Critical Review:

Does the use of atypical items in semantic based naming treatment for individuals with anomia related to aphasia result in more efficient generalization to untrained items when compared to the use of typical items?

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This critical review examines the impact of the use of atypical items versus typical items on generalization to untrained items in a semantic based treatment for individuals with aphasia who have naming deficits. A literature search yielded 5 papers with single subject experimental design with multiple baselines. Overall, the literature reviewed indicates that training atypical category items results in more generalization to untrained items. The clinical implications and future recommendations of these findings are discussed.

Introduction

Aphasia is a language impairment that results from neurological injury to the brain (Kiran & Bassetto, 2008). Naming deficits are common to all aphasia types and various intervention approaches exist for treating word-finding deficits (Kiran & Bassetto 2008). This critical review will be focusing on one such treatment approach, namely, the typicality treatment approach. The typicality treatment approach is a semantic based treatment that involves the use of semantic feature analysis with items varying in complexity. (Kiran & Bassetto, 2008). Semantic feature analysis treatment involves using a feature analysis chart where individuals with word finding deficits are asked to generate semantic features of the target concept. (Boyle, 2010). The underlying assumption of the typicality treatment approach is that it enhances access to target semantic representations as well as semantically related neighbours, which consequently results in activation of its corresponding phonological representations. (Kiran &Bassetto, 2008)

Several studies examining semantic based treatment have been successful in improving naming to items that are directly targeted in treatment (Boyle, 2010). However, a number of these studies have found limited generalization to untrained items (Kiran, 2007). Generalization to untrained structures is an important clinical outcome to successful treatment especially in a health care system where the duration of aphasia treatment is limited to few sessions (Kiran, 2007). There are several variables that can vary in this approach, including the complexity and familiarity of items. It is important to systematically investigate the impact of these variables on the efficiency and effectiveness on treatment, one such variable is the typicality of items, that is, how characteristic of the category an item is. Investigating the impact of typicality in semantic based treatment will enable us to make informed decisions during selection of items in therapy. Consequently, this could impact patients with aphasia in terms of reducing duration of treatment (Kiran, 2007) and improving communication ability, thus enhancing quality of life.

Evidence that atypical examples have a different status within a category, comes from studies showing that participants name typical items more than atypical items during verbal fluency tasks (Mervis & Rosch, 1975). Additionally, studies using online verification tasks of animate categories (birds and vegetables; Kiran & Thompson, 2003) and inanimate categories have found that typical examples had a faster response time than atypical examples. This effect was described as the typicality effect (Kiran, 2007). Atypical examples are defined as having more distinctive features shared by few examples in the category and are more distinct from the category prototype. A category prototype is a generic representation of the common features of the category taken as a whole (Kiran, 2007). Typical examples possess more prototypical features, fewer distinctive features and have a lot of shared features with other typical examples (Kiran, 2007). Based on these featural differences within a category, a semantic complexity hierarchy can be derived (atypical items are more complex than typical times). Norming procedures were utilized for the selection of atypical and typical examples within a category.

The Complexity Account of Treatment Efficacy (CATE) predicts that training of complex items will result in greater generalization (Thompson, Shapiro, Kiran & Sobeck, 2003). Support for the CATE comes from previous findings related to the training of complex syntactic structures in adults with agrammatic aphasia (Thompson, Shapiro, Ballard, Jacobs, Schneider & Tait, 1997). The CATE has also been investigated in naming treatment (Kiran &Thompson, 2003). The studies reviewed in this critical review examine the

effects of treatment that proceeds from complex to simple category items (atypical to typical) compared to treatment that proceeds from simple to complex items (typical to atypical). Based on the CATE, it was hypothesized that treatment of atypical items in a semantic based treatment would result in greater generalization.

Objectives

The primary objective of this paper is to critically appraise the existing literature on the effectiveness of using semantically complex items versus simple items for facilitating generalization to untrained items in a semantic based naming treatment for individuals with aphasia. Evidence based recommendations regarding the clinical value of these findings will also be discussed.

