Sensory Simulation, Motor Simulation and Mentalizing during Narrative Reading: Insights from Eye-Tracking

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Introduction

People engage in simulation when they become part of a narrative. Three kinds of simulation can be identified: motor simulation, sensory simulation and mentalizing1.

Each kind of simulation affects reading, behaviorally2-5 and neurally6-11.

In this study we had two questions:

RQ 1: Can we disentangle distinct roles of motor simulation, sensory simulation, and mentalizing in reading?

RQ 2: Are there individual differences in the effect of simulation on reading?

Methods

102 participants (81 female, M = 23.27 years, range 18-40) read the same three short stories with no extra task (natural reading).

Gaze durations to each word were identified using eye-tracking.

Additionally questionnaires were presented:
- Story World Absorption Scale (SWAS)12
- Story Appreciation Questionnaire
- Reading Habits Questionnaire
- Author Recognition Test (ART)13
- Interpersonal Reactivity Index (IRI)14

Results

On average, motor simulation resulted in shorter gaze duration (faster reading), whereas sensory simulation and mentalizing resulted in prolonged gaze duration (slower reading), as can be seen in Figure 1.

Analysis Step 1

1. The SWAS consists of the subscales Transportation, Mental Imagery, Emotional Engagement and Attention. The Story Appreciation Questionnaire consisted of the components Positive Affect 1 based on the story using feeling and emotions, Positive Affect 2 based on the story using feeling and emotions, Emotional Engagement 1 found the story beautiful, engaging 1, capturing, interesting; Emotional Engagement 2 found the story beautiful, engaging 2, empathic.

Analysis Step 2

Individual variation in the effect of simulation on gaze duration was related to individual variation in aspects of story world absorption, story appreciation, reading habits and perspective taking abilities (see Figure 2).

Analysis Step 1:

- Motor simulation (ranging from 0 to 30)
- Sensory simulation (ranging from 0 to 30)
- Mentalizing (ranging from 0 to 30)

Analysis Step 2:

- Motor simulation (ranging from 0 to 30)
- Sensory simulation (ranging from 0 to 30)
- Mentalizing (ranging from 0 to 30)

Summary

RQ 1: Can we disentangle distinct roles of motor simulation, sensory simulation, and mentalizing in reading?

Yes

This is compatible with previous studies showing a difference between the roles of motor simulation and mentalizing in reading or listening to stories10,15.

RQ 2: Are there individual differences in the effect of simulation on reading?

Yes, and these differences are related to differences in aspects of story world absorption and story appreciation.

Conclusion

It is important to distinguish between different kinds of simulation in language research, instead of looking at one general variable for mental simulation.

We need to consider:

1. Differences between kinds of simulation on the group level.
2. Differences between the effects of simulation within individuals.

References