A User Model for People with Autism within Search

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MSc Computer Science Project Proposal*

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Abstract

The current proposal presents my objective to research and build a user model within Search, to address the downfalls of current Search tools for individuals with Autism Spectrum Disorder (ASD). The user model will be built around the core features of ASD. The model will be applied to results returned from a synthesis of three leading existing search engines. The final product will be a web application, integrated with motion-controller user interface, with the aim to enhance the user experience of Search for people with ASD. These findings will provide novel insights into the needs and wants of individuals with ASD within search, and enable future development and interventions within these information streams and communication channels.

Contents

*This proposal is substantially the result of my own work, expressed in my own words, except where explicitly indicated in the text. I give my permission for it to be submitted to the JISC Plagiarism Detection Service.

1 Introduction

1.1 Problem Statement

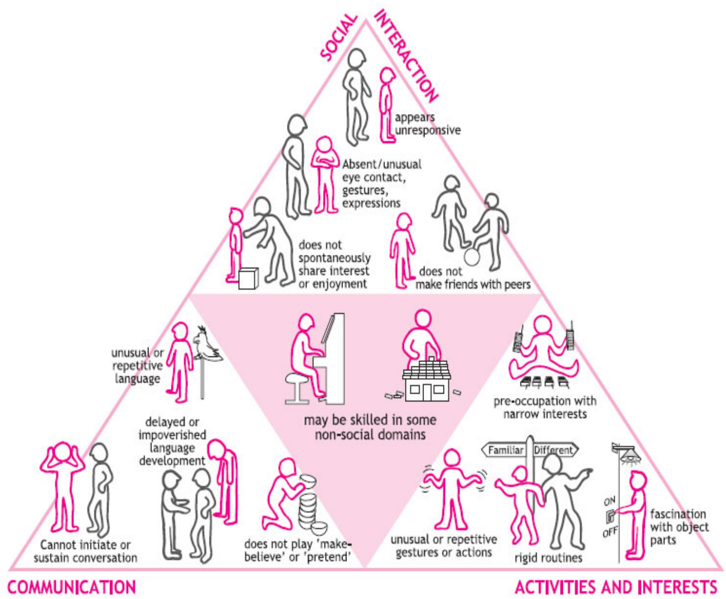
Most search engines apply a general user model to refine search queries. These models are designed to work with the general population, e.g., the auto-complete, query understanding, site and page quality signals, user content and synonym snippets are all geared towards working with the typical user. Very little research to date has attempted to define a user model within search for individuals with Autism Spectrum Disorder (ASD). It is currently unknown whether current user models need to be adjusted for this subgroup. Although people with ASD are relatively proficient with technologies, we argue that the user models that underlie the way in which search queries are handled and the needs of the user differ to the mainstream models. This project aims to build a suitable user model of ASD to address this issue. As it has been shown that individuals with ASD are more engaged (sand how sustained attention) when using technology that is receptive (games, responsive consoles, motion controlled devices) and interactive compared to technology that is not, this project will combine interactive, Motion Recognition hardware with Search to improve the User Interface and architecture of Search for individuals with ASD.

1.2 The Role of Context In Search

It is unlikely that any given page on the web will contain a word or phrase that means exactly (or nearly) the same as another word or phrase in that language (e.g., shut and close). How is it then that your search engine of choice picks these phrases to mean the same thing, and returns them synonymously in the results of your query? Well, quite simply put, it is by virtue of the fact that each of their neighbouring words and associations are similar. These are indirect, higher-order associations, and provide the context in which the search engine can index keywords. This context plays a crucial role in search; first, in the interpretation of the user query, and second, the context is reflected in the results returned to the user.

1.3 What is ASD?

The prevalence of Autism Spectrum Disorder (ASD) is amongst the most common neurodevelopmental condition and it is currently estimated that 1/68 children meet criteria for ASD (CDC, 2014). ASD is five times more common amongst boys than girls (1/42 boys, and 1/189 girls). According to the DSM-V (2013) diagnostic manual, ASD is characterized by persistent and early deficits in reciprocal social interaction and repetitive behaviours. Individuals vary from high functioning to low functioning (along a spectrum), with behaviours emerging around 2 to 3 years of age.



