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Aphasia and interdisciplinarity

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Abstract

Aphasia is an acquired language impairment, which occurs due to a brain damage. In receptive aphasia speech production is more fluent but less meaningful. In expressive aphasia, the patient's intellect might be intact, but speech production severely damaged. In either case the psychosocial impact of this condition is significant. Although, there are several studies on aphasia in medicine, psychology and linguistics, the latter is rarely involved in researching aphasia by medical teams. A recent survey on awareness of aphasia involving 226 Romanian respondents (154 with medical background) showed that only one physician was aware that linguistics also has aphasia as a research focus. This paper describes how we see collaboration between linguistics and other fields of specialities interested in researching aphasia. *Medicine and Linguistics* Medical imaging could be particularly helpful in mapping how the adjacent areas of the damaged language centre of the brain overtake lost functions for a visual understanding of speech activation in aphasics. *Psychology and Linguistics*: According to the biopsychosocial approach, therapeutic methods could be tailored according to functions of the nervous system of the individual, which would improve the efficiency of the applied therapy. *Information Technology and Linguistics*: Assistive technology consists of computers and related devices to aid aphasics' communication and the relearning process. Speech analysis by PRAAT, a free computer software, shows that emotional elements can play the role of facilitating factors in the communication of aphasics. *Conclusions* In spite of the vast literature on aphasia we found little evidence of collaborative work among medicine, psychology, information technology and linguistics. Joint efforts may produce better results in understanding aphasia and subsequently can help to construct more productive methods for the benefit of these patients.

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1. Introduction

Aphasia refers to a disturbance or loss of language skills. It can occur due to a brain damage in the language centre (AMA, 2001). There are two main categories receptive or expressive aphasia. If Wernicke's area is affected, speech production is more fluent but less meaningful. If Broca's area is affected, the patient's intellect might be intact, but speech production severely damaged. Either way the psychosocial impact of this condition is significant. There is no specific treatment, but speech therapy may help recovery (Merck Manual, 2013).

Although, there are several studies published in medicine, psychology and linguistics on aphasia, when we search the internet for the keywords *aphasia* and *interdisciplinary* we mostly find articles on joint research performed by teams of different medical fields and rehabilitation (neurology, speech therapy, and neuropsychology) (see e.g., Jensen, 2015; Hoover, Waters, Caplan & Carney, 2013).

2. Survey on awareness

A Turkish study on awareness found that aphasia is a disorder little known to the public. Studies on awareness are rare and the authors think that educational programmes should be developed to increase public awareness (Mavis, 2007). According to the Aphasia fact sheet of the US National Aphasia Association, more people have aphasia (at least 1,000,000 people in the USA) than have many other common conditions (Lam, Wodchis, 2010). The United Kingdom tries to raise awareness via internet stating that although there are around 250,000 people suffering from aphasia in the UK, many have never heard of it (Connect, 2015).

Based on this idea we conducted a survey involving a total number of 226 respondents out of which 154 had medical background. The questionnaire focused mainly on awareness of aphasia and fields of specialities that deal with aphasia. Of the 154 respondents with medical background only one physician marked linguistics as a field of specialty that deals with aphasia. The surveyed healthcare practitioners knew nothing about neurolinguistics and psycholinguistics. Of the 72 respondents without any medical background, 68 had never heard of aphasia before. After filling in the questionnaire, they declared that they looked up the word in the dictionary. Only those respondents knew the meaning of the word who had already been in contact with aphasia through a family member or people from the surrounding community.

Aphasia is still little known by the public and requires further research by specialists. The question is how the various fields of specialities can find a common ground to aid a better understanding of this condition and diminish the psychosocial impact of this condition.

This paper describes how we see collaboration between linguistics and other fields of specialties interested in researching aphasia.

3. Medicine and Linguistics

Healthcare specialists who are mostly interested in conducting research on aphasia are usually members of a multidisciplinary team from the field of neurology, neuropsychology, rehabilitation, speech therapy and occupational therapy. Although neurology and neuropsychology help linguists understand the condition there is little evidence of joint research on aphasia.

When asking healthcare professionals about the idea of joint research teams they could envisage collaboration among the medical fields listed above and linguistics, but would never mention medical imaging.

In order to explain how we see the role of medical imaging in this context we would like to introduce the idea of robot-assisted gait training that uses a robotic device connected to a computer to help those with impaired ability to walk. The mechanism is still not clear, but specialists believe that "the repetitive walking pattern helps the brain and spinal cord work together to re-route signals that were interrupted by injury or illness". A computer with sensors measures and estimates the activity of a patient providing performance-related feedback to the patient and therapist. (Banz, Bolliger, Colombo, et al. 2008)

Based on this idea medical imaging could aid the development of a similar methodology. The combination of positron emission tomography with computer tomography imaging makes 4D mapping and visualization of speech activation possible in aphasic patients. This visual assessment of how adjacent areas of the damaged language centre

of the brain overtake lost functions during repeated speech activation could help linguists and speech therapist understand and monitor the process of relearning in an aphasic brain.

