The nature of transparency effects in Chinese compound processing

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Abstract

- Two new variants on the lexical decision task:
  - **Blocking** by transparency to see if strategies from one block can carry over to the other.
  - **Internal priming**, i.e., highlighting different components at different times, to see which components are used when in which type of compound.
- **Conclusion:** Decomposition is strategic rather than obligatory; it appears to be generally avoided for opaque words, and even for transparent words it may have to be explicitly “turned on”.

Decomposition questions

- Is morphological decomposition obligatory?
- Does it occur prelexically or postlexically?
- If decomposition only occurs when it's useful, does it occur for existing words, which can always be looked up whole?

Transparency as a tool

- Opaque compounds would not benefit from decomposition, since the components compete with the whole word
- Transparent compounds may benefit from decomposition, assuming that related words are linked in the mental lexicon
- Manipulating transparency can thus serve as a tool to address decomposition questions

Transparency effects in Chinese

- **Transparency speeds up** response times (RTs) in lexical decision for compounds (e.g., Su, 1998)
- **Negative morpheme frequency effects** in word lexical decision for opaque compounds (e.g., Peng, et al., 1999)
- Consistent with obligatory decomposition: activated components of opaque compounds compete with whole-word meaning

Opacities in Chinese studies

- The above effects are not fully robust (failures to replicate include Lü, 1996)
- Opaque compounds sharing components prime each other only with a sufficient time lag (Liu & Peng, 1997)
- Such results suggest that decomposition could be non-obligatory and/or postlexical

A Chinese twist

- The orthographic unit is the morpheme-like **character**, with no spaces between words
- This suggests that the relevant process for Chinese compounds may be **composition** rather than decomposition
- The symptoms of composition would be the same as for obligatory prelexical decomposition

Our goals

- Examine the possibility that decomposition is an opportunistic strategy
- Explore the time course of (de)composition
- To these ends, we developed **two new variants on the lexical decision task**

Blocking by transparency

- What if we gave a block of **fully transparent compounds** (**TT**) prior to a block of **fully opaque compounds** (**OO**), or the reverse?
- Would strategies develop in the first block and then carry over to the second block?
  - A (de)composition strategy would benefit TT
  - A whole-word strategy would benefit OO

Where the materials came from

- All were nominal compounds of mid-range frequency composed of free morphemes
- 140 naive speakers judged compounds for semantic relatedness with their components
- Compounds classified into OO, OT, TO, TT by selecting items for each set furthest from the median of the mean scores (following Libben, et al., 2003)

