

Optimal Viewing Position (OVP) Interacts with Both *Aksharas* and *Maatras* in Hindi: Evidence from Lexical Decision Task.

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OVP is the position within a word, where if fixated, leads to max. information gathering. OVP effect has been found in many languages like English, French, Hebrew, Arabic, Chinese, German, Japanese, Dutch, etc. OVP is affected by position of critical information within a word [1]. Here, OVP effects have been investigated for Hindi words; written in segments (seg).

Experiment 1: To investigate OVP in words with maatraas.

Participants: N=35 (Male=26, Female=9), Age range = 18 ~ 32 years (M=22.14, SD=3.03).

Stimuli: 90 3-seg, 120 4-seg and 150 5-seg words with maatraas taken from Shabd [2]. All segs taken as initial fix pos for all stimuli. 30 words in each initial fix pos for each seg length.

Procedure: Lexical Decision Task. Procedure is same for all experiments and shown in fig. 1.

Results: Model used: $\log(RT) \sim \text{fix_pos} + (\text{fix_pos}|\text{sub}) + (\text{fix_pos}|\text{target})$. Linear (est=0.03, $t=2.422$, $p<0.05$), (est=0.03, $t=3.17$, $p<0.01$), and (est=0.03, $t=2.49$, $p<0.05$) and quadratic (est=0.04, $t=4.19$, $p<0.001$), (est=0.06, $t=7.08$, $p<0.001$), and (est=0.06, $t=3.77$, $p<0.001$) trends were found to be sig. for 3, 4 and 5-seg words respectively. See fig. 2.

Experiment 2: To investigate OVP in words without maatraas.

Participants: N=35 (Male=28, Female=7), Age range = 18 ~ 32 years (M=22.85, SD=3.47).

Stimuli: 48 2-seg, 72 3-seg, 96 4-seg words, 20 5-segment words (w/o maatraas) were taken from Shabd [2]. There were 30 words in each initial fixation pos for each type of seg length.

Results: Model: same as exp 1. No effect for 2-seg words. Sig. quadratic trend (est=0.03, $t=3.82$, $p<0.001$) for 3-seg words. Sig. linear (est=0.03, $t=2.42$, $p<0.05$) and quadratic (est=0.07, $t=6.308$, $p<0.001$) trends for 4-seg words. See fig 3.

Experiment 3: To investigate interaction between OVP and maatraa positions.

Participants: N=35 (Male=28, Female=7), Age range = 18 ~ 32 years (M=22.85, SD=3.47).

Stimuli: 48 2-seg, 72 3-seg and 96 4-seg words (1 maatraa) were selected from Shabd [2]. There were 24 words for each of the maatraa pos and initial fixation pos for each seg length.

Results: Model: $\log(RT) \sim \text{fix_pos} : \text{maatraa_pos} + (1|\text{sub})$. Interaction bet. initial fixation pos. and maatraa pos. was found to be sig. for the 2-seg ($F(3, 1528.2)=12.40$, $p<0.001$), 3-seg ($F(8, 2271.1)=7.03$, $p<0.001$) and 4-seg ($F(15, 381.43)=4.44$, $p<0.001$) words. See fig 4, 5 and 6.

Discussion: Unlike English where the OVP is largely determined with reference to letters, OVP in terms of RTs for Hindi (*Devanagari*), interacts with positions of *aksharas* and *maatraas*.

References

- [1] O'Regan, J. K. (1990). Eye movements and reading. In E. Kowler (Ed.), *Eye movements and their role in visual and cognitive processes* (pp. 395–453). Amsterdam: Elsevier.
- [2] Verma, A., Sikarwar, V., Yadav, H., Jaganathan, R., & Kumar, P. (2022). Shabd: A psycholinguistic database for Hindi. *Behavior research methods*, 54(2), 830–844.

Figures and Tables

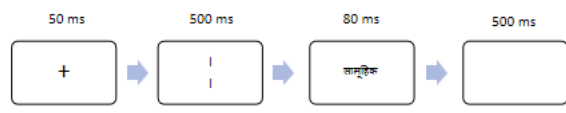


Figure 1: Procedure for exp. 1, 2 and 3.

