

Unveiling the Parallel Function Hypothesis on Personal Pronouns: A Corpus Analysis Utilizing Eye-Tracking Data

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1. Introduction

This study investigates the influence of the **Parallel Functioning Hypothesis** on first fixation duration, number of fixations, and number of skips during sentence processing by using the **LARC-ID** eye-tracking dataset.

3. Research Question

- From a naturalistic reading perspective will the personal pronoun regulation obey the Parallel Functioning Hypothesis?
- Will the different grammatical functions of personal pronouns (SS, SO, OS) influence how people process referents?
- Will different sentence structures (inter and intar) influence how people process referents?
- How do previous knowledge and experiences influence an individual's pronoun resolution?

4. Data Set

We evaluate the following corpus:

- The **LARC-ID** eye-tracking dataset [Harris and Rich, 2021]
- 15 college students (10 females, 5 males) were recruited
- All participants were native English speakers with a mean age of 19 years (SD = 1.13 years), ranging from 18 to 22 years
- All participants had some college experience, with an average of 2 years (range: 1-4 years)

5. Data Annotation

12 sentences were selected

- 6 PF sentence and 6 NPF sentences

Four main areas of a sentence

- Target **subject** (the referent of the pronoun)
- Target **pronoun**
- Pronoun Region A (two words **before** the target pronoun)
- Pronoun Region B (two words **after** the target pronoun)

11. References

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[Harris and Rich, 2021] Harris, J. and Rich, S. (2021). Los angeles reading corpus of individual differences: Pilot distribution and analysis. In *Proceedings of the Annual Meeting of the Cognitive Science Society*, volume 43.

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2. Background

Parallel Functioning Hypothesis (PFH)

Pronoun interpretation is influenced by both linguistic contexts, such as syntactic structures, social cues, eye gaze, and physical gestures [Arnold and Lao, 2015] [Chien and Wexler, 1990]. In complex sentences, the presence of the pronoun and its referential noun phrases (**NPs**) within the same grammatical functional category leads to Parallel Function Pronoun Resolution (**PFR**) [Sheldon, 1974] [Grober et al., 1978]. PFR results in easier and quicker processing when the pronouns and their referents fall into the same grammatical function category (Parallel Function), compared to Non-Parallel Function Pronoun Resolution (**NPFR**)

6. Result: Comparison Between PF and NPF Sentences

Measurements	First Fixation Mean (ms)		Number of Fixations		Number of Skips		Total Count	
Group	PF	NPF	PF	NPF	PF	NPF	PF	NPF
Target Subject (SUB)	218.23	216.59	71	75	19	15	90	90
Target Pronoun (PRO)	195.13	198.95	41	43	49	47	90	90
Pronoun Region A	212	211	101	120	19	5	120	125
Pronoun Region B	217	218	119	96	6	7	125	103

Notes: PF N = 6, NPF N = 6

7. Result: Comparison Between SO SS and OS

Comparison Between PF and NPF Sentences

Measurements	First Fixation Mean (ms)			Number of Fixations			Number of Skips			Total Count		
Group	SO	SS	OS	SO	SS	OS	SO	SS	OS	SO	SS	OS
Target Subject (SUB)	219.34	218.23	200.55	64	71	11	11	19	4	75	90	15
Target Pronoun (PRO)	194.48	217.07	213.7	33	41	10	42	49	5	75	90	15
Pronoun Region A	211.19	212.07	209.75	104	101	16	4	19	2	108	120	18
Pronoun Region B	220.77	217.58	204	81	119	15	6	6	2	87	125	17

Notes: SO N = 5, SS N = 6, OS N = 1

8. Result: Comparison Between Intar and Inter sentences

Comparison Between PF and NPF Sentences

Measurements	First Fixation Mean (ms)		Number of Fixations		Number of Skips		Total Count	
Group	Intra	Inter	Intra	Inter	Intra	Inter	Intra	Inter
Target Subject (SUB)	224.21	214.14	47	99	13	21	60	120
Target Pronoun (PRO)	195.13	212.87	24	60	36	60	60	120
Pronoun Region A	214.58	210.43	56	165	3	21	59	186
Pronoun Region B	225.12	214.4	69	146	5	8	74	154

Notes: Intra N = 4, Inter N = 8

9. Conclusion

- There are **minimal differences** between PF and NPF sentences, failing to provide positive support in favor of this hypothesis.
- The intrasentential structures lead to **longer** first fixation duration for the target subject, target pronoun, and both pronoun regions compared to intersentential structures.
- The grammatical positions of the subjects and the pronouns indicate that when the subject and pronoun are in the **subject-object position**, participants exhibit **longer first fixation duration** at the subject and **shorter first fixation duration** at the target pronoun.

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