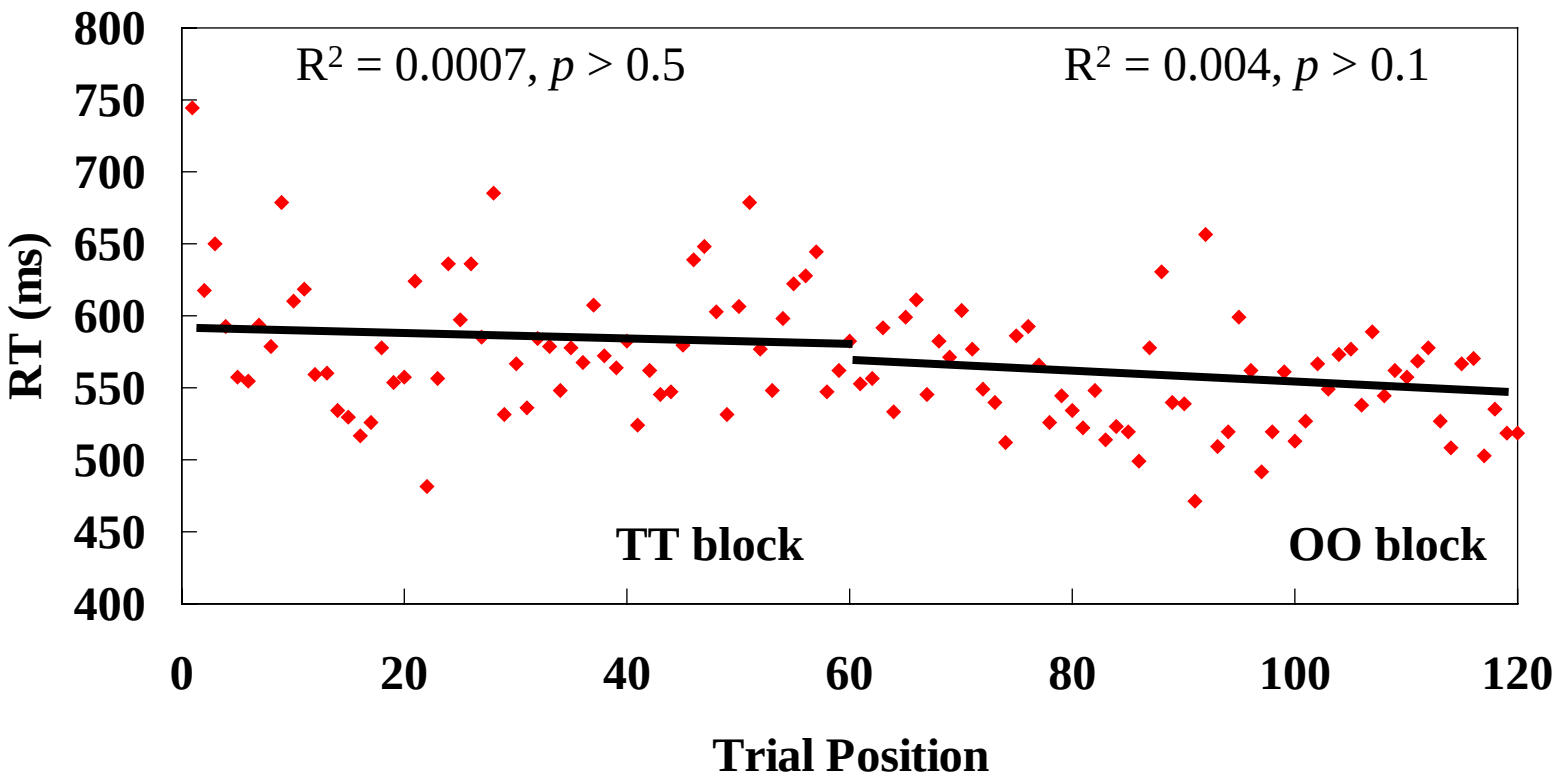
Experiment overview

- 120 trials (60 real compounds: 30 each of TT, OO, matched for frequency)
- 40 participants
  - **TT-OO group** (20 participants): TT block before OO block
  - **OO-TT group** (20 participants): OO block before TT block
- Visual lexical decision (foils composed of real characters)