Methods

Search Strategy

Computerized databases, including PubMed, CINHAL ScienceDirect and ASHA publications were searched using the following key terms: ((Anomia) OR (word finding deficits)) AND ((semantic naming treatment) OR (semantic treatment)) AND (typicality) AND (generalization). Reviewing the reference list of retrieved articles yielded further studies for review.

Selection Criteria

Studies included in this critical review were limited to studies investigating the effects of CATE on semantic based naming treatment in adults with aphasia. No limits were set on the demographics of research participants (i.e. time post onset of stroke, type and severity of aphasia) or outcome measures.

Data Collection

Results of the literature search yielded 5 articles that met the above mentioned selection criteria. All of the studies employed a single subject experimental design.

Results

Single Subject Designs

Single subject designs can be carried out with one participant or replicated across participants to discover whether the behavior being studied changed after the introduction of the intervention (Logan, Hickman, Harris & Heriza, 2008). Crucial aspects of the design in rigorously testing the cause and effect hypothesis regarding the introduction of the intervention include the number of measurements compared in the baseline and treatment phases, and the replication of the effect using a phase-in approach called multiple baselines. Single subject designs are suitable for testing hypotheses in individuals with aphasia and naming deficits due to the heterogeneous and small subject population. Interpretation of results should be made with caution due to the small sample size and potential selection biases.

Kiran and Thompson (2003) investigated the effect of training atypical versus typical items of two animate category exemplars (birds and vegetables) on generalization to untrained items using a multiple baseline treatment design with four participants with fluent aphasia. Outcome measures included standardized tests commonly employed in this type of research administered before and after treatment, and probes (naming of trained and untrained words) measured during baseline (3-5 measures), treatment (every second session), and at follow up (1 measure). The order of categories trained and typicality (atypical or typical) of stimulus sets were counterbalanced across participants. Treatment was administered twice a week for 2 hour sessions and was discontinued when naming accuracy reached 87% or when a total of 20 treatment sessions was completed. Treatment focused on 4 tasks: 1) naming the picture, 2) sorting pictures by category, 3) identifying semantic attributes applicable to the target from a set of category features and 4) answering yes/no questions regarding the semantic features of the target item. Results analyzed using visual inspection indicated that participants trained on naming atypical items demonstrated generalization to untrained typical items and participants trained on typical items did not demonstrate generalization to untrained typical items. This effect was replicated on 3 out of the 4 participants. Post-treatment, all 4 participants demonstrated improvements on the standardized language tests.

Despite the heterogeneous population, researchers attempted to control for several factors by using a participant selection criteria that included a single left hemisphere stroke, fluent aphasia, pre-morbid right handedness, at least a high school degree, onset of stroke at least 9 months prior to participation of the study, monolingual, and the absence of hearing and visual deficits. The duration of which each participant was involved with the treatment protocol varied. This study would have benefited from additional statistical analysis (i.e. effect size, c-statistic) to assist in comparing performance across phases. Appropriate statistical tests (i.e. chi-square) were utilized for error analysis which showed significant effects for all participants. There was a decreases in the proportion of general responses and increase in specific errors, order of treatment had no effect on the nature of errors produced. A stable baseline was established and appropriate number of data points were used for each participant. However, information with regards to the

untrained probes was not described in detail. Acceptable inter-rater reliability was reported for measures taken during the treatment.
Overall, this study provided compelling evidence that generalization occurs to untrained items when atypical examples are used and the same effects were not seen when typical items were used in training.

