

Embodied Language Processing: Desiderative Sentence Mood and Approach/Avoidance Actions

Berry Claus

Psycholinguistics Group / CoLi

Outline

- I Traditional view vs. embodied view of language comprehension
- II Experimental Study: Does comprehending desiderative-mood sentences interact with approach/avoidance actions?

Representing Described Situations

Representation of described situation

- tokens standing for the entities that make up the described situations
- Representation of non-linguistic entities

A girl cut her finger when slicing lemons

- How are representations of described situations related to representations that are constructed during perception and interaction with the world?

Two Possibilities

One → separate-systems assumption

Representational format of representations of described situations is **different** from the representational format of representations that are constructed during direct experience

Two → common-systems assumption

Representations of described situations and representations constructed in action and perception share the **same** format and recruit the same mental subsystems

Traditional View

Separate-systems assumption → traditional view

Traditional view of language comprehension

(e.g., Fodor, 2000; Kintsch, 1988)

Language comprehension is based on the manipulation of amodal, abstract symbols → **amodal view**

e.g., sentence about the girl who cuts her finger is represented through a structure of arbitrary symbols

→ representation is unrelated to representation that would be constructed when actually perceiving the cutting event

Traditional amodal view suffers from two related problems

Traditional View: Two Problems

Transduction problem

Lack of an account as to how amodal symbols emerge in the mind
How are perceptual experiences transduced into arbitrary symbols?
(Barsalou, 1999; Brooks, 1987)

Grounding problem

How are amodal abstract symbols mapped back onto the world?
How is the meaning of the symbols grounded?
(Harnad, 1990 → Chinese/Chinese Dictionary-Go-Round)

Both problems: intimately related to the separate-systems assumption

Embodied View

Embodied view of language comprehension

(e.g., Barsalou, 1999; Glenberg, 1997, 2008; Zwaan, 2004)

(aka modal view aka simulation view)

Language comprehension involves embodied mental representations that are grounded in perception and action

Common-systems assumption → embodied view

Representations of described situations are built in the same modality-specific mental subsystems as representations constructed during actual experience

→ modal representations

composed of representations of features in different modalities and representations of motor programs

Embodied Simulations

Embodied view: linguistic input gives rise to a re-enactment of the modality-specific memory traces from past experiences with entities being denoted by the given words

 **mental simulation of experiences**

Kurt Vonnegut (1969): “*to turn print into exciting situations in their skulls*”

e.g., comprehending the sentence about the girl who cut her finger by mentally simulating the perception of the described situation

Note: simulations are not full-fledged

even representations in perception are highly selective and incomplete

simulations of described situations might even be sketchier: linguistic input hardly ever specifies every detail of the described situations

Embodied View: Empirical Evidence

Neuroscientific studies

Overlap of pattern of brain activation when processing a linguistic expression and when actually perceiving the object or performing the activity denoted by the linguistic expression, e.g.:

González et al. (2006): Reading odor-related words (e.g., *cinnamon*) evokes activation in the olfactory cortex

Hauk et al. (2004): Reading action verbs (e.g., *kick*) activates areas in motor cortex that overlap with the areas that are activated when actually doing the actions

Behavioural studies

Action-sentence-compatibility effect

Comprehending a sentence describing an action in a particular direction facilitates performing an action in the same direction compared with the opposite direction

e.g., Zwaan & Taylor (2006): Processing *John closed the water bottle* (clockwise manual rotation) facilitates turning a knob in clockwise compared with counter clockwise direction; processing *John opened the water bottle* (counter clockwise manual rotation) facilitates turning a knob in counter clockwise compared with clockwise direction

Embodied View and Sentence Mood

Most of the evidence for the embodied view:
from studies investigating the comprehension of content words referring
to concrete situations