Figure 1 is an example of speech activation in a stroke patient. The brain of an aphasic patient was a sealed “black box” not so long ago, but recently introduced imaging techniques make possible to access the records of the cerebrovascular events.

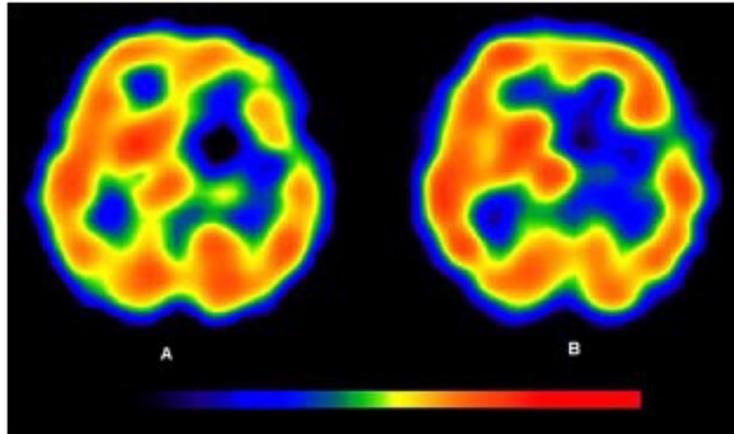


Fig 1. SPECT (Single Photon Emission Computer Tomography) images of transversal sections of the brain.

(A) idle and (B) speech activation in a right-handed stroke patient. Image B displays the areas that support speech activation. The hemispheric shift shows the limited recovery of the speech function. (Borbely, 2005)

4. Psychology and Linguistics

The biopsychosocial model was created to better understand health versus disease or illness in relation to the complex interaction among biological, psychological, and social factors rather than merely relying on biological aspects.

According to Gilbert Paul (2002), the “biopsychosocial approach could offer a powerful integrating framework for clinical psychology once we are clear about its true holistic nature. Clinicians are aware of this concept, but few of them adopt it in their clinical practice or research. The main reasons are that clinicians do not understand it and it calls for radical shifts in research, training and practice”.

Individual differences should also be taken into consideration. There have been few studies on elementary differences like gender, however evidence show that this is an important feature in relation to stress and the evolution of different disorders.

Concerning further individual differences, the ancient Greeks described four temperaments - choleric, sanguine, phlegmatic and melancholic. The Myers-Briggs Type Indicator (MBTI) was compiled to understand the differences and similarities in human personalities, based on the psychological theory of Carl Jung, who believed that personality traits are inherited or innate. The 16 MBTI personality types can be useful in developing strategies for efficient communications, successful relationships and ways of learning, (Personality Types and Learning, 2015) including aphasics’ relearning process. All these individual differences suggest that personalized therapies tailored to the patients’ needs would provide much better results.

5. Information Technology and Linguistics

We can assert that in researching aphasia Information Technology is one of the best friends of linguistics. There are several examples of good collaboration.

PRAAT (the Dutch word for "talk" or "speak"), developed by Paul Boersma and David Weenink in 1995 is a free and flexible, continuously updated computer software to perform speech analysis. A PRAAT tutorial for clinicians in the field of communication disorders was compiled at Stanford University, which offers “a wide range of standard and non-standard procedures, including spectrographic analysis, articulatory synthesis, and neural networks”. (Lieshout, Pascal van 2003)

The representation of basic emotional elements in a speech diagram, the spectrum and intensity curves of these elements provide a visual base for comparison. Speech analysis shows that emotional elements can play the role of facilitating factors in aphasics' communication (Gyorfi, 2010).

A further useful tool is the free, on-line AphasiaBank (MacWhinney, 2007), a rich database for researchers that comprises 393 protocols from 286 different persons with aphasia (PWA), 190 controls with protocols, 19 PWA each reciting from 12 scripts, transcribed and linked to video, 91 PWA with the Famous People protocol (designed for those with limited spoken language), video only, 46 Aphasia Group videos.

Aphasia assistive technology consists of computers and related devices to aid and, in some cases, to facilitate communication and help the relearning process. These are computers, tablets and smartphones with softwares specifically developed for aphasics: talking devices, speech generating devices, sentence software, etc. (Albyn Davis, 2013)

6. Conclusions

In spite of the vast amount of literature on aphasia research we find little evidence of collaborative work among medicine, psychology and linguistics.

Raising awareness and the idea of interdisciplinarity in countries like Romania would be imperative.

Joint forces between medical imaging and linguistics may definitely produce better results in understanding aphasia and could help develop more productive methods for the benefit of these patients, similar to robot-assisted gait training.

New therapeutic methods tailored to the diverse functions of the nervous system could be developed, which might significantly improve the efficiency of the applied therapy.

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