

Visual Search Patterns in Neglect: Comparison of Peripersonal and Extrapersonal Space

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INTRODUCTION

- Neglect manifests on visual search and cancellation tasks in peripersonal (near) space with
 - A rightward start position¹
 - A decreasing gradient of target detection from right to left²
 - Fewer searches by row¹
 - Many shifts between row, column and diagonal search¹
 - A higher proportion of repeated target reports¹
- The irregular and unsystematic search pattern of neglect patients in peripersonal space has been related to
 - A rightward attentional bias³,
 - A right-to-left gradient of decreasing attention³, and
 - A deficit in spatial working memory^{4,5}
- The gradient of attention in neglect has been dissociated in peripersonal (near) and extrapersonal (far) space⁶.
- Peripersonal neglect is reported after damage to the dorsal visual stream, specialized for visuomotor control^{7,8}.
- Extrapersonal neglect is reported after damage to the ventral visual stream, specialized for perceptual representation^{7,8}.
- The dorsal visual stream is related to near space, lower visual field, global processing bias, enhanced focused attention and attentional resolution⁹.
- The ventral visual stream is related to far space, upper visual field, local processing bias, more efficient attentional shifting, and a visual search advantage⁹.
- Visual search patterns may be dissociated in extrapersonal and peripersonal space depending upon the availability of attentional resources related to each space.

QUESTIONS

- Do the visual search patterns of Neglect patients differ from those of Stroke controls and/or Healthy controls?
 - In what ways do search patterns differ?
- Do visual search patterns differ between peripersonal (near) and extrapersonal (far) space?

PARTICIPANTS

Group	N	Age (yrs) ^a	Education (yrs) ^a	Days Post-stroke ^a
NC Controls	10	57.9 (13.7)	15.8 (2.4)	N/A
RH Controls	11	57.1 (16.7)	11.9 (3.5)	63.9 (40.2)
Neglect**	9	66.0 (11.3)	10.0 (2.1)	101.1 (59.4)

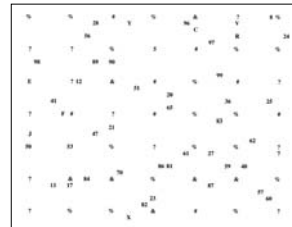
Mean (SD), NC = Healthy, non-neurological controls (5M, 5F), RH = Right hemisphere stroke, no neglect (7M, 4F)
 ** Performance at or below cutoff on >2 of 6 Behavioral Inattention Test conventional subtests (8M, 1F)

Lesions	Dorsal	Ventral	Subcortical	Mixed
NEG	1	3	0	5
RHC	1	5	3	2

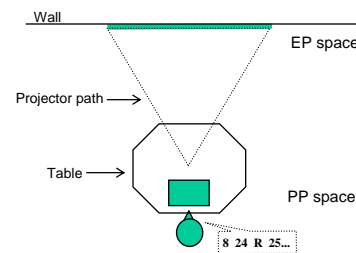
Dorsal = SFL, SPL; Ventral = IFL, IPL, STL

METHODS

- Scanning Sheets: Report letters and numbers within two minute limit (5 sheets per space)



- 32 x 32 x-y coordinate grid separated into eight columns
- Peripersonal space (PP): Scanning sheets on table 30cm from the subject.
- Extrapersonal space (EP): Scanning sheets projected on wall 250cm from the subject.



RESULTS

TARGET DETECTION

Target Detection (percent of total targets)

- Fewer targets detected overall in EP (78%) than PP (84%) space
- NEG (54%) detected fewer targets than RHC (88%) and NC (97%)

Gradient of Target Detection (left-to-right linear slope)

- NEG slope (5.44) steeper than RHC (1.02) or NC (-0.38) and NC

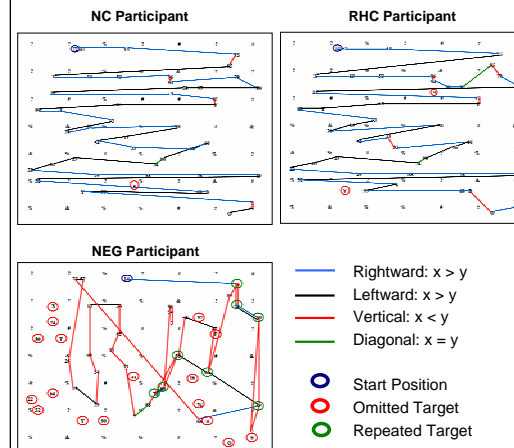
Target Repetitions (percent of all reports)

- NEG (26%) had most repetitions followed by RHC (11%) and NC (1%)
- More repetitions on right (13%) than left (11%) side of search area

RESULTS

VISUAL SEARCH PATTERNS

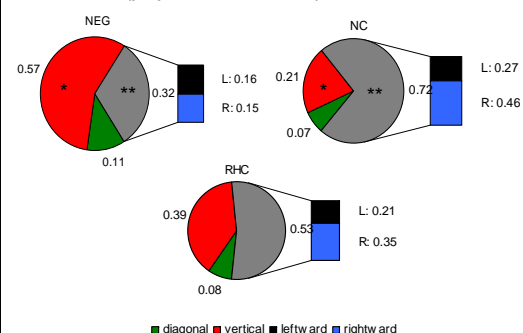
No PP and EP space differences in visual search variables



Start Position (x-axis location)

- Further right start for NEG (20.6) than RHC (10.8) and NC (10.1)

Shift Direction (proportion of total shifts)



Shift Size (x-y axis units)

- Larger vertical shifts by NEG (5.8) than NC (3.0); RHC (4.0)
- Smaller horizontal shifts by NEG (3.9) than NC (7.9); RHC (5.9)
 - Only NC vertical and horizontal size differed significantly
- Left shifts were smaller for NEG (4.1) than NC (9.8); RHC (7.3)
- Right shift size did not differ among NEG (3.7), NC (5.9), RHC (4.5)
 - Only NEG showed no difference in size of left and right shifts

DISCUSSION

Target Detection

- NEG group showed right-to-left decreasing gradient of detection
 - Consistent with gradient of attention³
- Stroke patients (NEG > RHC) showed increased target repetitions
 - Consistent with spatial working memory deficit^{4,5}

Search Patterns

- NC group showed 'reading' pattern
- RHC group did not differ from NC 'reading' pattern
- NEG group showed unsystematic search that differed from NC 'reading' pattern
 - Rightward start
 - Consistent with rightward attentional bias³
 - More vertical and fewer horizontal searches than NC,
 - Proportion and size of vertical and horizontal shifts not significantly different in NEG group, and
 - Equal proportion and size of left and right shifts
 - Consistent with a local attention bias

Space Dissociations

- Fewer targets detected overall in EP than PP space
 - May be associated with differences in visual acuity
- No difference in search patterns in PP and EP space
 - Suggests similar mechanisms of attentional control for search in near and far space
- Lack of a space dissociation in the NEG group may be related to the heterogeneity of lesions, however
- Further research on space dissociations should include homogeneous NEG groups with either dorsal or ventral stream damage

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