THE ROLE OF COGNITIVE CONTROL AND REFERENTIAL COMPLEXITY ON REFERENTIAL CHOICE OVER THE ADULT LIFESPAN

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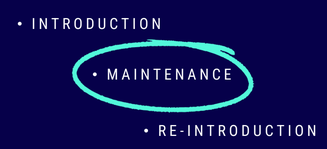
BACKGROUND AND PREDICTIONS

1 Our study examines referential choice over the adult lifespan, where pragmatic and cognitive skills have been found to vary considerably.

2 Here we probed adults' (aged 18-82) choice of referential forms (i.e., names vs pronouns) across 4 story continuation experiments, focusing on an understudied discourse stage: Maintenance.



Prior work has linked the use of ambiguous pronouns to age-related decline in EF [1,2].

We ask: Do these patterns also emerge in the *absence of topic shifts*, when the complexity of the visual context varies systematically?

3 Holding the discourse stage constant, we manipulated features of the visual scene, testing and expanding upon Fossard et al.'s scale of referential complexity [3].

Level 1	Level 2	Level 3
1 character	2 characters different gender	2 characters same gender

4 According to Fossard et al., pronouns should decrease as referential complexity increases, since pronouns signal topic continuity [4].

Participants' choice of referential form thus provides insight into their perception of the topicality of a referent.

5 Based on prior work [5-6], we predicted that younger and older adults would rely on different cognitive strategies for referential choice.

Exp 1

Younger adults: At peak cognitive capacity; can rely on a suite of cognitive skills for referential choice.

Older adults: Switching more likely to remain in tact in old age, and is the preferred mode of cognitive control in older adults as inhibitory control/WM can be more cognitively taxing [7].

PREDICTION: Switching will underlie older adults' pronominal use.

This prediction also raises an interesting question: At what stage of adulthood do potential shifts in cognitive strategies occur? Our separate analyses on younger, middle aged, and older adults should help to provide an answer.

6 We also predicted that novel factors (related to *competition for topichood*) would also modulate referential choice, such as:

Exp 2: the NUMBER of competitor referents in the scene/discourse (0-2)

EXP 3: the TIMING of competitors' presence (early or late in the scene/discourse)

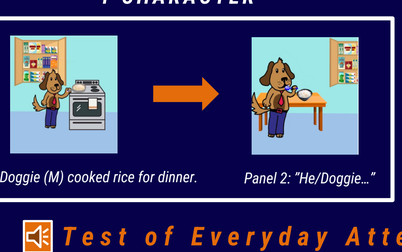
EXP 4: the EMPHASIS on competitors (relative to the main character)

EXPERIMENT 1

Testing Age and EF with Fossard's scale (1 vs 2 characters)

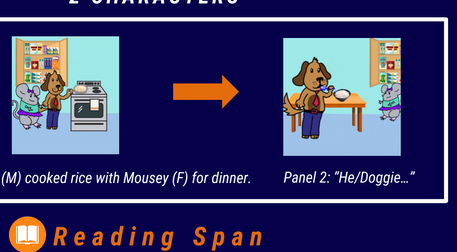
Participants (n=100, aged 19-82) produced story continuations in displays where scenes varied [8]:

1 CHARACTER



Panel 1: Doggie (M) cooked rice for dinner. *Panel 2: "He/Doggie…"*

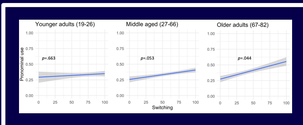
2 CHARACTERS

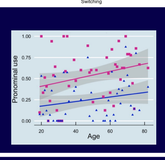


Panel 1: Doggie (M) cooked rice with Mousey (F) for dinner. *Panel 2: "He/Doggie…"*

Test of Everyday Attention + Reading Span

RESULTS





Our initial model of Pronominal Use (with Age and EF as predictors) revealed higher rates of pronominal use with advanced age, a common finding in the literature [2]. As hypothesized, better switching was associated with more pronouns, driven by an increased reliance on switching in later life to guide referential choice.

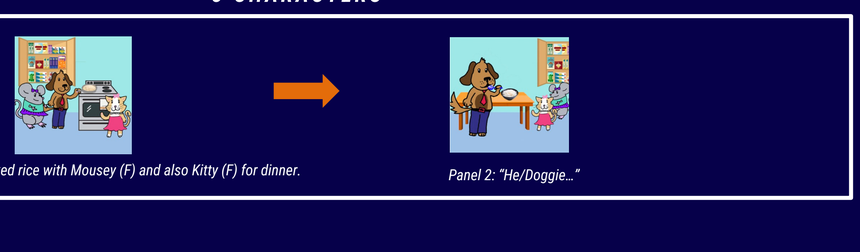
Our LMER model of Pronominal Use (with Age and Complexity as predictors) revealed lower rates of pronoun use for more complex scenes, irrespective of Age.

