Applying Main Concept Analysis (MCA) to analyze spoken discourse by Cantonese speakers with aphasia and unimpaired individuals

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Introduction

- **Main Concept Analysis (MCA; Nicholas & Brookshire, 1995)** is a content-based analytic approach that focuses on the quantification of presence, accuracy, and completeness of essential information in oral discourse by persons with aphasia (PWAs).
  - more comprehensive and multilevel coding of PWAs’ spoken output
  - able to distinguish PWAs from controls using single and sequenced pictures, in *English* (Kong, Whiteside, & Bargmann, 2016; Nicholas & Brookshire, 1993, 1995), Cantonese (Kong, 2009), and Mandarin (Kong & Yeh, 2015).

**MCA measures**

A main concept should contain only **one main verb** and provide an outline of the gist depicted in a picture, or an outline of the essential steps in a procedure.

1. **# of Accurate and Complete (AC) concepts**
   - E.g. **The man (tried to) save the girl.**
   - 孫人(驚/驚)嘗試救那個女人
2. **# of Accurate but Incomplete (AI) concepts**
   - E.g. **The man saved someone.**
   - 孫人 賞救一個女人
3. **# of Inaccurate but Complete (IC) concepts**
   - E.g. **The girl was saving the man.**
   - 女仔/女仔嘗試救這個男人
4. **# of Inaccurate and Incomplete (II) concepts**
   - E.g. **The girl tried to save the man.**
   - 女仔嘗試救這個男人
5. **# of Absent (AB) concepts**
   - E.g. none of the essential information in a main concept is given
6. **Overall main concept score (MC score):**
   - “3xAC + 2xAI + 2xIC + 1xII”
7. **# of AC per minute (AC/min)**

Aims

1. **To establish the MC lists for tasks of storytelling, procedural description, single & sequential picture description**
2. **To examine effects of age, gender, educational level, & genre type on discourse performance in unimpaired speakers**
3. **To determine how well MCA differentiated between fluent & non-fluent PWAs**
4. **To investigate how factors of fluency status, semantic processing integrity, & naming ability would predict PWAs’ MCA performance**

Method

- **Language samples were extracted from the Cantonese AphasiaBank**
  - 150 neurologically-unimpaired native Cantonese speakers
  - 105 PWAs
- **Aim 1:** Relevant concepts (RCs) mentioned by all unimpaired participants were tallied.
  - **Target MCs -** RCs produced by at least 25% of the speakers, together with acceptable vocabulary
- **Aim 2:** *four-way mixed ANOVAs* were used to analyze effects of tasks, gender, age (18-39 years, 40-59 years, +60 years) and education (High and Low), as well as their interaction effects on MC score and AC/min
- **Aim 3:** *one-way ANOVAs* to compare fluent and non-fluent PWA’s performance across tasks, as measured by standardized MC Z-score and AC/min
- **Aim 4:** A **stepwise multiple regression** was conducted

Results

### Aim 1

<table>
<thead>
<tr>
<th>Task</th>
<th>Total MC</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequential picture description 1 (Broken Window)</td>
<td>10</td>
<td>The boy kicked the ball to window, the man looked at the window</td>
</tr>
<tr>
<td>Sequential picture description 2 (Refuse Umbrella)</td>
<td>14</td>
<td>The mother gave the boy on umbrella, the boy looked at the umbrella</td>
</tr>
<tr>
<td>Single picture description 1 (Flood)</td>
<td>7</td>
<td>The flood was coming</td>
</tr>
<tr>
<td>Single picture description 2 (Cat Rescue)</td>
<td>17</td>
<td>The boy was chasing the cat, the man saved the cat</td>
</tr>
<tr>
<td>Procedure description (Egg and ham sandwich)</td>
<td>12</td>
<td>To cut the egg, &amp; mix with the ham</td>
</tr>
<tr>
<td>Story telling 1 (The tortoise and the hare)</td>
<td>13</td>
<td>The hare was faster than the tortoise, the tortoise got the trophy</td>
</tr>
<tr>
<td>Story telling 2 (The boy who cried wolf)</td>
<td>17</td>
<td>The boy was crying/wolf, the man went to the village</td>
</tr>
</tbody>
</table>

### Aim 2

- **Significant main effects age and education were found for standardized MC score**
- **Younger > Older groups:** MC scores, AC/min
- **High > Low Education groups:** MC scores

### Aim 3

- **Fluent PWA > Non-fluent PWA**
- **General performance on all tasks**
- **Significantly better standardized MC Z-score and AC/min**

### Aim 4

- **Naming (of action/object) was a significant predictor for MC score**
- **Fluency status was a significant predictor for AC/min**
- **In short, PWA who had a higher word retrieval integrity would perform better in MCA, and fluent PWAs was more efficient in producing AC concepts than non-fluent PWAs**

Reliability

- **Intra- and inter-rater reliabilities** (based on calculation of 10% of randomly selected PWA and control samples): 83.2% or better point-by-point agreement and at least 0.92 Pearson correlations of all MC scoring

Discussion

- **High level of inferencing is needed for single picture description tasks. Ideas produced were more heterogeneous, and target MCs were less likely to be mentioned.**
- **Dialogic speech was common, especially in storytelling tasks, for both speakers groups.**
- **Visual complexity of stimuli and familiarity of topic also seemed to contribute to PWA’s difficulty in producing the discourse.**
- **A more refined scoring system that can better reflect performance along the accuracy-completeness continuum is suggested.**
- **‘Coherence’ or ‘temporal sequence’ of MCs mentioned was not addressed currently.**

Key references


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