The ASD Triad (source: http://media.kingdown.wilts.sch.uk/mod/page/view.php?id=7374)

1.4 Aims and Objectives

Search engines assume that the user is context-driven, and attempt to model the user's intent using higher-order contextual information gathered from available web pages. This process also models the human brain's ability to extract context and semantic associations from information. However, people with ASD are less context-sensitive, preferring a more detail-focused processing style [25]. They would intuitively form search queries very differently. Individuals with ASD are also less likely to engage in a relational (hierarchically organized) style of processing [22] suggesting that relating information in a hierarchically organised framework is less likely. Hierarchical organisation implies a great deal of flexibility and mental-shifting, as a simple example, in a search for 'apple', it would imply awareness that the word is related to 'pear' but also to 'fruit'. Awareness of this latter relation also suggests awareness that 'apple' is related to 'pomegranate'. Of course, in genuine search queries these associations can get very complex very quickly. Generally speaking, individuals with ASD prefer, and are more likely to engage in an item-specific processing style, and, whilst intelligent cognition is definitely possible, search queries are more likely formed of first-order associations[1].

Several Psychology learning and intervention studies for individuals with high functioning ASD have suggested that assimilation and accommodation of new information is most appropriate when:

1. Information is concrete (i.e, not abstract).

[1] Of course there is a great deal of individual variability in Autism Spectrum Disorder.

2. Information is presented in small manageable chunks.

3. Information is not verbally ”overloaded” (not too many words).

4. Information is presented in a set visual format to aid navigation.

Several interventions have been built around this body of literature (www.autismspeaks.org). Given these findings from the literature we can make several adjustments to current Search tools to enhance their benefit for people with ASD. For example, a user with ASD would have improved user-experience if their search results:

1. Were first assessed (before presentation to the user) for the Key Word In a suitable context.

2. Followed a similar order of semantic association, in line with the search query itself (preference for first-order relations).

3. Had smaller snippets and presented in a more manageable way (less overloaded with words).

4. Were visually consistent.

5. Had a high degree of verbal consistency/similarity with the search query.

This project will **integrate** these insights from the Psychology literature with the proposed application.

1.5 Proposal Organisation

This proposal outlines my research to date on the field of Search, ASD, and Motion Controller interfaces. I also include my preliminary planning of the methods I will use to implement the enhanced Search tool for ASD. The remaining chapters discuss:

1. in Section 2, I give a brief introduction to Search engines, and the downfalls of current Search engines for individuals with ASD. I discuss the motivation behind the proposed work

2. in Section 3, I discuss the potential for user modeling within Search

3. in Section 4 I review current existing combination search engines

4. in Section 5 I outline my proposed search application for ASD

5. in Section 6, I briefly discuss API's and Libraries that I will use during the project, including Custom Search Engine APIs such as the Google Custom Search API, and Yahoo BOSS, Lucene Key Word In Context

6. in Section 7 I review motion controller hardware that I aim to integrate with the search application

7. in Section 8 I outline my project plan, and

8. in Section 9 I discuss the future directions and implications of this research.

2 What should Search offer people with ASD?

2.1 Search and Learning

The Internet is one of the largest resources of information, and can be searched by users from different areas of the world relatively quickly. Search engines allow users to collate hundreds of links on a single topic, using only a few words or phrases. The information returned is vast, and the depth of users searches can be determined by more advanced refinement options [2]. Search is an therefore an important learning tool; its significance is duly noted because of the learning benefits it brings for children and adolescents as they begin to navigate the Internet and gain an understanding of several subjects.

[2] For example, using the keyword NOT, or, by applying precedence to a selection of search query terms likely to be returned. This implies the user can flexiblly shift perspective to guess the keywords likely to be picked up and returned by the search engine. Assuming the user has this knowledge they may choose to do a targeted search for just some specific key term.

2.2 Clues from virtual reality and gaming

Almost all teenagers (97% of those aged 12-17) use a computer, web, portable or console devices, 73% of which is desktop or laptop based. Teenagers with ASD also use technology and spend a substantial amount of their time using devices [7]. They are proficient, and use these devices with relative ease, showing high levels of engagement with consoles like the Xbox (Kinect) or Wii, Portable Gaming Devices (Nintendo DS), or cell phone or handheld device. For individuals with ASD, computer-based technologies can provide a stable, consistent learning environment that can be customized [2]. With this in mind, the proposed application will utilize motion controllers to facilitate user attention and engagement with Search.