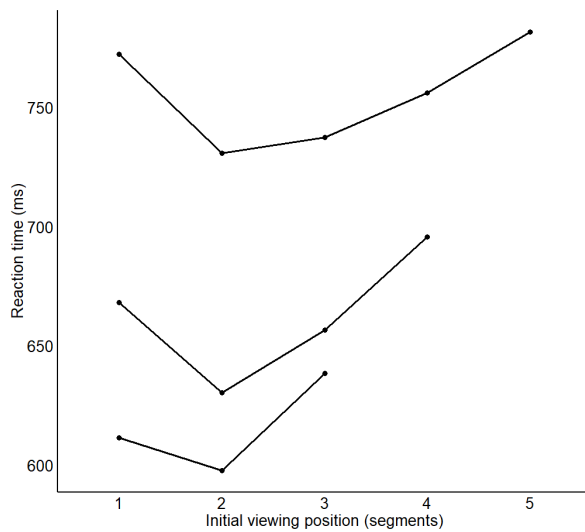


Figure 2: Mean RTs for all cond for exp 1

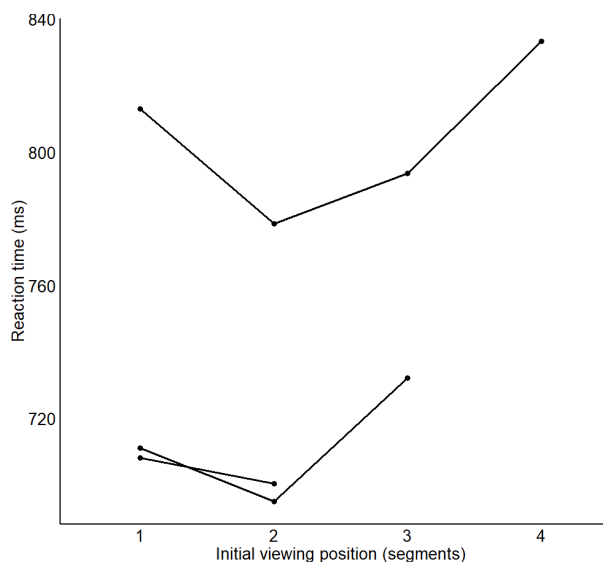


Figure 3: Mean RTs for all cond for exp 2

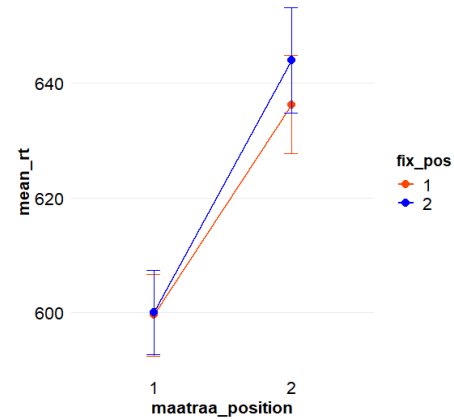


Figure 4: Interaction bet fix pos and maatraa pos for 2-seg words in Exp 3.

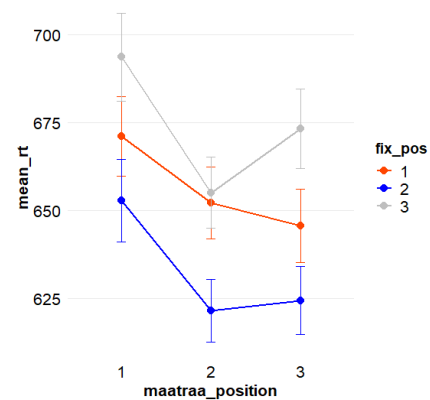


Figure 5: Interaction bet fix pos and maatraa pos for 3-seg words in Exp 3.

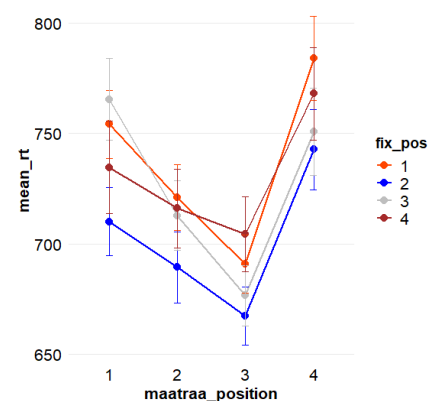


Figure 6: Interaction bet fix pos and maatraa pos for 4-seg words in Exp 3.

Description of Hindi (Devanagari) orthography:

Hindi (Devanagari) is a segmental writing system. A word can be broken down into segments. Each segment is made up of aksharas and maatraas. For simplicity, aksharas can be treated as letter units and maatraas as subsidiary units of these aksharas. A segment can have more than one aksharas and maatraas.

Table 1: Examples to understand types of words used in this study.

Word	N_Seg	Maatraa pos	Breakup of seg containing maatraa
खेल (/kʰe:l/) “game”	2	1 st segment	“ख” + “े”
दशा (/dʂa:/) “condition”	2	2 nd segment	“श” + “ा”
सुबह (/subəh/) “morning”	3	1 st segment	“स” + “ु”
पवित्र (/pəvɪtɾ/) “holy”	3	2 nd segment	“व” + “ि”
लड़की (/ləɾki:/) “girl”	3	3 rd segment	“क” + “ी”
शिरकत (/ʃɪrkət/) “participation”	4	1 st segment	“श” + “ि”
सहायक (/səha:jək/) “assistant”	4	2 nd segment	“ह” + “ा”
चयनित (/tʃəjənɪt/), “selected”	4	3 rd segment	“न” + “ि”
सहमति (/səhməti/) “agreement”	4	4 th segment	“ति” + “ि”