

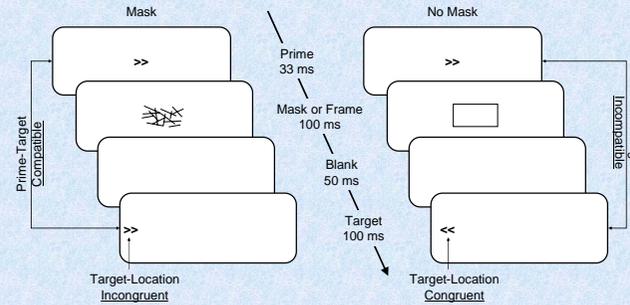
## Background

- Cognitive Control = Ability to prevent irrelevant information from interfering with ongoing goal-directed behaviour
- Normal aging and some psychiatric disorders cause changes in cognitive control<sup>(1-2)</sup>
- Other factors have been suggested, but the evidence is mixed<sup>(2-6)</sup>
- Here, we tested whether gender, cultural background, and bilingualism affected cognitive control

## Method

- Fully automatic **hybrid motor priming-Simon task** with masked (subliminal) or non-masked (visible) primes<sup>(7)</sup>
- Simon task**
  - Respond to the identity of a target stimulus with a spatial (left- or right-hand) response, but ignore its spatial location
  - Target location is either congruent (corresponds to the response hand) or incongruent (corresponds to the other hand)
- Motor priming**
  - Each target is preceded by a to-be-ignored prime stimulus
  - Prime is either compatible (identical to the upcoming target) or incompatible (identical to the alternative target)
- Participants**
  - 72 young (18-22 yrs), healthy volunteers: 38 female, 38 Chinese, 38 bilingual

## Hybrid Prime-Simon Task



## Logic

### a) Interference effects

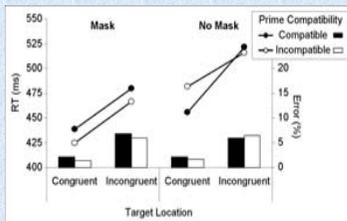
- If relevant and irrelevant information coincide, response execution is facilitated, if they are in conflict, interference occurs
- Interference effects measured as RT differences between conflict and non-conflict trials
- Magnitude of **Simon effect** indicates high-level control over interference triggered by spatial information
- Magnitude of **priming effects** indicates control over interference triggered by stimulus identity
  - High-level** (consciously perceived) with supraliminal primes
  - Low-level** (not consciously perceived) with subliminal prime

### b) Gratton effects

- Interference effects are typically smaller following conflict than following non-conflict trials (Gratton effect)
- This has been interpreted as evidence for a high-level (frontally mediated) conflict control system, which prevents interfering information from gaining access to the response system<sup>(8)</sup>
- Domain-specific** Gratton effect
  - Influence of Simon-conflict on subsequent Simon effect
  - Influence of priming-conflict on subsequent priming effect
- Domain-general** Gratton effect
  - Influence of Simon-conflict on subsequent priming effect
  - Influence of priming-conflict on subsequent Simon effect

## Results I

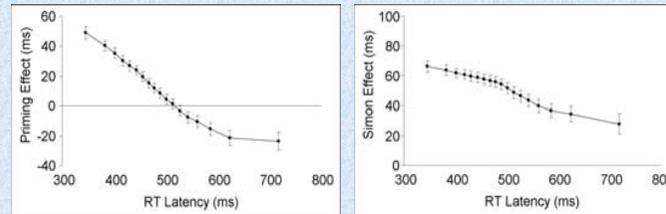
### Interference Effects



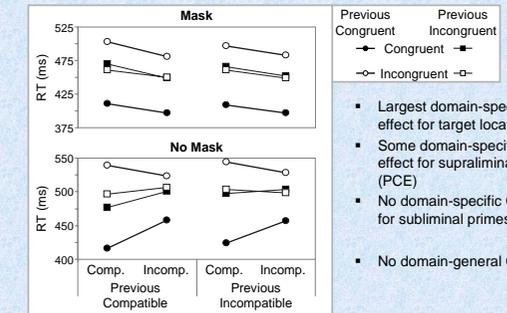
- Negative compatibility effects (NCEs) with masked primes
- Positive compatibility effects (PCEs) with non-masked primes
- Simon effect does not interact with NCE
- Simon effect interacts with PCE

