer, 2011)

Some terms benefit from being “broken out” – Avoid “government speak”

Separate out the components of words like address into house # and street name – these words are easier for people with ESL to understand. It would be advantageous if governments could think about which words may be broken out or simplified. This study found that the words “height” and “residential (address)” were two of the least understood in the context of the services I analyzed. Again, these kinds of issues are easily identified if the service is looked at holistically, this kind if adaptation is obvious to someone who deals with these kinds of issues everyday.

English narration is helpful

Audio narration, although presented in English appeared to reinforce the message, and helped those who understand spoken English. All the participants understood some spoken English even if they could not read simple words.

Speak at a normal speed

Words may be interpreted individually if spoken too slowly (Doak et al. 1985). It is also advisable to avoid the use of unnecessary words. It is not necessary to say: “please enter…” only speak what is needed. E.g.,: “plate number”.

When to use which representation (line / animation / realism)

The literature and my own observations suggest using line drawing for more abstract concepts such as *any* car, house or person. In the game, line drawing worked very well to communicate simple concepts. During the tests, animations were interpreted as actions. Therefore, the use of animation should represent an action and not a thing (i.e., moving vs. truck), or that the user should take action or interact with an object on screen, like the green arrows in the proposed prototype, or the sticker going into the envelope before it flies away. Participants of the game easily recognized official government documents like the licence plate and driver’s licence, and intuitively interacted with them. The skeuomorphic form interfaces proved easy for people to use, and all participants were able to type into the licence plate with little encouragement.

A method for finding simple representations

Start with one image that you think represents the idea you want to communicate, layer in complexity one piece at a time by adding images, words and sounds until the participant guesses correctly. Finding the simplest possible way to represent each part of the transaction prevents confusion, because more complex visuals leave more room for multiple interpretations.

Use a game to engage people in discussion about interface design. The game method used in the study elicited a lot of enthusiastic participation. I was able to test and gather ideas very rapidly. Make participants comfortable and involve family members in the game when dealing with cultures where family cooperation is integral.

Discussion

Low-text transactions are possible and may help ESL people to get services.

Focusing on making forms more visual could increase their usability for low-literacy audiences and help to serve clients in areas with very diverse populations.

Visuals worked well, testers were able to figure out how to do key parts of the transaction.

Realistic form elements are intuitive – they don't need to look like traditional forms

When presented properly, skeuomorphic interfaces can be extremely intuitive. Zooming in on areas to be interacted with leaves little else to focus on. This may have improved the usability of the form elements presented.

Forms are due for a shake up.

The response to high-fidelity prototypes was strong. I think that if people who are currently intimidated by text-heavy services were able to access a set of services that were more visual, they would be more likely to do their transactions online. Since most people don't do service transactions online, the perception of usability afforded by a visual redesign might prompt others to revisit previously unusable service transactions. If the transaction increases usability, I would expect increased traffic to the transaction, which could be measured.

More widely, professionals who construct web forms for a living should consider what they could do to make their forms more visually based.

Further Study

More testing and further iterations

Further study would require that this prototype be Iterated and tested with a wider audience. Images should be tested more widely with various audiences to confirm the connection between the concepts and the visual styles we found worked well for this study. A more sophisticated prototype could incorporate the most recognized graphic images and spoken words into a higher fidelity iteration of this application. The next iteration of the design could include realistic form elements for the insurance and drive clean documents. Considering that the odometer interface was usable and was understood by the end of the last game, it would be worth exploring other ideas for things that look “specific enough.” Testing a payment process that incorporates realistic looking credit cards would be a good next step. Choosing key transactions like a payment process could prove useful to a wide audience that extends beyond the government to the private sector. Other unanswered questions include: when should text be shown on screen and for what duration?

Share the ideas and code

Reusable component could be useful for front-end designers. Create patterns that can be shared though github[8] – sharing of this resource could lead to more visual forms.

More interfaces like this one should be built to test the limits of what is possible.

Identify the services most required by non-English speakers for redesign.

Ethnographic studies may be useful to understand specific communities.

More interviews with ServiceOntario staff could uncover ways to make improvements to the language and processes in existing online pages and processes. One simple improvement already suggested to the Ontario.ca UX team is the addition of photographs of service locations and pictures of required documents for transactions.

Outline game method

The game method employed in this study facilitated active participation and elicited very useful feedback from participants. Others may find it is a useful method for gathering feedback on visual transactions from those who speak many languages.

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[8] www.github.com is an open source sharing platform

Conclusion

It is now apparent to me that each interface type and circumstance will require a new set of images and that achieving true accessibility in forms for those who don't speak or read English may be something that requires quite a bit of research. There may be ways to speed the process of figuring out which images align to which concepts. After seeing the designs in action with those who don't speak or read English, I have quite a lot of hope for their use.

UX designers should push the boundaries of what we think of as web forms and be inspired by native applications that immerse the user in the experience and leverage the user's mental model by employing skeuomorphism and cues from the physical world to increase usability. Reducing the amount of text required to complete a service will also increase usability for those who have trouble reading the language. UX designers should pair the visual interface with audio narration for added comprehension.

Tests with the realistic interfaces clearly showed that they lent the users intuitive sense of where information belonged and encouraged them to "fetch" their "matching" document and enter information letter for letter. This made it possible for those who could not "write" in English to use the form. The participants seemed enthused at the idea that there might be more visual interfaces available and believed that this would be something "everyone can use."

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Appendix A: CD containing the Javascript / HTML / CSS prototype(s)

A CD is attached that contains the prototype. On the CD is the Adobe Photoshop file, a .jpg representation of the design and HTML, CSS, and Javascript that make up the interactive part of the prototype.

The form elements may look fancy but are very accessible, they are simply forms with fancy backgrounds and fonts. Much of the animation is done using CSS transforms, some with Javascript.

A readme.txt file on the CD provides more information about the code and how pages should be structured on a web server.