

Helping Aphasic People Process Online Information

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ABSTRACT

In this paper, we describe the HAPPI (Helping Aphasic People Process Information) project which aims to develop web based systems to help Aphasic people gain access to web based information such as online news stories. It does this by simplifying the language and providing alternative means to help jog users' memories and hence improve their comprehension of the online material.

Categories and Subject Descriptors

K.4.2 [Programming Languages]: Social Issues – *assistive technologies for persons with disabilities.*

General Terms

Human Factors.

Keywords

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1. INTRODUCTION

Aphasia is a blanket term covering a broad spectrum of language loss brought about by head trauma: most often cerebral vascular accident (CVA) which is more commonly known as stroke. The Stroke Association cites the annual incidence of stroke in England and Wales as 130,000 of whom 120,000 are post retirement age. Importantly, though, because aphasia is a chronic condition, prevalence is higher than incidence which means that "more people are subject to the disorder, over a continuing period of time, than are afflicted by it at any one time" [1].

About a third of people who experience strokes are affected by aphasia, with other aetiologies increasing the overall incidence. According to The Stroke Association [3]:

"stroke has a greater disability impact than any other medical condition. A quarter of a million people are living with long-term disability as a result of stroke in the UK".

This figure is confirmed by the British charity Action for Dysphasic Adults, although the Stroke Research Unit at The Queen Elizabeth Hospital in Gateshead, UK, reports that 350,000 people are disabled in some way by stroke at any one time.

There are in fact a number of sub categories or syndromes of the condition including Wernicke's Aphasia, Broca's Aphasia and Global Aphasia, and people afflicted by aphasia can conform to one type or present a mixture of symptoms. Speech, reading, writing and aural comprehension can all be affected, with the condition manifesting itself in an inability to find the right word to say, or to name familiar people and objects, or to be able to decode complex sentences when reading, to name but a few of the common effects. This research is interested in addressing the problem of reading difficulty caused by aphasia, which is usually referred to as alexia, specifically with regard to comprehension of individual words.

Recovery from the condition is subject to several factors such as health, age (with a greater recovery rate among young people [5]), aetiology (there is a better prognosis for aphasia caused by head injury than that caused by stroke, which makes this a greater problem for the elderly), and treatment, since once past the acute stage, assessment and therapeutic intervention should aid recovery [2]. Remediation is primarily by means of clinical therapy administered by speech and language therapists but in the last 20 years computer based therapy and remediation has become an important and popular adjunct to therapy.

Computer based intervention is the concern of the research presented here. Many therapeutic interventions may cease after a period of around six months when an aphasic individual's recovery is seen to plateau. However, for the many people living with the condition there is still a keen desire to be able to engage in the day to day activities that they enjoyed pre-onset. As Triandafilou [4] observed: "many patients reached a point in their rehabilitation where they wanted to continue to work on areas of difficulty, but not in a formal setting. They craved participating in the same leisure activities they had before their stroke...reading promotes self-esteem, cognitive stimulation, and provides an outlet for general enjoyment and pleasure". The HAPPI project (Helping Aphasic People Process Information) is about allowing aphasic people to be able to re-engage with the reading process by simplifying the language that they find most difficult.

2. BACKGROUND TO THE PROJECT

At the University of Sunderland (UK), two previous projects sought to address alexia through the use of automatic approaches to text simplification. The first was the PhD research of Devlin [1] which looked at the feasibility of automatically simplifying the text of newspaper stories to a level that was understandable by aphasic people. The research covered both lexical and syntactic simplification but the practical developments covered lexical simplification alone. Devlin worked alongside people with

aphasia in developing her system which replaced difficult, infrequently occurring words with simpler synonyms. The second project was the PSET (Practical Simplification of English Text) project which led directly from Devlin's work. The PSET project was a collaboration between the universities of Sunderland and Sussex and looked at employing syntactic simplification using full sentence parses. It was funded by the UK Engineering and Physical Sciences Research Council (EPSRC) under the 1996 Research Programme in Speech and Language and ran until September 2000.

3. PROJECT OVERVIEW

The HAPPI project aims to help people to read by 'jogging the memory'. If a word is not understood, another word can be selected which has the same meaning but is a more common or easier word. This is achieved by using databases of words that contain information on the psycholinguistic properties of words – that is, how frequently the words occur, how familiar they are etc.

In order to make the system as widely available to as many users as possible the HAPPI project developed a prototype Web based text simplification system. This system was built around linguistic resources and tools that had been used in Devlin's previous work and the subsequent PSET project which were still widely in use in Natural Language Engineering projects worldwide. However, some of these tools had of course been further refined and newer versions of some were available for either academic research or had become freely available for commercial work. The primary difference between the tools used in previous work and the present day was the fact that now a small number were available in alternative formats. For example, part of a research project by Android Technologies had involved porting Princeton University's WordNet tool into a MySQL database format, which opened up the possibility of developing a text simplification tool in a modern Web language such as PHP. The advantages this progress offered were not only technical. It also provided a means to deliver a system to a much wider audience without the need for expensive equipment or a local installation of large scale software systems by an end user.

The linguistic tools deemed most suitable for providing the functionality required of the system are listed below. Both the academic value and commercial availability for future work were used as criteria when deciding which resources and tools to integrate in the HAPPI project:

- LT CHUNK Part of Speech Tagger (from Edinburgh University Language Technology Group using the Penn Treebank tag set)
- Android Technologies MySQL port of WordNet (from Princeton University)
- The Irvine Phonotactic Dictionary

The finished prototype system permits users to copy and paste news stories into the system and simplify them and was tested with a local Newspaper website from the North East of England. The simplification system takes three input parameters which control the number of synonyms considered while querying the WordNet database. It is thought that the final system will simply ask the user for a web address and the best input parameters will

be determined during user testing planned in the next phase of the project.

Additionally, research was also carried out to investigate allowing users to click on difficult words and be shown images of the concept that the word represents, or to hear the word being spoken - both measures that the psycholinguistics and aphasiology literature inform us would increase comprehension. As aphasia affects people differently, and even affects an individual differently day to day, there is a need to produce systems that attempt to counter problems in a number of ways. Such a multimedia approach would it is hoped counter any problems of linguistic property gaps, for example should the situation arise that there are no synonymous/hypernymous relations available in the (psycho)linguistic database for particular words. The advancement in both online speech tools and large scale online image databanks has permitted further refinement of the initial HAPPI prototype system to incorporate these additional factors.

4. FUTURE WORK

One of the key aims of the HAPPI project was to investigate the feasibility of taking forward the previous language simplification work of Devlin in light of recent developments in the aphasia literature and the related software. Having completed this preliminary study and development work, the next step in the study is the field testing of the current prototype systems. In parallel, further research and software development work will be undertaken to improve the accuracy of the simplification software. Among the possible, and in some cases necessary, future directions are: the incorporation of software for WSD (Word Sense Disambiguation), named entity recognition, and robust morphological analysis and generation; facilitation of more autonomous interaction between user and system i.e. allowing the user to select the words they wish to be simplified; image retrieval of concepts; use of additional psycholinguistic factors such as age-of-acquisition and imageability; and finally, further investigation of syntactic simplification measures.

5. ACKNOWLEDGMENTS

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