**Present Study: Can the embodied view also handle abstract
linguistic devices like desiderative sentence mood?**

desiderative sentence mood

expressed by non-factual mood markers like
want, wish, would like to

Example *Antoine wants to marry a hairdresser.*

Approach and Avoidance

Starting point: Distinction between two systems in accounts of the regulation of behaviour

Approach → associated with desirable events

Avoidance → associated with undesirable events

→ **Processing sentences in desiderative mood activates the approach system and facilitates approach actions compared with avoidance actions**

Approach/Avoidance Related Actions

Approach → e.g., pulling something toward you

Avoidance → e.g., pushing something away from you

Exp 1: Comprehension → Action

Experiment 1

Does processing sentences in desiderative mood facilitate an approach action compared with an avoidance action?

Exp 1: Method

Participants listened to sentences
and had to judge whether the sentences were sensible

Material

sensible and non-sensical sentences

Experimental sentences (all sensible)

two versions → 'desired' / 'factual' (control)

Lea wants to rest in a hammock. [Lea will in einer Hängematte liegen.]

Lea has rested in a hammock. [Lea hat in einer Hängematte gelegen.]

Exp 1: Method (cont.)

Two response conditions

Responding to the sensibility-judgment task via moving a joystick

→ 2 conditions

yes-is-pulling (approach)

→ indicate a *yes, sensible*-response by pulling the joystick
(and a *no, non-sensical*-response by pushing)

yes-is-pushing (avoidance)

→ indicate a *yes, sensible*-response by pushing the joystick
(and a *no, non-sensical*-response by pulling)

Exp 1: Design and Prediction

Each participant was initially randomly assigned to one of the two joystick-direction conditions (**yes-is-pulling** / **yes-is-pushing**)

Halfway through the experiment, the assignment of response to joystick direction was reversed

Half of the experimental sentence in '**desired**' version, the other half in 'factual' version

Dependent variable: Response times for correct responses to the (sensible) experimental sentences

Prediction

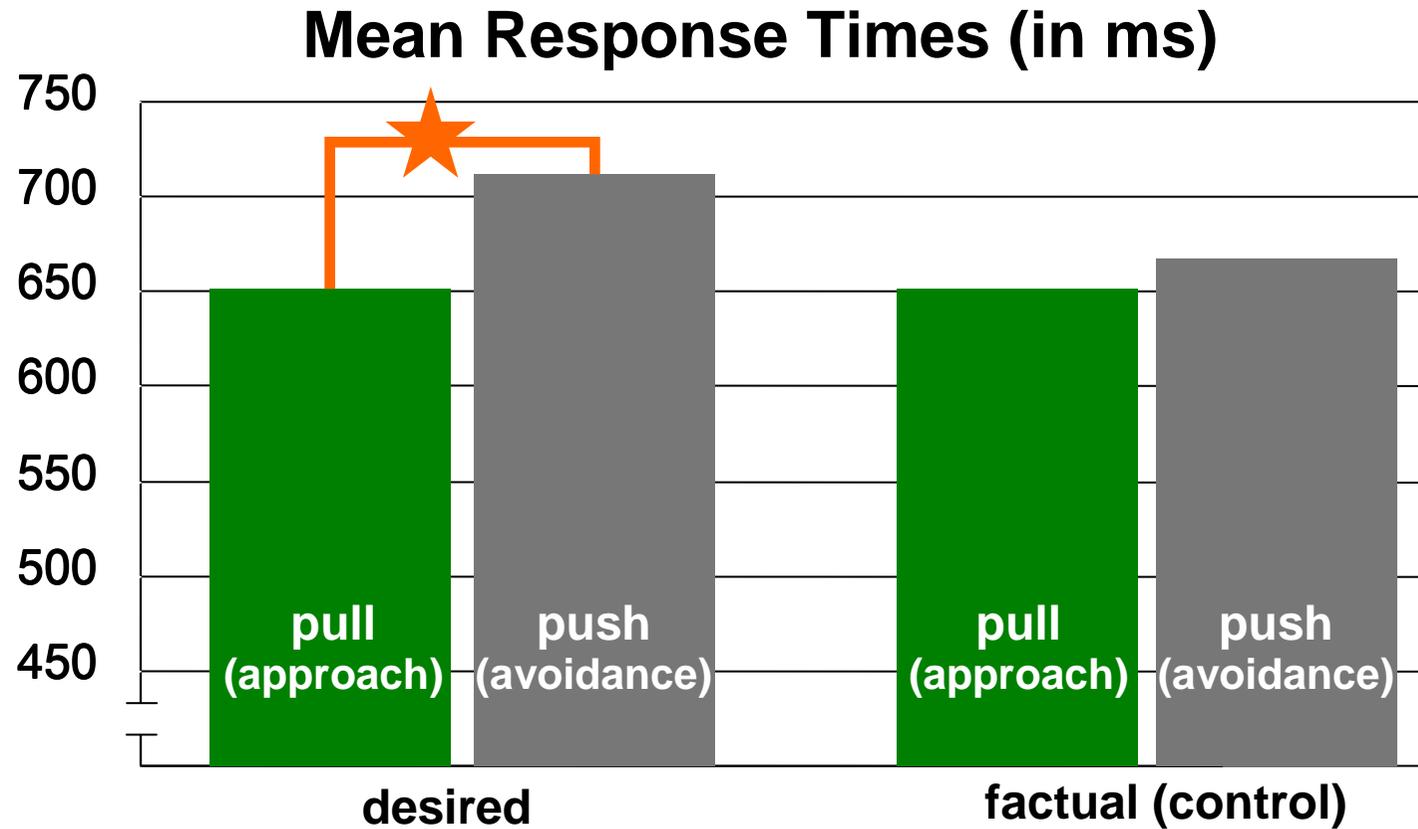
'**desired**'

