Is world knowledge activation exhaustive or selective during language comprehension? Evidence from bidirectional self-paced reading

Chengjie Jiang, Walter van Heuven, Ruth Filik (University of Nottingham)

It has been extensively demonstrated that world knowledge (WK) can be readily activated and affect real-time language comprehension, but few studies have recognised that an individual may hold conflicting knowledge from multiple cultural backgrounds simultaneously. For example, though *"the trains are white"* causes processing difficulties when presented to Dutch participants in Dutch (as Dutch trains are yellow, not white [1]), it may not be the case if presented to Chinese participants in Mandarin, as white trains are common in China. This raises a critical question: when individuals, particularly bilinguals, have knowledge of multiple cultures (e.g., knowledge about trains in both the Netherlands and China), is WK activation culturally exhaustive or selective? On the one hand, since lexical semantics are closely linked with their corresponding real-world concepts, WK may be stored and activated in a way similar to lexical semantics, which is exhaustive [2]. On the other hand, WK activation may be selective based on situational relevance [3]. For example, people may only activate knowledge about the country where the experiment is conducted. Alternatively, given the strong link between language and culture, people may automatically access culture-specific knowledge based on the language in which they are reading.

We conducted two bidirectional self-paced reading experiments in the UK. All participants were late and proficient Mandarin-English bilinguals, who were born and lived in Mainland China for at least 18 years, and had lived in the UK for at least six months before the experiment. Both Exp1 (n = 71) and Exp 2 (n = 60) manipulated the written language (Mandarin vs. English) and WK (consistent vs. inconsistent with the culturally specific WK for each language, e.g., English-consistent conditions were consistent with UK WK but not China WK and vice versa) in a 2 × 2 design (Table 1 & 2, 24 targets, 48 fillers). In Exp 1, the stimuli did not specify which country was being discussed. If WK activation is selective to the language of the stimuli, the WK consistency effect (longer RTs in inconsistent, than consistent, conditions) should be found in both Mandarin and English stimuli; if WK activation is selective to the country of the experiment, the consistency effect should be found in English stimuli but reversed in Mandarin stimuli; if WK activation is exhaustive, there should be no consistency effect in either language. The stimuli in Exp 2 included specification of the relevant country (e.g., "In the UK…") as a control for Exp 1, to confirm that the WK consistency effect can be observed in a specified scenario using the current methodology.

A combined analysis was conducted using Bayesian linear mixed models for three reading measures (first RT, go-past RT, and total RT) across seven regions of interest (from "bad fortune" to "of all kinds", Table 1 & 2). For all three measures in the critical, spill1, spill2, and spill5 regions, analyses provided evidence for an Experiment × WK interaction, BF_{10}s > 3.6. Specifically, there is evidence for the WK consistency effect in Exp 2, BF_{10}s > 5.8, but not in Exp 1, BF_{10}s < 0.26.

In conclusion, the current findings challenge the notion that only the information most relevant to the discourse is activated during comprehension [3]. Instead, they suggest that when the cultural context is not explicitly specified, WK is activated in an exhaustive manner similar to lexical semantics [2] — all knowledge relevant to the discourse is retrieved from comprehenders' long-term memory, irrespective of situational relevance.

Table 1. Exp 1 experimental conditions and exemplar stimuli

Conditions	Examples
Mandarin-consistent	四*常被视作*一个*不吉利*的数字。*不同人*可能会有*各种不同的*迷信。 Four is often perceived as an **unlucky** number. Different individuals may have all kinds of different superstitions.
Mandarin-inconsistent	十三*常被视作*一个*不吉利*的数字。*不同人*可能会有*各种不同的*迷信。 Thirteen is often perceived as an **unlucky** number. Different individuals may have all kinds of different superstitions.
English-consistent	The number 13 * is often * associated with * **bad fortune** * by many people. * Different individuals * may have * other superstitions * of all kinds.
English-inconsistent	The number 4 * is often * associated with * **bad fortune** * by many people. * Different individuals * may have * other superstitions * of all kinds.

Note. Different colours were used to highlight different regions in which effects were found: critical region, spill1 region, spill 2 region, spill5 region.

Table 2. Exp 2 experimental conditions and exemplar stimuli

Conditions	Examples
Mandarin-consistent	四*常被视作*一个*不吉利*的数字。*不同人*可能会有*各种不同的*迷信。 In China, four is often perceived as an **unlucky** number. Different individuals may have all kinds of different superstitions.
Mandarin-inconsistent	十三*常被视作*一个*不吉利*的数字。*不同人*可能会有*各种不同的*迷信。 In China, * thirteen is often perceived as an **unlucky** number. Different individuals may have all kinds of different superstitions.
English-consistent	In the UK, the number 13 * is often * associated with * **bad fortune** * by many people. * Different individuals * may have * other superstitions * of all kinds.
English-inconsistent	In the UK, * the number 4 * is often * associated with * **bad fortune** * by many people. * Different individuals * may have * other superstitions * of all kinds.

Note. Stimuli of Exp 2 were modified from those used in Exp 1 by adding a specification of the discussed country at the beginning — “In the UK” was added to the beginning of all English stimuli, and “在中国” (“In China” in Mandarin) was added to the beginning of the Chinese stimuli.

References

[1] Hagoort, P., Hald, L., Bastiaansen, M., & Petersson, K. M. (2004). Integration of word meaning and world knowledge in language comprehension. *Science*, *304*(5669), 438–441.

[2] Dijkstra, T., & van Heuven, W. J. B. (2002). The architecture of the bilingual word recognition system: From identification to decision. *Bilingualism: Language and Cognition*, *5*(3), 175–197.

[3] Sanford, A. J., & Garrod, S. C. (1998). The role of scenario mapping in text comprehension. *Discourse Processes*, *26*(2–3), 159–190.