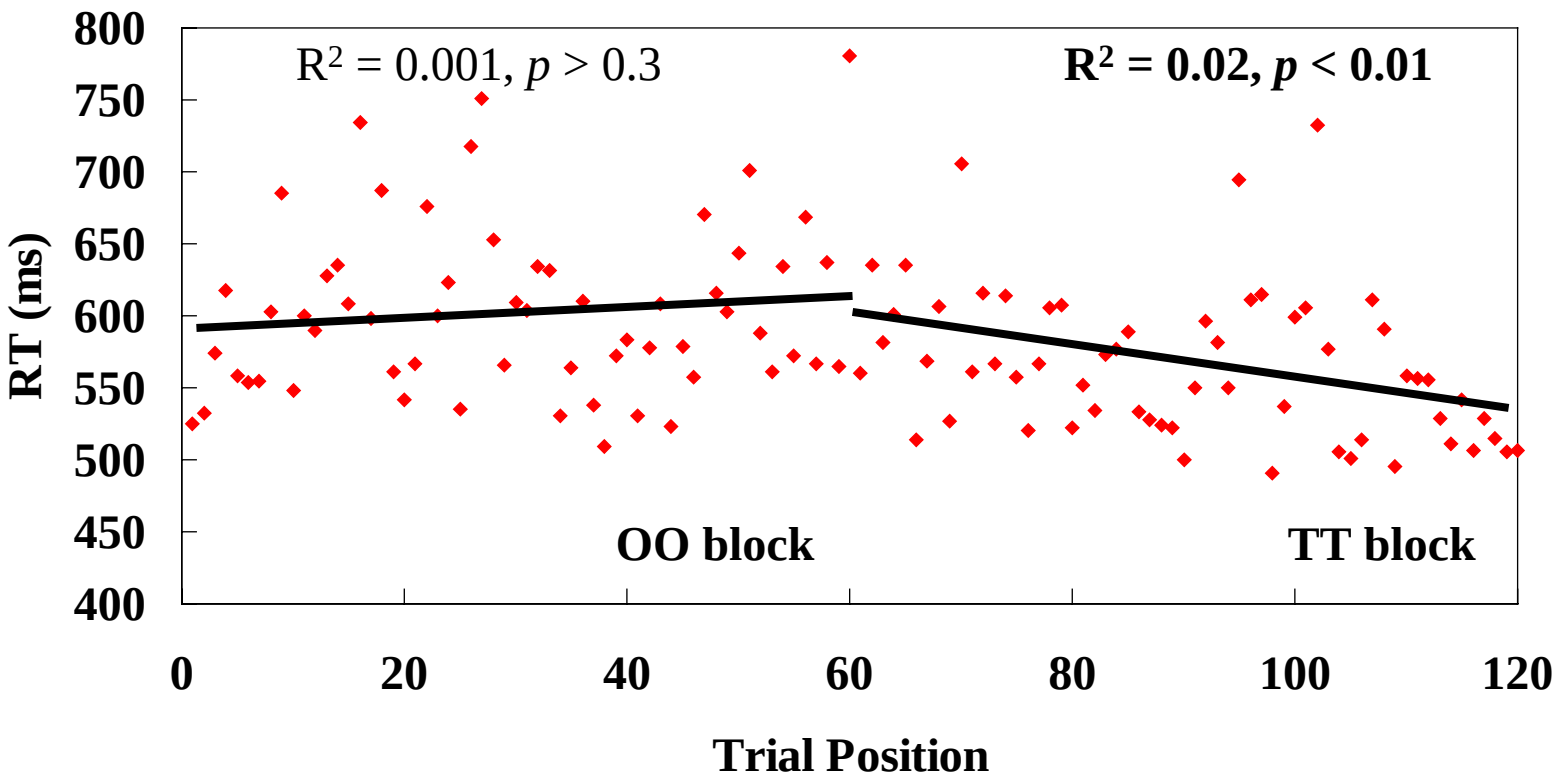
Analysis

- Lognormed RTs for correct word responses were submitted to a linear mixed effect model with categorical factors **Block Order** (TT-OO vs. OO-TT) and **Compound Type** (TT vs. OO), plus covariate **Trial Position** (1-120)
- No main effect of Compound Type, but there was a three-way interaction ($p < 0.01$): **RTs in TT block of OO-TT dropped faster**

TT-OO block order



OO-TT block order



Interpretation

- **Decomposition is not obligatory**
  - Context makes a difference
  - Decomposition only applied to TT when contrasted with OO (in OO-TT block order)
- **Decomposition is not generally useful**
  - It doesn't help transparent compounds so much as hurt opaque ones
- **Composition thus cannot be the sole strategy either**

Time course questions

- When decomposition occurs, how does it make transparent compounds faster?
- Is it because **prelexical** activation of components is an efficient strategy for accessing transparent compounds?
- Or is it because **postlexical** activation of components doesn’t conflict with the confirmation of transparent compounds?

Target-internal priming

- What if we highlight components while readers judge compounds? This might affect different stages differently.
  - **Position of transparency:** OO, OT, TO, TT
  - **Position of highlight:** Character 1, Character 2
  - **Timing of highlighting:** Early, Late
- Highlighting components should affect RT only at times the system is using them

Experiment overview

- 144 targets (72 real compounds: 18 each of OO, OT, TO, TT, matched for frequency)
- 42 participants in a Latin square
- Black characters “flashed” red (50 ms)
  - **Character 1**, **Character 2**, **Both** (as control)
  - **Early** (SOA = 0 ms), **Late** (SOA = 200 ms)
- Visual lexical decision (foils composed of real characters)