sentences: Response Time_{**pulling**} < Response Time_{pushing}

'factual'

sentences: No effect of joystick direction on response times

Exp 1: Result



Exp 2: Action → Comprehension

Do approach/avoidance related actions affect processing sentences in desiderative mood?

Exp 2: Method

Participants had to perform an approach or avoidance action while listening to sentences

Approach pressing one palm against the bottom of a table and maintain arm tension

Avoidance pressing one palm on top of a table and maintain arm tension

(adopting a procedure from studies on affective processing, e.g., Neumann & Strack, 2000)

same material as in Experiment 1 (*Lea wants to rest / has rested in a hammock*)

→ two versions of experimental sentences: 'desired' / 'factual'

judging the sensibility of the sentences by pressing either of two keys
(**!not by moving a joystick**)

Exp 2: Design and Prediction

Each participant was initially randomly assigned to one of the two action conditions (**table bottom** / **table top**)

Halfway through the experiment, the action condition was changed

Half of the experimental sentence in '**desired**' version, the other half in 'factual' version

Dependent variable: Response times for correct responses to the (sensible) experimental sentences

Prediction

'**desired**'

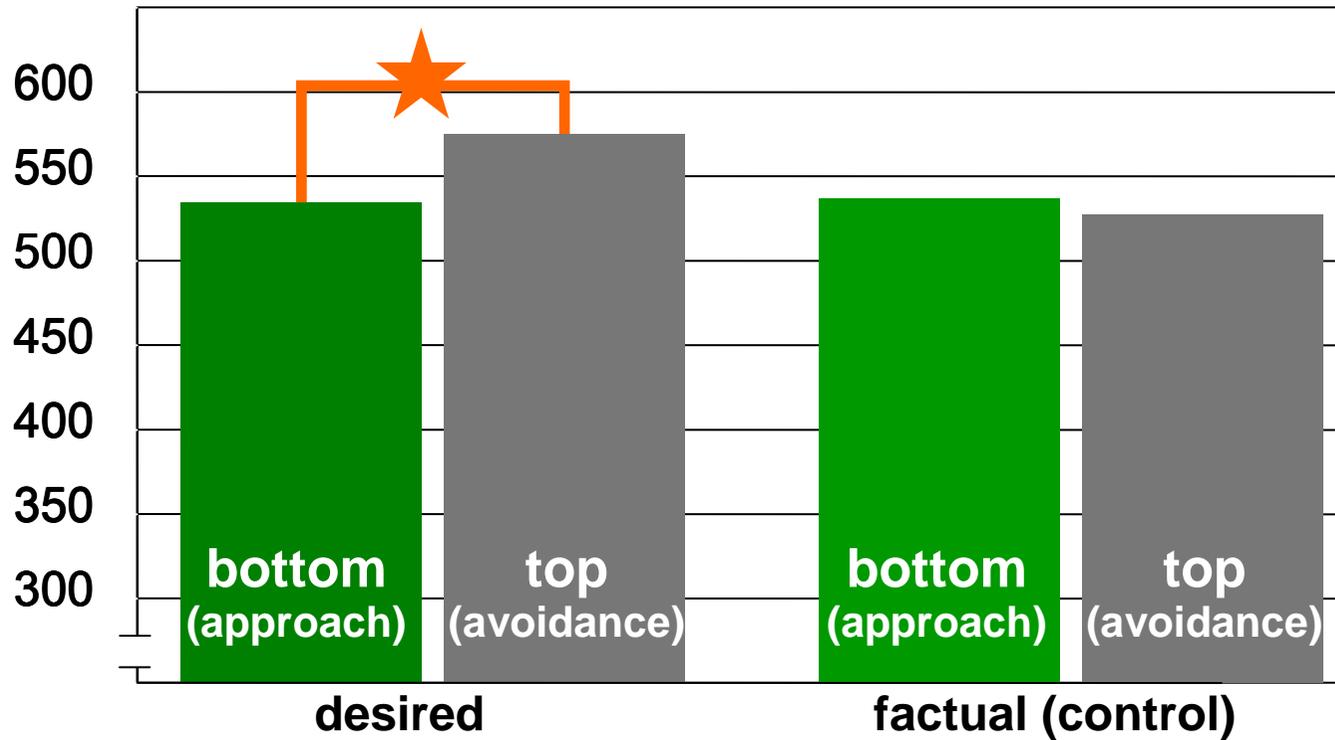
sentences: Response Time_{**bottom**} < Response Time_{top}

'factual'

sentences: No effect of action on response times

Exp 2: Result

Mean Response Times (in ms)



Conclusion