### Time Series Analysis

(non-masked primes only)



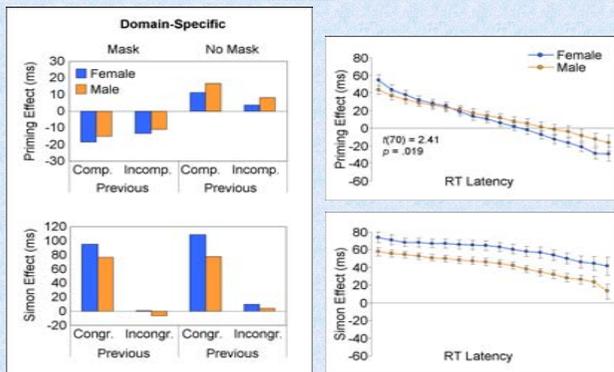
- Fast, active inhibition of prime-induced interference
- Slower (possibly passive) decay of target location-induced interference



- Largest domain-specific Gratton effect for target location (Simon)
- Some domain-specific Gratton effect for supraliminal primes (PCE)
- No domain-specific Gratton effect for subliminal primes (NCE)
- No domain-general Gratton effect!

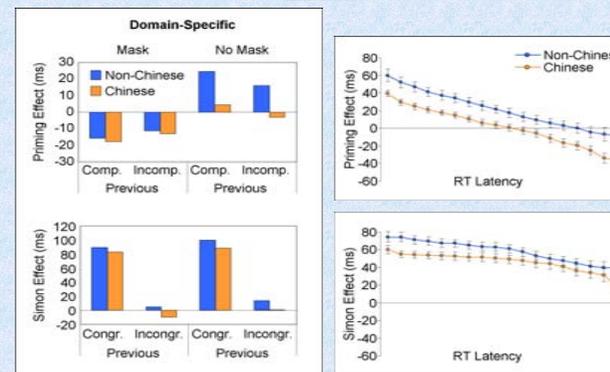
## Results II

### Gender



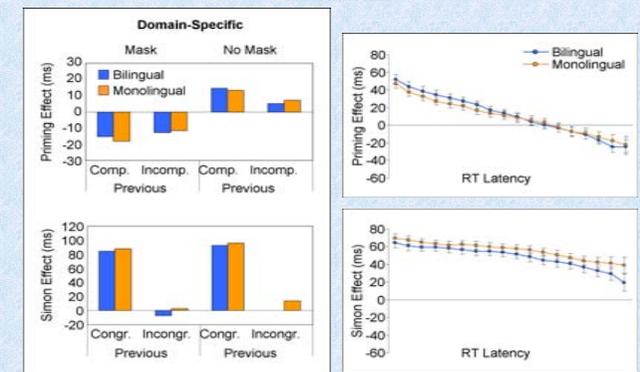
- Simon effects women > men
- Modulation of Simon effects (Gratton effect) woman > men (with non-masked primes only)
- PCE slope women > men

### Culture



- PCE non-Chinese > Chinese

### Languages



- No language effects

## Conclusions

- "Cognitive Control" is not a unitary phenomenon: Spatial (Simon) and identity (prime) interference are handled by different systems
- Magnitude of interference effect is insufficient to determine if differences in inhibitory cognitive control exist time-series analyses provide a better insight
- Gender and culture, but not bilingualism, affect high-level interference and control processes in priming and Simon tasks
  - Women show more effective inhibitory control of prime-induced interference than men (steeper slope)
  - Women and non-Chinese show more interference from (but not less inhibitory control of) irrelevant information than men and Chinese
- Low-level interference control (NCE) is mediated by yet another system, which is
  - not affected by either ongoing high-level control
  - nor by individual differences in gender, cultural background, or number of languages spoken

## References

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