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Testin the Multimodality Hypothesis: Learning Printed Words With and Without Auditory and Gesture Feedback

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Document Abstract

Most AAC applications use multiple representations of concepts: orthographic, pictographic, auditory, and gestural information are often combined. The underlying hypothesis is that multimodality facilitates learning and processing. Clinicians want to use multimodality in strategic ways to increase learning and speed of processing. The present study looks at learning curves of pseudo-words that have been associated with different types of additional modalities. The study explores if the associated modality will be stored as attached information to the international presentation of the words. If this is the case, it is important to know which modalities provide (or hinder) effective learning. If auditory feedback (provided by a speech-generating device) helps to learn and remember new words, then it may be recommendable to use speech-generating devices for establishing and reinforcing an internal phonology as part of internal lexical representation. Furthermore, it is important to explore if gestural modalities (gestures and/or manual signs) have a similar reinforcing effect, which would give strength to the hypothesis of a multimodal nature of the internal lexicon. It would add evidence to the practice of using manual signs as part of Augmentative and Alternative Communication (AAC).

Research Description

Introduction/ background

Multimodality is the term used to describe the practice of communicating through a combination of natural speech, written language, gestures and manual signs, device-generated speech output, and graphic symbols. Typical communicators have been described as on-line detectors of which configuration of communication modes works best at any given time for a direct person-to-person communication. Augmentative and Alternative Communication (AAC) seeks to maximize the human potential of flexibility in modality use by determining which modalities are accessible and learnable by individuals with limited natural speech.

Related to this description, multimodality also refers to an internal network of symbols in multiple modalities. Typical language users who are literate have developed

mental representations of written words connected with those of spoken words. AAC users capitalize on this potential by extending this modality with other graphic symbol as well as gestural representations.

A preliminary study was conducted in 2008 by our team in the United States and France (we reported on this study in a poster at ASHA 2008). That study was limited to the effects of auditory speech input (through a speech-generating barcode reader (an AAC device)) and was focused on determining the probability that speech/auditory input would facilitate internal phonological representations - hence better recall. We found a strong positive effect of the auditory feedback on recall of complex words. The effect on recall of simple words was not clear, probably because learning reached ceiling after few probes.

Gestures, by definition, are complex hand movements that convey communicative signals during message exchanges between senders and recipients. Gestures serve internal and external functions that both have a significant impact on communication skills (Lozano & Tversky, 2005). There is a growing body of research on how gestures internally facilitate spoken language for speakers. In contrast, relatively limited research has been done to investigate the role of gestures from the recipients' perspective— how gestures utilized by message senders (i.e. communicative partners, such as parents, therapists, or teacher) affect their recipients (such as children or second language learners) in language developing and learning. Clinically, gestures provide valuable information in diagnosis, prognosis, goal selection, and intervention. Therefore, viewed as a facilitator of language learning, gestural inputs have been used to facilitate children's language learning in some clinical practice, such as direction following, word retrieval, or development of an idea (Capone, 2004). In addition, there is a vital connection between language and gesture not only in children language development, but also in second language acquisition, (McCafferty & Stam, 2008). Therefore, this study is proposed to shed light on external functions of gestures in language acquisition and learning from (language) recipients' perspective.

Purpose

The purpose of this study is to investigate the effects of multimodality inputs (auditory and visual stimuli) on orthographic recall of pseudowords. Additional modalities are demonstrating favorable effects on language learning. Therefore, this study is proposed to investigate to what extent the combination of additional modalities can produce maximal facilitation. Two types of additional modalities, auditory (i.e., pronunciations of the pseudowords) and visual aids? (i.e, gestures) are utilized in this study. In addition, two types of gestures, iconic and phonological gestures, are employed to further examine which types of gestures will yield a greater effect on orthographic recall. The auditory and gestural stimuli correspond with 32 pseudowords to generate six different modalities, (1) no auditory input nor gesture, (2) auditory input only, (3) iconic gesture only (4) phonological gesture only, (5) auditory input and iconic gesture, and (6) auditory input and phonological gesture. The study is run parallel and simultaneously with participants in the United States, France, and Belgium. The multi-national (cross-linguistic) approach allows us to investigate the robustness of multimodality phenomena across languages and countries (culture?).

Each participant is asked to learn 32 pseudowords presented via six levels of modality conditions during each of four trials. Orthographic recall will be assessed to measure pseudoword learning outcomes following each of the four consecutive learning trials.

Research questions:

1. Whether providing supplemental modalities (e.g., visual and/or acoustic input) facilitate novel word learning?
2. Which additional modality or combination of two modalities yields greater effects on word learning?
3. Do learning outcomes indicate a significant difference between the employment of two types of gestures (iconic or phonology-related)
4. Does learning outcome show significant differences between three language groups?
5. What are the learning curves of the words (throughout 4 sessions) among different additional modalities?

Methods

The study is designed to investigate the effects of six conditions on word learning. All of the twenty student participants were exposed to all 6 treatment conditions (described below) to learn 32 printed pseudowords over four consecutive sessions. Each pseudoword is linked with a picture of a concrete object and one of the six treatment conditions, shown as follows.

1. Condition 1: printed words and pictures presented incorporating neither auditory input (the sounds of the pseudo words) nor gestures.
2. Condition 2: printed words and pictures presented with auditory input only.
3. Condition 3: printed words and pictures presented with iconic gestures only.
4. Condition 4: printed words and pictures presented with phonological gestures only.
5. Condition 5: printed words and pictures presented with both auditory input and iconic gestures simultaneously.
6. Condition 6: printed words and pictures presented with both auditory input and phonological gestures simultaneously.

The following are the descriptions of two types of additional modalities.

Auditory input: Words are generated with freeware speech-generated software that emulate a female Romanian speaker. The Romanian speaker is selected because we want a phonology and articulation system that is not English (nor French or Dutch, the languages in which we anticipate to conduct future comparative research)

Visual input: Two types of gestures will be employed as visual inputs in this study, including (1) iconic gestures corresponding to the picture/semantics of words, and (2) phonological gestures, which has a correspondence to the initial and last phoneme (letter) and the syllable structure. The two types of gestures are demonstrated by the same person and recorded onto video clips, which allows us to standardize the given stimuli. The iconic gestures adopted in this study are selected from the simplified sign system, a highly iconic gestural system developed by Bonvillian and his associates.

All stimuli in the four conditions are presented through PowerPoint slides to provide consistency of all treatment conditions to all participants in all settings.

Results

Previous results had shown that a multimodality effect varies depending on the complexity of the words. The results of the study indicate that all participants did make significant learning gains in all conditions – at the fourth probe, many of the participants had learned all the words. The first results showed an advantage of the speech-generated auditory feedback. This advantage is more pronounced for the phonologically complex word (four-syllables) than the less complex words. The more challenging the structure of the word is, the more the learner seems to benefit from acoustic-phonological information. Initial inspection of the results indicates that there is no significant effect of the phonology of the participants' native language (English vs. French). These limited data favor the hypothesis that an internal phonological representation can be built based on the auditory feedback from the device.

Result analysis of the present study is under way at the moment of submission of this proposal.

Conclusions

The present study intends to provide evidence for a model of multimodality and our understanding of its effects on Augmentative and Alternative Communication. The data seem to suggest that multimodality effects on learning will vary depending on degrees of complexity of the stimuli.

Clinical applications

This study provides evidence for the potential of auditory feedback in establishing an internal phonology. The use of speech-generating devices may therefore be beneficial for more than direct person-to-person communication. The use of speech devices could be integrated in therapeutic and educational activities that are geared at reinforcing internal phonological representations (including literacy-oriented activities).