Examples

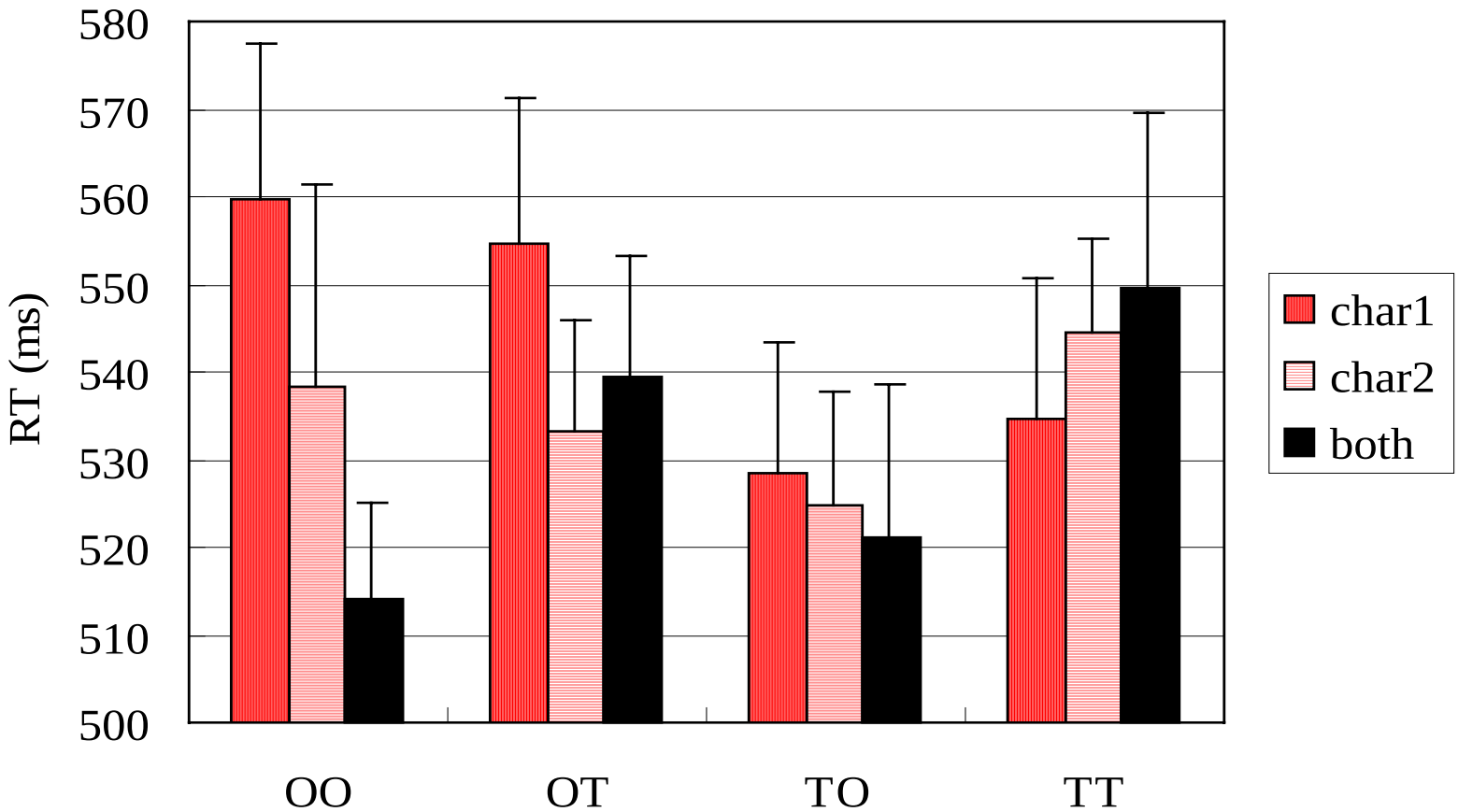
- Char1 Early: 國王 → 國王 → 國王
- Char2 Early: 國王 → 國王 → 國王
- Both Early: 國王 → 國王 → 國王
- Char1 Late: 國王 → 國王 → 國王
- Char2 Late: 國王 → 國王 → 國王
- Both Late: 國王 → 國王 → 國王

(TT *guo2wang2* “king”)