In a similar study, **Stanczak, Waters and Caplan (2006)** investigated naming in 2 participants with anomic aphasia using 2 animate categories. Outcome measures included standardized tests commonly employed in this type of research administered before and after treatment, and probes (naming of trained and untrained words) measured during baseline (4-7 measures), treatment (every other session), and at follow up (1 measure, 6-7 weeks post-treatment). The order of categories trained were counterbalanced across sessions and the order of items within each category was kept constant. Treatment was administered once a week for 2 hour sessions and was discontinued when 7/8 items were name in either semantic category. The treatment protocol consisted of a 3 step process: 1) naming the picture, 2) feature verification task and 2) naming the picture again. Results were analyzed using visual inspection and appropriate statistical analysis was used (C-statistic). A stable baseline was established and there were appropriate number of data points to measure change. Results from this study indicated that 1 of the 2 participants trained using atypical items demonstrated generalization to untrained items as well as marginally significant generalization from trained typical items to untrained atypical items and demonstrated improvements on the BNT. This pattern was not observed in the second participant.

The participants were matched in terms of handedness and language spoken. However, the participants differed in terms of site of lesion, post stroke onset and type of aphasia. Hearing and vision of the participants were not accounted for. These factors could have impacted the outcome of the treatment and the researchers utilized these differences in their discussion on the effectiveness of the treatment. Inter-rater reliability was not reported in this study. Stanczak et al. (2006) attributed the difference in findings to the use of a modified treatment protocol compared to the Kiran et al. (2003) study as well as the use of a different generalization criterion and varying participation profile.

Overall, this study provided suggestive evidence that generalization can occur to untrained items when atypical examples are used.

Kiran and Johnson (2008) examined the effect of typicality training in 3 participants with anomic aphasia in two well-defined categories (shapes and females) using a multiple baseline experimental design. Outcome measures included standardized tests administered before and after treatment, and probes (naming of trained and untrained words) measured during baseline (3 measures), treatment (every second session), and at follow up (1 measure). The order of typicality was counterbalanced across participants. Treatment was administered twice a week for 2 hour sessions and the total number of treatment sessions varied among the participants (8-18 weeks). A treatment protocol similar to the Kiran and Thompson (2003) study was used with the addition of a 5^{th} step which included naming the target again. Results were analyzed using visual inspection and statistical tests (effect size and C-statistics) which indicated that all 3 participants demonstrated weak acquisition effects and 2 out of the 3 participant's demonstrated generalization to untrained typical examples in one category when trained using atypical examples. To explain the negative findings, the researchers concluded that acquisition and generalization effects within well-defined categories are overshadowed by their inherent abstractness making them difficult to train.

The researchers ensured that the participants were matched in terms of language spoken, handedness, type of aphasia, site of lesion, level of education, time post-onset and all passed hearing and vision tests. The number of treatment sessions that each participant was involved in varied. Inter-rater reliability was 100% and the outcome assessor was blind to the purposes of the study. Standardized assessments were repeated within 4 months of initial assessment, a larger duration is usually expected prior to re-testing.

Overall, this study provided suggestive evidence that generalization occurs to untrained items when atypical items are used within a well-defined category.

Kiran (2008) extended her previous work; this study examined naming within two inanimate categories (furniture and clothing) in five participants (3 fluent aphasia and 2 non fluent aphasia with apraxia) with aphasia, using a multiple baseline experimental design. Outcome measures included standardized tests commonly employed in this type of research administered before and after treatment, and probes (naming of trained and untrained words) measured during baseline (3 measures), treatment (every second session), and at follow up (1 measure). Treatment was administered twice a week for 2 hour sessions and the treatment was terminated when 80% accuracy for naming was achieved or a total of 20 sessions was completed. The order of typicality (atypical or typical items) and category trained were counterbalanced across

participants. The same treatment protocol that was used in the Kiran and Thompson (2003) study was utilized. Result analyzed using visual inspection and appropriate statistical analysis (non- parametric spearman rank correlation and effect size) indicated that 2 out of the 4 participants trained on naming of atypical examples demonstrated generalization to naming untrained typical examples. The researcher concluded that the typicality-based naming treatment works well for some patients with aphasia.

The participants were matched on the following: handedness, level of education, passed hearing and vision screening, language spoken and time post onset. The participants differed in terms of the type of aphasia and comorbidity. The 5th participant terminated treatment prematurely and was not included in the final results. Inter-rater reliability was 100% and error analysis was carried out by an assessor blind to the study.

