A theoretically motivated approach of receptive language assessment based on an interactive spreading activation account of language processing

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Introduction

In interactive models of receptive language processing such as Dell (1986) and Martin and Safran (1992) (Figure 1), spreading of activation between language levels is determined by 2 properties:

- **Decay rate of phonological, lexical and semantic activations**

  A decay impairment leads to a reduced impact of phonological representations, activated first and thereby suffering to a greater extent from the severe decay rate, as opposed to semantic representations.

- **Connection strength** between phonological, lexical and semantic levels of representation

  A reduced connection strength leads to an increased impact of phonological variables, and a reduced impact of lexical and semantic variables.

These two processing impairments can parsimoniously explain the co-occurrence of a number of language processing impairments in aphasic patients where classic box-and-arrow-type models of language processing need to posit the existence of multiple deficits.

Aim

Illustrate the parsimony of interactive models of language processing via the case study of patient MF, presenting a constellation of aphasic symptoms that can be explained as resulting from an abnormally increased decay rate of language activation.

Method

Participants

MF (aged 52) is an aphasic patient with a left hemisphere ischemic lesion and has subtle speech comprehension impairments. The control group is composed of 15 normally developing adults (mean age: 55 years).

Tasks

- **Minimal pair discrimination** with natural and temporally slowed stimuli if decay impairment, greater difficulties for slowed stimuli
- **Auditory lexical decision** with phonologically and semantically related primes if decay impairment, reduced phonological priming effect
- **Judgement of synonyms** for high and low imageability words if decay impairment, reduced performance for high imageability words
- **Single word repetition** for high or low imageability words
- **Disyllabic nonword repetition** if decay impairment, reduced performance

Discussion - Conclusion

The interpretation of MF’s language processing deficits differs according to theoretical approaches:

- **According to interactive models**: a single decay rate impairment (as expressed by a reduced impact of phonological variables as opposed to semantic variables) explains all aphasic symptoms.
- **According to classic box-and-arrow models**: multiple deficits have to be posited at the level of speech perception (auditory analysis system), phonological processing (acoustico-to-phonological conversion), lexical-semantic access (auditory input lexicon and to semantic system) and short-term memory.

MF illustrates the conceptual parsimony of computational accounts of language processing and their usefulness for the assessment of aphasia.

Results

<table>
<thead>
<tr>
<th>MF’s performances</th>
<th>MF Control group</th>
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<tr>
<td><strong>Minimal pair discrimination</strong></td>
<td>99 %, 96.9 % - 100 %, 91.3 % - 100 %</td>
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<tr>
<td><strong>Auditory lexical decision</strong></td>
<td>64.3 % * , 79.7 % - 92.8 %, 82.9 % - 91.1 %</td>
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<tr>
<td><strong>Judgement of synonyms</strong></td>
<td>23 ms * , 104 ms - 283 ms, 88 ms - 79 ms - 124 ms</td>
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<td><strong>Single word repetition</strong></td>
<td>374 ms, 301 ms - 425 ms</td>
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<tr>
<td><strong>Single nonword repetition accuracy</strong></td>
<td>98 %, 98.8 % - 100 %, 94 %, 98.8 % - 100 %</td>
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<td>* Indicates performance significantly different from controls according to the modified t-test by Crawford &amp; Garthwaite, 2000</td>
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References