Local and Global Processing in Typical Development: Perceptual and Strategic Aspects

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Introduction

- Typically developing individuals are thought to show a global processing bias or global precedence effect (GPE), i.e. better perception of global forms than details.
- However, findings are inconsistent.
- We examined whether the GPE can be manipulated by
  - Stimulus characteristics (Exp. 1)
  - Contingencies (Exp. 2)
  - Masking (Exp. 3)
- Stimuli: Hierarchical stimuli (large forms - global level - made out of small forms - local level)
- Task: Two-alternative forced choice task (diamond or squares?) See Fig 1 for illustration of the trial sequence.

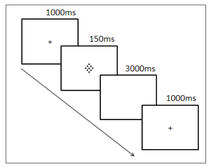

Figure 1: Trial sequence

Experiment 1

- ❑ **Question**: Do stimulus characteristics influence the GPE?
- ❑ **Outcome**: Confirmation of GPE which is mainly independent of perceptual stimulus characteristics.

Participants: N=20, age 18-29 (M=21.3yrs, SD= 2.9)
Stimuli: 9 sets of stimuli varying in size, form, outline/fill (examples in Fig 2) presented in separate blocks.
Analysis: Global-to-Local Ratio (GLR): Indicator of global/local bias. GLR < 1 : global bias; GLR > 1: local bias. (See last box for formula)

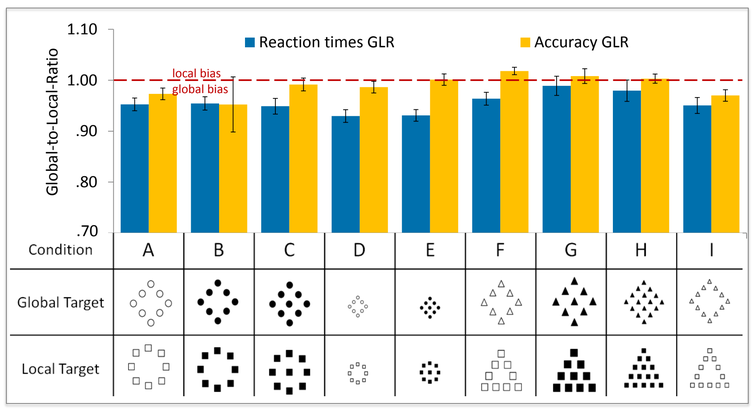

Figure 2: top: GLR_{RT} and GLR_{ACC} in Exp 1. Bottom: Examples stimuli for each set.

Results:
- Overall GLR_{RT} indicated a global bias (Fig 2).
- GLR_{ACC}: no sign. effects, ACC close to ceiling (global: 96%, local: 95.5%)
- Selected pairwise-comparisons of GLR_{RT} and GLR_{ACC} between stimulus sets (e.g. A vs C) were all non significant.
- GLR_{RT}: lower in smaller (combined) than larger stimuli.

Experiment 2

- ❑ **Question**: Is the GPE mandatory or can it be altered?
- ❑ **Outcome**: Participants can modulate their processing and switch from a global to local bias if this is strategically favourable. The GPE is therefore flexible on the decision stage.

Participants: N=27, age 23-38 (M=27.3yrs, SD= 3.2)
Stimuli: Stimulus set A presented in 5 blocks with different contingencies of local and global trials (0, 20, 50, 80, 100%)
Results:

GLR:
- Global bias overall as well as in G50L50, G80L20 for GLR_{RT} and GLR_{ACC} (Fig 3).
- Local bias in G20L80 in GLR_{RT} but not GLR_{ACC}.
- Global bias higher with higher contingency.

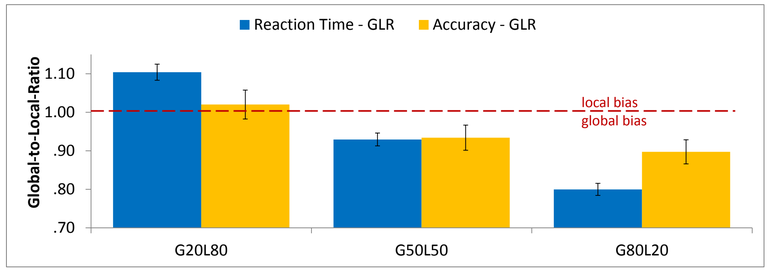

Figure 3: GLR in Exp 2.

RT:
- Global < local
- Faster the higher contingency (Fig 4a).
- Contingency effect reduced for targets on local level.

ACC:
- Global > local
- Higher the higher the contingency (Fig 4b).
- Contingency effect reduced in local targets.

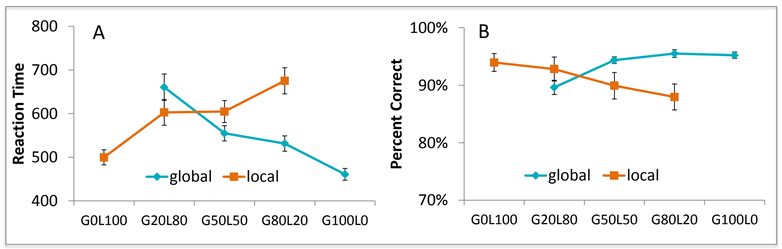

Figure 4: Reaction Times (A) and Accuracy (B) to global and local trials.

Abbreviations

GPE – Global Precedence Effect
RT – Reaction Time
ACC – Accuracy
GLR – Global-to-Local Ratio

Experiment 3

- ❑ **Question**: Does masking interrupt/ compromise processing?
- ❑ **Outcome**: Masking does not reduce the contingency effect or impair global processing. However, it impairs accuracy in local trials; local processing seems more susceptible to disruption.

Participants: Same as Exp. 2.
Stimuli: As Exp. 2 but with backward-mask (duration 50ms).
Analysis: Separate analysis as well as combined with Exp 2.
Results:

GLR:
- No effects of masking on the GLR_{RT}.
- GLR_{ACC} lower with masking than without but n.s. ($p = .054$)

RT:
- Equivalent to Exp 2; Masking not influencing RT.

ACC:
- For global trials equivalent to Exp 2. Masking did not affect ACC in global trials (Fig 7a)
- Masking reduced ACC in local trials (Fig 7b)

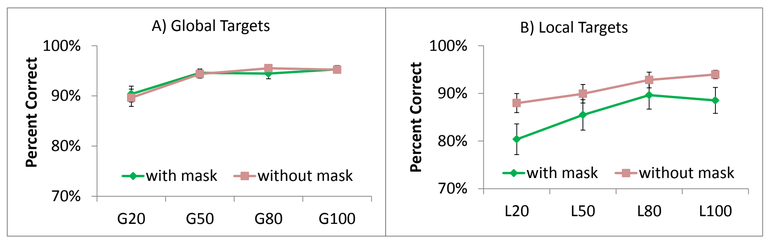

Figure 7: Accuracy of responses to global (A) and local (B) targets with masking (Exp 3) and without masking (Exp 2).

Conclusions and Outlook

The GPE has perceptual and strategic aspects. It appears to be mandatory on the perceptual stage (Exp 1 & 2) but can be altered strategically during the decision stage (Exp 2 & 3). Local processing is more apt to be interrupted or modified – perhaps reflecting its longer time course – than global processing which is more robust to perturbation.
Future work will examine developmental factors of local and global processing in typically and atypically developing children.

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Formulas for Global-to-Local Ratio:
$GLR_{RT} = RT_{global}/RT_{local}$
$GLR_{ACC} = ACC_{local}/ACC_{global}$

Interpretation:
GLR < 1 : global bias
GLR > 1: local bias