2.3 Motion Controllers

Motion recognition devices can be programmed to make consistent responses to environmental triggers. This is unlike real-world situations where environmental responses are not always consistent and may require further interpretation or guess-work. These controlled and interactive environments have shown promise for improving social communication skills and reducing repetitive behaviours [1].

2.4 Visual not text-based

People with ASD demonstrate stronger visal memory [11] than verbal memory, so a more visually-oriented approach to search (one that doesnt require sustaining a verbal search query in working memory) is a more appropriate way to present data to bolster the strength of visual memory in ASD.

3 Creating a User Model of ASD

3.1 What is a user model?

A user model is a collection of information associated with a particular user, with which a system can adapt its behavior in order to customize in line with the users needs. The concept of user modeling has strong implications for the way in which humans and computers interact; by creating a representation of the user, the system can be better informed about how to behave in various circumstances, for example, the system can acknowledge a specific kind of users needs, preferences, likes, dislikes, goals, plans, knowledge, and skill. The system can maintain this knowledge whilst interacting and adapting its behavior with the user. Persona development will support the user modeling process by identifying particular characteristics of individuals with ASD in Search. An individuals personal information pertaining to the persona, will be stored in a user profile which will contain information such as age, gender, lifestyle, frequent tasks, tools used, resources commonly used and crucially for this project, the profile will include information about diagnosis (Autism, Asperger, and high/low functioning).

3.2 Types of user models

User models can be static, and unchanging (i.e., no algorithms are used in order to teach the model about the changing preferences of the user, and no new information is fed into the model), or dynamic (representation of the user with their up-to-date changes in interests, and recent interactions with the system). Alternatively, user models can be stereotyped. This means they utilize demographic information to classify users into distinct subtypes. The system infers or assumes other characteristics about this subset of users by making use of data gathered from other users also included within this subset. Lastly a user model can be highly adaptive and try to model the one user on their own, without stereotyping or inferring the characteristics of the user. This type of user modeling requires a large amount of data collection prior to its implementation. The model can gather information through direct interaction with its user (e.g., via a registration process), by observing and interpreting the users actions, or, by a combination of both, that is, the system may ask for feedback, and alter its approach depending on the users behavior.

3.3 Benefits and difficulties of user modeling in earch

A user model needs to collect data before it can predict the users needs with accuracy, but once this is achieved, information can be presented according to the users knowledge, ability and goals. It can also effectively filter out irrelevant information and rank the remaining search results in the most relevant way according for the user. Creating a user model is not an easy task. The designer of the system has to set weights of parameters for the information that is fed into the model, and decide what course of action to take when two pieces of information may conflict. Some of the difficulties associated with deciding the priorities of elements of the model will be decided with user-feedback. Other elements of the user model will be based on modeling well-researched cognitive processes in ASD (for example, a user model that focuses on first-order, or, item-specific relations to form a search query, rather than hierarchical relations to form a search query).

3.4 Adaptive / Personalised Search

Adaptive or Personalised search, is one way in which search engines including Google, Yahoo and Bing have attempted to tailor the search results for their users. The feature was first introduced as part of a GoogleLabs project in 2004 and implemented in 2005. It associates each user search with a HTTP cookie this is a piece of data (a text file) sent from the website and saved in the users browser when the user navigates that website. These cookies contain information such as login information (gender, age), preferences (languages, interests) and other information about previous searches based on site traffic. The cookies allow the website to remember stateful information about what buttons the user clicked on, or what sites they visited. This cookie record allows the search engine to return results that are highly relevant to the search query, but also highly relevant to the pages that the user visited through previous searches. When personalised or adaptive search is combined with GPS data from a smartphone or device, it can provide useful information about the places that user has previously visited to higher rank local items in the users returned results. This creates a personalized or adaptive web search, as the feature allows the web search to be tailored to the users preferences over the course of time, and as more searches are recorded.