Overall, this study provided suggestive evidence that generalization occurs to untrained items when atypical items are used.

Kiran, Sandberg and Sebastian's (2011) study is a further extension of previous studies (Kiran, 2008; Kiran & Johnson, 2008; Kiran & Thompson, 2003). This study examines the effect of typicality within 2 goal-derived categories (i.e. things at a garage sale and things to take camping) in 6 individuals with fluent aphasia (4 with anomic aphasia and 2 with conduction aphasia). Outcome measures included standardized tests commonly employed in this type of research administered before and after treatment, and probes (naming of trained and untrained words): measured during baseline (3-5 measures), treatment (every second session), and at follow up (1-3 measures). The order of typicality was counterbalanced across participants. Treatment was administered twice a week for 2 hour sessions and the total number of treatment sessions varied among the participants and treatment was terminated when naming accuracy reached 80%. Results analyzed using visual inspection and appropriate statistical analysis (effect size, Wilcoxon matched paired tests and hierarchical cluster analysis) indicated that training atypical examples in the category resulted in generalization to untrained atypical examples in 5 participants. Training typical examples produced mixed results.

Participants were selected based on previous selection criteria used by Kiran et al. (2003, 2008). With the exception of the age range of participants being significantly larger (age 39-84) compared to previous studies. The treatment protocol was explained in detail to allow for replication and was slightly different compared to previously used treatment protocols. The treatment protocol included: 1) category generation 2) category sorting 3) feature generation/selection 4.) yes / no feature questions. Despite the treatment being counterbalanced, not all participants complete the entire treatment protocol.

Overall, this study provides compelling evidence that generalization occurs for untrained items when atypical items were used in naming treatment.

Discussion

Overall, the results from these studies indicate that using atypical items in a semantic based naming treatment does result in better generalization when compared to using typical items.

There was preliminary suggestive evidence that individuals with fluent aphasia appeared to demonstrate greater benefit with the use of this treatment approach (Kiran, 2008) compared to patients with non- fluent aphasia. In addition, certain types of categories (animate and inanimate) showed greater improvements in generalization when compared to the use of well-defined categories.

Four of the studies by Kiran et al. were well designed and described. These studies do challenge the clinical notion of errorless training (simple to complex). However, as the 4 studies from this critical review have been studied by the same author, the possibility of researcher bias should be considered.

In addition, the results of the studies should be interpreted with caution as 3 of the studies (Kiran & Thompson, 2003; Kiran & Johnson 2008; Stanczak et al. 2006) did not describe the untrained probes in detail and did not account for the possibility that frequent probing using the untrained items can affect the outcomes of the study (Nickels , 2002; Howard, 2000). Howard (2000) reported that participants with aphasia improved in their ability to name when they were repeatedly exposed to the untrained items but did not improve in their ability to name the set of untrained items that were only presented a single time before and after treatment. Kiran et al.'s (2008, 2011) studies included analyses to account for these factors. Variation in treatment protocol as well as participation profiles and limited number of subjects used in the above studies are factors that could reduce the strength of the evidence.

Future research considerations:

It is recommended that further research be conducted to replicate and confirm the effectiveness of generalization using atypical items. To strengthen the evidence future research designs could consider the following recommendations:
1) Using more subjects to increase the confidence in implementing this treatment in a clinical setting.
2) Utilizing appropriate statistical analysis to account for the frequency in which untrained probes are used and the impact they have on the outcome of the treatment.
3) Incorporating a consistent treatment protocol to allow for comparison between studies.
4) Assessing factors that affect learning and generalization in order to maximize the impact of the intervention.

Clinical Implications

The evidence provided by these studies is suggestive and requires further research prior to implementation in a clinical setting. Implementing this treatment protocol may prove challenging due to the lack of norming data available for each semantic category. Clinical application of this treatment approach should be used with caution considering the heterogeneous nature of the disorder and ensuring that categories selected in treatment do have real world utility.

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