The sentence wrap-up dogma

Laurie Stowe
University of Groningen

Edith Kaan
University of Florida

Laura Sabourin
University of Ottawa

Ryan Taylor
University of British Columbia
Sentence-final positions are “special”

- Lengthening of self-paced reading times; increase in regressions in eye-tracking

..asked whether the_worker unlocked the_N with the_key that morning.

(data from Kaan et al. under review)
Sentence-final positions are “special”

• Positive shift in ERPs

Kutas and Hillyard, 1980: Sentence final positivity
The sentence wrap-up dogma

The reasoning ("dogma"):

• The end of the sentence is special, since this is where "wrap-up" effects take place.

• Testing (ERPs, eye-movements) at the end of the sentence is therefore confounded, making the results uninterpretable or non-generalizable.

• A critical test position at the end of the sentence should be avoided by all means.

The consequence:

• Testing at sentence-final positions may sometimes be the only possible option (verb-final languages, ....!), but

• Reviewers tend to reject such papers b/c of the above reasoning
The sentence wrap-up dogma

The upshot of this talk:

• There is no good reason to avoid sentence-final positions in experimental designs
  • It is unclear whether there are any processes that are unique to sentence-final positions
  • W.r.t. ERPs, there is no evidence that “wrap-up” is confounding other effects
What is sentence final “wrap-up”? 

Just & Carpenter (1980)

• “A special computational episode occurs when a reader reaches the end of a sentence. …”

• “search for referents that have not been assigned, the constructions of inter-clause relations (with the aid of inferences, if necessary)…”

• “…and an attempt to handle any inconsistencies that could not be resolved within the sentence” (p. 345)

• But: these processes are not unique to sentence final positions
  • referential processing/search can take place mid-sentence
  • inferences can take place mid-sentence
  • semantic integration and dealing with inconsistencies can take place mid-sentence
Semantic integration: occurs right away (N400)
Gloomily the men stood around the -----grave/ - - - pencil ....

Discourse integration: occurs right away (N400)
(context in which the brother is very quick in getting ready to go:)
Jane told the brother that he was exceptionally ---- quick/ - - - slow ....

Van Berkum et al. 1999
What is sentence final “wrap-up”? 

Just & Carpenter (1980)

• “A special computational episode occurs when a reader reaches the end of a sentence. …”

• “search for referents that have not been assigned, the constructions of inter-clause relations (with the aid of inferences, if necessary)...”

• “...and an attempt to handle any inconsistencies that could not be resolved within the sentence” (p. 345)

• But: these processes are not unique to sentence final positions
  • referential processing/search can take place mid-sentence
  • inferences can take place mid-sentence
  • Semantic integration and dealing with inconsistencies can take place mid-sentence
The sentence wrap-up dogma

The upshot of this talk:

• It is unclear whether there are any processes that are unique to sentence-final positions
  • No reason to avoid sentence-final positions more than mid-sentence positions

• W.r.t. ERPs, there is no evidence that “wrap-up” is confounding other effects
Is wrap-up confounding ERPs?

• What is an ERP candidate for wrap-up?
  • Positivity
  • Sentence final negativity?
Sentence-final negativity

The observation:

• Sentences with mid-sentence syntactic anomalies can show a negativity at sentence-final position

Osterhout and Mobley (1995)
Sentence-final negativity

The observation:
• Sentences with mid-sentence syntactic anomalies can show a negativity at sentence-final position

The reasoning:
• Hence, if you place the critical word at the sentence-end, the ERP effects will be confounded by this wrap-up negativity
  • different scalp distribution, latencies, amplitudes, b/c of component overlap
  • E.g. you may see a left anterior negativity, resulting from overlap of P600 and negativity
The counterargument:

The negativity is not related to “wrap up”

• May be driven by task/response preparation
  • disappears when there is no task (Osterhout and Mobley, 1995)

• The “wrap-up” negativity is not even sentence-final:
“Wrap-up” negativity is not sentence final

• Negativity starts before the end of the sentence:

Hagoort et al. 1993

The spoiled child throws/*throw the toys onto the ground.
Is wrap-up confounding ERPs?

• What is an ERP candidate for wrap-up?
  • Positivity
  • Sentence final negativity?

• Is wrap-up confounding ERPs? --No convincing evidence that it does
  • Studies reporting ERP differences between violations at mid-sentence vs. end-of-sentence are confounded
  • Otherwise: no reported qualitative differences between mid-sentence and end-of-sentence effects
Studies reporting ERP differences between violations mid- vs. end-of-sentence are confounded

Mid-sentence syntactic violations

*The [common gender]/ *the [neuter gender]*
broken **umbrella**[common gender]

End of sentence: larger N400

*Cindy slept badly due to*
the[common gender]/*the[neuter gender]*
gruesome **dream** [common gender]

Larger N400, but the preceding context + determiner may have lead to certain semantic expectations, making the actual *noun semantically less expected than in the mid-sentence conditions*

Hagoort & Brown (1999)
Studies reporting ERP differences between violations mid- vs. end-of-sentence are confounded.

Mid-sentence violations:

End of sentence:

Osterhout (1997)

The boat sailed down the river and SANK

The boat sailed down the river and ATE

Larger N400/smaller P600 but these are different participants!
Is wrap-up confounding ERPs?

No convincing evidence for this:

• Studies reporting differences between violations mid-sentence vs. end-of-sentence are confounded

• Otherwise: no reported qualitative differences between mid-sentence and end-of-sentence effects
  • either direct comparisons, or across studies
Semantic integration: occurs right away (N400)
Gloomily the men stood around the ----- grave/ - - - - pencil [....]

Discourse integration: occurs right away (N400)
(context in which the brother is very quick in getting ready to go:)
Jane told the brother that he was exceptionally ---- quick/ - - - slow [....]

Van Berkum et al. 1999
See also
Kutas & Hillyard (1993)
Van Petten and Kutas (1991)
Hagoort and Brown (2000)
Kuperberg et al, 2003: main effect of position and main effect of manipulations

No difference in N400+P600 effects between mid-sentence and sentence-end

General positive shift at sentence-end

→ There is no convincing evidence that “wrap-up” is confounding other ERP effects
Summary: The sentence wrap-up dogma

• It is unclear what “wrap-up” is. There is no “wrap-up” process that is unique to a sentence-final position

• There is no convincing evidence that “wrap-up” is confounding other effects at the end of the sentence

→ Avoiding sentence-final positions as test point is based on a dogma, not motivated by evidence
Wrap-up of this talk:

There is no good reason to avoid sentence-final positions, or to reject well-designed studies that test at sentence-final positions!
Thank you!

Contact:
Edith Kaan
kaan@ufl.edu
brainlanguage.lin.ufl.edu