3.5 Disadvantages of Curent Adaptive Search for Individuals with ASD

Although adaptive search seems to have significant user benefit in terms of relevance to the user for that search query, it decreases the likelihood that the user encounters new information and biases the results towards the users location and their previous site traffic. This has the unwanted effect of creating a filter bubble (Pariser, 2011), which is argued to close us off from important and relevant information and create a personal ecosystem of information for one particular user, creating the impression that our narrow self interest is all that exists. The filter bubble also has potential privacy problems, as the user may be unaware that the search has been specifically tailored towards their interests and they wonder why things that they have previously searched for have become more and more relevant. The filter bubble may positively reinforce restricted interests in ASD as the user constantly receives feedback about their previous (idiosyncratic and personalized) searches without being able to break out of that repetitive loop. Recent research has suggested personalization also increases background noise relative to the search results [4]. Briggs (2014) suggests that there is a carry-over effect in personalized search for the users, whereby prior search results influence the results of subsequent searches [3]. Nevertheless this carry-over may be disadvantageous for people with ASD as it muddies their search space. In order to produce a search tool specifically tailored to reduce the filter bubble effect in ASD, widen the information gateway and reduce the possibility for restricted and repetitive searches, the weighting on previous search results needs to be reduced. This would be particularly important for individuals with restricted interests. For these users, it would limit the possibility that they get trapped in a spiraling loop of ever-narrowing user-relevant information and over personalization of self-reinforced information ecosystems.

3.6 Persisting the User's Information?

The user will be asked to sign in with a Google+ account (providing their demographic imformation), and the Google+ API will be used to store/retrieve this information about the current user. The API contains methods to access 4 resource types; People, their Activities, Comments and Moments. A person is represented with many fields in Google +, including name, gender, title, occupation, all of which can be used to model individual users in the current project. Information about web searching history for any individual user can be obtained from the browser history (if needed).

[3] It should be noted that personalization of search results generally takes a lower priority for the ranking algorithms than the URLs ranked top in terms of their relevance for the search query.

4 Existing Combination/Advanced Search Engines

4.1 Bing vs Google

Bing vs. Google presents the users search query results from both search engines to allow the user to make a comparison (the Google and Bing results can be presented vertically or horizontally beside each other), and provides the experience of navigating both search pages simultaneously. The number of other personal preferences options is very limited (the orientation of the results is just about all the user has the option to choose). There is also double the information on the page, so not suitable for the current project.

4.2 Qrobe.it

Qrobe combines three search engines results (Google, Bing and Ask) and presents them conveniently on one page. Unlike Bing vs Google the user can search web, images or popular (to reveal stories from Reddit). Qrobe.it also has a cheatsheet that allows user to search using shortcuts, which may prove useful to a seasoned Qrobe user. Qrobe unfortunately has no API for developers to use to extend its functionality further.

4.3 AskBoth

AskBoth is a work in progress, and combines both Google and Bing, with a section in the middle dedicated to twitter. AskBoth argues that the selling points for the site are its uncomplicatedness, aesthetics and user experience which promises to be particularly good (that is, has promised, since 2009!).