EXPERIMENT 2

Extending the scale: NUMBER of competitors (1-3 characters)

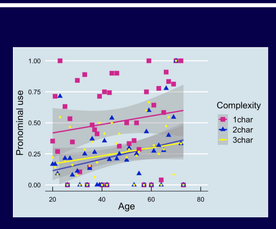
New online participants (n=96, aged 18-73) were administered the same task, now with 3 character scenes

3 CHARACTERS



Panel 1: Doggie (M) cooked rice with Mousey (F) and also Kitty (F) for dinner. *Panel 2: "He/Doggie…"*

RESULTS



Our initial model of Pronominal Use (with Age only) revealed a higher rate of pronominal use in older than younger adults, as expected.

Our LMER model of Pronominal Use (with Age and Complexity as predictors) revealed greater pronoun use for 1 character scenes than 2 or 3 character scenes, but no difference between 2 and 3 character scenes. Thus the addition of a third character who also differs in gender from the main character does not appear to increase referential complexity.

EXPERIMENT 3

Extending the scale: TIMING of competitors (early vs late)

New online participants (n=100, aged 19-77) were administered the task; here timing was manipulated

EARLY COMPETITION

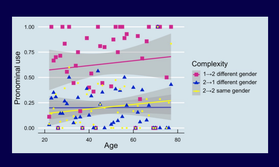
Panel 1: Doggie (M) played Hide and Seek with Mousey (F) this afternoon. *Panel 2: "He/Doggie…"*

LATE COMPETITION

Panel 1: Birdie (M) decided to chop some firewood. *Panel 2: "He/Birdie…"*

Note: In addition to comparing 1->2 and 2->1/ different gender, we compared 2->2/ same gender. Comparing the first two allowed us to test the role of TIMING; comparing 2->2/ same with either of the other conditions let us test the role of gender ambiguity.

RESULTS



Our initial model of Pronominal Use (with Age only) revealed a higher rate of pronominal use in older than younger adults.

Our model of Pronominal Use (with Age and Complexity as predictors) revealed a difference between 2->1 and 1->2 trials, whereby adults of all ages make complexity calculations early.

In addition, the presence of multiple characters from the outset had a bigger impact on referential choice than gender ambiguity, perhaps because pronouns are less ambiguous in Maintenance contexts.

EXPERIMENT 4

Extending the scale: EMPHASIS on competitors (repeated mention)

New online participants (n=100, aged 18-73) were administered the task; here emphasis was manipulated

EMPHASIS CONDITIONS

- *1->2/ different gender*
- *2->/ different gender*

+ pronoun

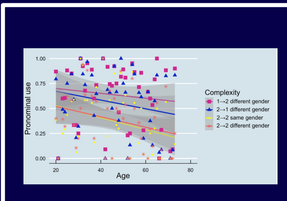
Example prompt:
Kitty went to play in the back garden.
She was in a great mood.
- repeated mention
- pronoun use (signalling topichood)

- *2->2/ same gender*
- *2->2/ different gender*

+ repeated name

Example prompt:
Doggie cooked rice with Mousey for dinner.
Rice was Doggie's favorite meal.
- repeated mention

RESULTS



Surprisingly, our initial model of Pronominal Use (with Age only) revealed a higher rate of pronominal use in younger rather than older adults. Why? Unlike Exps 1-3, with visual + linguistic manipulations, Exp 4 was linguistic only. Perhaps older adults are less sensitive to linguistic-only cues.

Our model of Pronominal Use (with Age and Complexity as predictors) revealed greater pronominal use for both 1->2 and 2->1/ different than 2->2/ different gender trials, likely due to a double boost of prominence from pronouns or a decrease in names to avoid the Repeated Name Penalty.

CONCLUSIONS

Our results provide insight into the relationship between pragmatics and ageing by identifying a link between older adults' switching skills and the use of pronouns as a marker of topic continuity. Likewise, our results reveal what type of contextual information is prioritized at different ages, highlighting older adults' preserved sensitivity to (visual) scene complexity but reduced sensitivity to linguistic prominence cues, compared to younger adults. These findings contribute to our understanding of individual differences in pragmatic behavior and can be used to refine the referential complexity scale [9] as well as current computational models of reference [10].

References: [1] Hendriks et al. (2008). *Journal of logic, language and information*, 17, 443-466. [2] Hendriks et al. (2014). *Language, Cognition and Neuroscience*, 29(4), 391-407. [3] Fossard et al. (2018). *Frontiers in Psychology*, 176. [4] Ariel, M. (1990). *Routledge*. [5] Long et al. (2018). *Cognition*. [6] Bambini et al. (2021). *Cognitive processing*, 22(3), 435-452. [7] Braver, T. S. (2012). Trends in cognitive sciences, 16(2), 106-113. [8] Arnold & Griffin. 2007. *Journal of Memory and Language*. [9] Long et al. (2023). Journal of Experimental Psychology: Learning, Memory, and Cognition. doi: 10.1037/xlm0001273. [10] Hendriks, P. (2016). Frontiers in Psychology, 7, 506.