Analysis

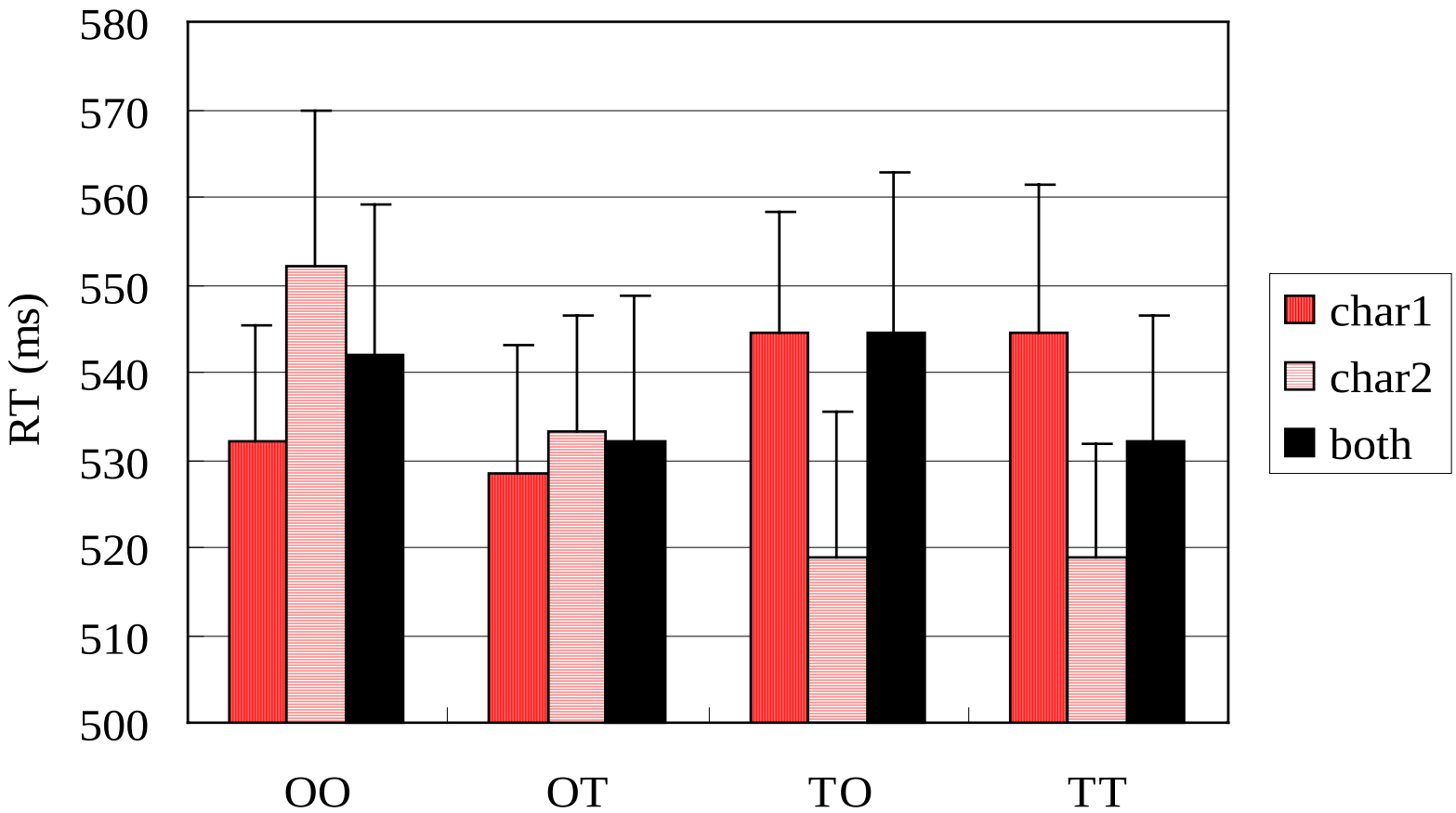
- Lognormed RTs for correct word responses were submitted to linear mixed effect model with factors **Compound Type** (OO, OT, TO, TT), **Position** (Char1, Char2, Both), and **Flash Time** (Early, Late)
- No main effects, but there was a three-way interaction ($p < 0.02$)

Effects of early flashing



(Bars represent standard errors from a 3-way ANOVA on raw RTs)

Effects of late flashing



(Bars represent standard errors from a 3-way ANOVA on raw RTs)

Result highlights

- Early flashing:
  - **Flashing char1 slowed RT if this component was opaque** (OO, OT)
  - **Flashing char1 sped RT** (TT only)
- Late flashing:
  - **Flashing char2 sped RT if *char1* was transparent** (TO, TT)
  - No other obvious patterns

Interpretation

- **Left-to-right processing**
  - Char1 effects early, char2 effects late
  - Char1 transparency more relevant than char2
- **Decomposition isn't generally useful**
  - OO & OT slowed by early char1 flashing
  - TO unaffected by early char1 flashing
- **Postlexical effects?**
  - Role of char1 transparency in char2 flashing effects

Overall summary

- **Blocking:** When transparent block followed opaque block, transparent compound RTs sped up only gradually.
- **Internal priming:** Flashing first component early slowed RT for opaque-initial compounds, but RT for transparent-initial compounds were sped only by late second component flashing.

Conclusions

- Decomposition occurs:
  - Speed-up in TT after OO block may imply that decomposition was “turned on”
  - Left-to-right effect in flashing experiment is consistent with prelexical decomposition
- But it isn’t obligatory:
  - TT wasn’t faster than OO in general
  - Opaque access derailed only if a component was highlighted, and only if it was the initial one

Acknowledgements

- Research assistants: Wang Wenling, Chiu Chenhao, Peng Yuru
- Financial support: Chiang Ching-Kuo Foundation (RG001-D-02) and a SSHRC MCRI grant

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