4.4 Spectra

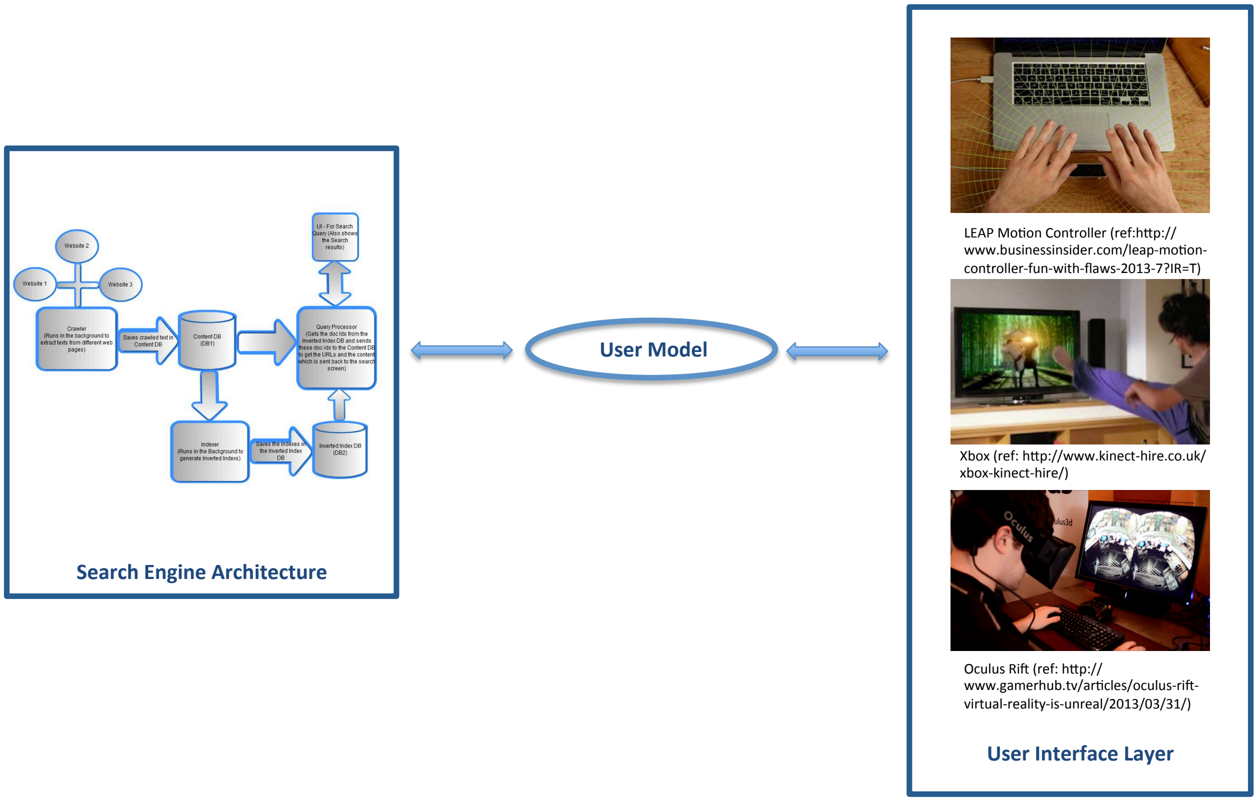
Spectra takes searching from Google, Bing and Yahoo engines one-small-step-further. This site allows users to assign weights and determine the way results are displayed. Spectra gathers the search results, ranks them and displays them according to their algorithm. Spectra does not provide an API for developers, and the rigor of the search is hard to test.

4.5 Conclusions and ways forward

These search engines allow users to see more results than what one search engine alone would present, they often do this with a cost – redundancy. The benefits are that there is more information presented to the users at once but often at a cost of cognitive overload and/ or near duplicates. This is not ideal for users with ASD, as this is precisely the opposite of what the application's aims and objectives were see Section 1.1. To date, a user model for ASD within Search has not been built. The following section proposes an application that will try and address this issue.

5 Proposed Search Page and Controller Web Application

This project will produce a search engine designed to enhance the user experience within search for people with ASD. Below I list the core and non-core features to include:



(ref for Search Engine Architecture Image: https://insightsdelight.wordpress.com/2012/01/24/inverted-index-the-basic-ingredient-behind-the-recipe-called-search-engine/)

5.1 Core Features

1. A web application that synthesises the results from three of the largest and most popular search engines (Google, 67.5%, Microsoft Bing 18.4% and Yahoo 10.3%) [21]

2. The design and implementation of a user model to apply to these results to filter them according to specific user needs. The model will return concrete, managable (not text-overloaded) results, in a consistent mannar. The search engine will perform a Key Word In Context search and prioritise results where the key words are used direcly, or results have first-order semantic relations to the query words (see Section 1.4), i.e., they appear in matched context to the search query.

3. The application will utilise motion controllers to enhance embodiment within search, and enhance the search query process. I will investigate the use of the LEAP motion controller as the main device in the first instance.

5.2 Non-core Features

1. Investigating the user preferences when a page with a higher number of pictures ranks higher than those with many words.

2. An investigation of other motion controller devices, possibly the Oculus VR Rift, Xbox Kinect.

6 Implementing the Application

6.1 Selecting Existing Search Engines

The three most popular search engines (as calculated using an average of the unique monthly visitors) are Google (1,100,000,000 estimated monthly visitors), Bing (350.000.000 estimated monthly visitors) and Yahoo! (300,000,000 estimated monthly visitors)[17]. Google is the most recent and goliath question-answering system (query volume = 64.5%)[21], and the word has become synonymous with the word search on the web.This search engine is often considered the most innovative and dynamic, and is the most popular amongst users worldwide (using global traffic rank figures, in March 2015). Yahoo (2003) was the first ever web directory service; it has stronger advertising and e-commerce partnerships and has a query volume of 19.8%. Bing (Microsofts answer to search, previously known as msn search), was officially launched in 2005, and has a query volume of 12.8%, which is substantially less than Google, but nevertheless, is within the top 3 search engines.Other search engines include Ask, AOL, WOW, which will not be included in the search system proposed here in order to limit the redundancy of the search results (of which there will already be a fair amount, see Section 4).