Results of two experiments → Comprehending desiderative mood sentences interacts with approach/avoidance related motor actions

Exp 1: Comprehending → Action

Processing desiderative mood sentences facilitates approach-related actions compared with avoidance-related actions

Exp 2: Action → Comprehending

Performing an approach action facilitates processing desiderative mood sentences compared with performing an avoidance action

→ **Preliminary evidence that the embodied view can handle even abstract information like desiderative sentence mood**

Outlook: Future Experiments

Using a different control condition

Exp 1 and 2: Control condition (e.g., *Lea has rested in a hammock*) and desiderative-mood condition (e.g., *Lea wants to rest in a hammock*) did not only differ wrt to sentence mood; control condition described a event that did take place

alternative control condition: sentences in future tense, e.g., *Lea will rest in a hammock*

Outlook: Future Experiments

Location and time course of the effect

→ Where does the effect of desiderative-mood on pushing/pulling occur? Already at the desiderative mood marker or later?

Exp: Word-by-word presentation of the sentences; participants advance through a sentence by either pulling or pushing a joystick

(results from pilot experiment: effect at mood marker:

Lea | will | in | einer | Hängematte | liegen)

→ Does negation reverse the effect?

e.g., *Lea | will | nicht | in | einer | Hängematte | liegen*

(Lea does not want to rest in a hammock)

That's it

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