6.2 APIs, Text-Search Libraries

I will be using APIs to work with the three search engines outlined in the above section. Although the same information could be gathered by inspecting the source code for the pages that return the search query results, the APIs were considered to be far more efficient in doing so (e.g., Apache Lucene Key Word In Context is optimised for maximum search efficiency see Section 6.2.5).

6.2.1 Google Custom Search

Google Custom Search (GCS) provides a Java API to create a personalised search engine that can be configured to search web pages and images. It works on a pay per search principle. Once signed up, the GCS requires a consumer key and secret, which are hardcoded in the development of the search.
The API has methods which allow the user to TODO
However, this API needs to be used in conjunction with a textual-search library in order to reach the Goals of this project (the API does not offer Key Word In Context Search in order to trace the contextual information being returned to the user). Costs $0.01/search.

6.2.2 Yahoo BOSS

Just like Google Custom Search, the Yahoo BOSS Java API required the creation of a search engine project (pay per search) with a consumer key and secret. The API is also easy to use and offers the same functionality as the CSC but again is not sufficient alone to reach the goals of the project. Costs $0.01/search.

6.2.3 Bing Search API (Data)

The Bing Search API, similar to Yahoo BOSS and GCS will produce results for Web, Images, News, Videos, Related Search. Bing Search Java API also includes spelling suggestions based on the query entered. Costs $0.00/search (max 5000 searches/month)

6.2.4 Faroo API

Is a free alternative Java API to Google Custom Search API (business), Yahoo BOSS API (commercial) and Bing Web Search Enterprise (commercial). It offers the possibility to do a Web Search with more that 2 billion pages indexed. Faroo can return news search (articles from newspapers, magazines and blogs) and sort results by publishing date, with author and article image. Trending news pages are also indexed and can be grouped by topic. The API includes suggestions with auto-completes for misspelled items in the search query [24].

6.2.5 Apache Lucene Library

Apache Lucene Library is a text-based context search. It is particularly relevant for the current project because it provides powerful, accurate and efficient algorithms to search textual data, the algorithms are scalable and high performance, and so will enable users to receive results from their search query with good temporal speed. The API offers the possibility to carry out phrase, wildcard, proximity and range queries which will mean the goals of the project can be fulfilled (Package org.apache.lucene.search.highlight, for the aims of the project refer to Section1.4). The library also affords ranked searches, with type tolerant suggesters and field searching.

6.2.6 Key Word In Context

The Apache Lucene open-source search engine library written in Java allows contextual-text search, also known as Key Word In Context (KWIC)[12]. KWIC works by forming an index to allow each word to be searchable. The library takes care of the efficiency of this process, and can return Weighted Terms of a given query (as an example).

6.2.7 Google+ API

Persona (a type of user) development will support the user modeling process by identifying particular characteristics of individuals with ASD in Search. An individuals personal information pertaining to the persona, will be stored in a Google+ user profile and can be used with the Google+ API (written in Java), containing information such as age, gender, lifestyle, frequent tasks, tools used, resources commonly used. It is also be possible to store information in the 'about me' section on the profile about individual diagnosis (Autism, Asperger, and high/low functioning). This information can be parsed when the query is submitted to the search engine.

6.2.8 API for LEAP Motion Controller

Leap Motion SDK offers 2 types of API to get tracking data from the Leap Motion Service. A native dynamic library interface, to create LEAP applications, and a WebSocket interface, allowing Leap Web Based applications. I will use the latter of the two.

The LEAP motion service has a WebSocket server listening in on http://127.0.0.1:6437. The user can enable or disable the WebSocket server as they choose to do so, in the device's control panel. The server sends tracking data in JSON messages and an application can send configuration messages back. This library will be used to establish connection to the server and consume the JSON messages [3].

6.2.9 ThreeJs Library (Non-Core)

This javascript library enables WebGL-3D in a web browser. WebGL brings hardware-accelerated 3D graphics to the browser without installing additional software. This libaray may be used to better integrate the application with the motion controller, and improve the experience of embodiment with the application.

7 Integrating the Application with Motion Controller Hardware

7.1 Hardware Selection Process

Humans have many senses that go beyond the computer's screen. The usability of the hardware will this be determined as follows:

1. Good timing of the device correlates to a good meaning and a good User Experience. The LEAP has options to poll frames at a constant rate (to keep timing of movement accurate).

2. Cognitive lag time. Each of our senses operates with a different lag time. Hearing has the fastest sense-to-cognition/understanding time, and surprisingly sight is the slowest. The device should therefore work with the combinatorial configuration of the senses.

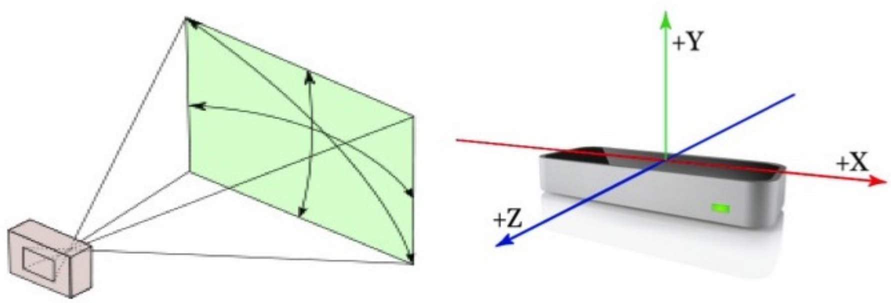
3. As this is a tool to be used with individuals with ASD, the sensory experience of the device cannot be overwhelming.

4. Cognitive load should not be high (the device is being used to assist with search, so operating the device should not require a great deal of cognitive effort).

5. The device should integrate with concrete behaviours, e.g., drop or grab.

7.2 LEAP Controller

The leap controller can recognize and track hands, fingers and finger-like tools. It can report positions, motions and gestures using an infrared light and optical sensors along the x, y and z axes (Cartesian coordinate system). The controller has a 150-degree field of view, and can operate in a range of 1 inch to 2 feet. The API works with distance in millimetre resolution. Time is measured in microseconds, speed in mm/s and angles in radians.

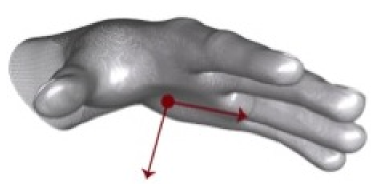


The LEAP controller, with 150 degree view [3].

The LEAP uses frames to represent tracked entities such as hands, fingers, tools or gestures. Motion data is recorded as a set of frames (stored, read-only information) containing the detected information. Frames can be created by calling the Controller.frame(), and up to 60 can be held in the history buffer with the current API. Frames may be 'dropped' if there are resource contrainsts, or, they are missed for example. Once a frame is created, the data can be gathered from the hands(), arms(), fingers(), tools() methods.

7.2.1 Hands

The Hand class, returns information about the ID, position of fingers associated with that hand, and arm infomration (left/right).



The Hand palmNormal() method and direction vectors define the orientation of the hand [3].

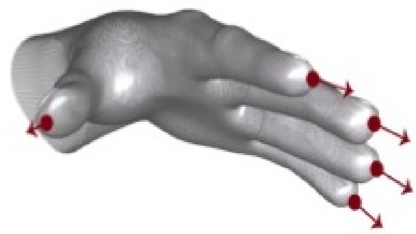
The software uses parts of visible hand, internal model and previous observations to form a model of the hand. Five finger positions will always be shown but subtle movements of hand, especially if they are tucked up into the hand are harder to detect. For this there is a Hand.confidence() method that provides a rating of how well the observed data fit the internal model [3].

7.2.2 Arms

The Arms class can return information about orientation, length, width and end points of movements. The LEAP controller software bases these return measurements on previous observations of the user, and using typical human proportions.

7.2.3 Fingers

These characteristics are based on the anatomy of the hand, and recent observations.



Finger tip position and direction are given as vectors. [3].

7.2.4 Tools & Pointables

Tools can represent any real object (noun), but are longer, straighter and thinner than fingers. Tools must be cylindrical.

7.2.5 Gestures

The LEAP recognises certain movement patterns (for each finger or tool individually) allowing the user to indicate an intent. These gestures are observed in a frame and include: CircleGesture, KeyTapGesture, ScreenTapGesture and SwipeGestures.

8 Project Plan

8.1 Project Timeline

A highlevel plan of the project timeline is presented in table Table 1. The start date of the project is June 5th 2015, and end date is September 13th 2015.

Table 1: Project Stages

Dates #	Task
Jun 05 - Jun 12	Gather relevant API's & Libraries.
Jun 13 - Jun 19	Work on synthesis of search results.
Jun 20 - Jun 27	Build & Research user model of ASD
Jun 28 - Jul 06	Work on configuration with Google+ API
Jul 07 - Jul 14	Apply User Model to Search
Jul 14 - Jul 21	Develop User Interface
Jul 21 - Jul 28	Integrate motion controller tools
Jul 29 - Aug 05	Develop Questionnaire and Eye-Tracker Set up.
Aug 06 - Aug 13	Test the model and ask for user feedback.
Aug 14 - Aug 21	Revise the Model and Interface
Aug 11 - Aug 25	Write up project report.
Early Sep (tbc)	Present findings to supervisor.

TODO!! Describe my Product Features
Describe user stories e.g., a user wants to be able to search for pages containing the most videos.
Assign these a priority: Must Could Should Want (MCSW model)
Set SPRINT deadlines to enable the functionality

8.2 Methodology

The current project has a relatively short deadline in which a single developer will research and deliver a system prototype and report. The APIs, technology and areas of development are unfamiliar. In addiion the final product depends on user feedback testing, there is an element of uncertainty about what the final product will be/should look like, a feature may be added/removed at the feedback stage. The characteristics of the current project mean that the most suitable methodology to deliver the application is Agile Methodology. I will focus on an incremental development and rapid feedback early in the development, to make changes to the project direction. This methodology works well with the demands and offers the most flexibility and adaptability.

8.3 Development Languages

8.4 Testing

8.4.1 Feasibility Testing

To ascertain whether the goals of the project have been met I will need to test the application with people with Autism. This will include;

- Recruiting participants to take part in the research. Adolescents and adults with a diagnosis of ASD. Recruited from NAS, will be asked to test the application.
- Obtaining user feedback on the intital product by testing the web search with the LEAP motion controller, with a group of individuals diagnosed with ASD. I will design a questionnaire to test the application's feasibility. If time allows, I hope to use a Tobii Eye-tracker TX300 (in the Department of Psychology, Centre for Brain and Cognitive Development, Birkbeck University of London) to gather high resolution eye-tracking data on the participants as they use the application. This will inform my future developments for revising the application.
- Revising the model and the ideas to choose the best possible approach/tools to achieve optimization for people with ASD.

8.4.2 Unit Testing

For testing the application code, I will be using Test Driven Development (TDD). For Java I will use the current version of JUnit (at the time of writing this is 4.12).External dependencies will be mock tested using Mockito. JSON Test will be used to test JavaScript Object Notation [8]. As well as unit testing, Regression testing will be used to testing the project as a whole unit.

8.5 Risks/Issues, probabilities and mitigation of impact

not being able to use the API freely
the API not allowing the use of hieracrchical structure testing
find work around for this?

1. There is a likelihood the Google, Yahoo and Bing APIs will

9 Summary & Concluding Statement

I have proposed to research and build a User Model for people with Autism within Search. I presented my research on the downfalls of current search tools, and how they can be improved. I also discussed the use of motion controller hardware (the LEAP) to improve embodiment and user experience within Search. I outlined a proposed solution, and presented my research to date on the tools and resources and methodologies I will draw upon to meet the goals of the project. Last, I outlined the project's timeline.
We are moving towards highly personalized information access and retrieval systems. The future of Search will promise the return of user specific results given their needs. This project aims to build a user model of Autism, but the same can be achieved of any group of users. Search engines can assist with the forthcoming information-overload problem by exploiting these user models to turn the masses of information available into a specific set of information goods for any one user, providing good quality personalized information.

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