

Concreteness Effects of Constituents in Naming Mandarin Compound Words: An ERP study

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The representation of compound words in the mental lexicon remains a central debate in psycholinguistic research, with full-listing models[1][2][3] proposing holistic storage and compositional models[4] arguing for morpheme-based access. The present study investigated this issue by examining the concreteness effect of constituents in Mandarin Chinese compound word production, using both behavioral measures and event-related potentials (ERPs). Unlike previous studies that compared concrete versus abstract whole words, we manipulated the concreteness of individual constituents while keeping the entire compound words concrete and carefully controlling for lexical and sub-lexical variables including whole-word frequency, constituent frequency, familiarity, imaginability, stroke count, and semantic transparency. Forty-one native Mandarin speakers performed a picture-naming task while EEG was recorded. Two conditions were compared: concrete-concrete (cc) compounds, in which both constituents were concrete (e.g., 河马 “hippo”, from 河 “river” and 马 “horse”), and abstract-abstract (aa) compounds, in which both constituents were abstract but the whole compound was concrete (e.g., 乐队 “band”, from 乐 “music” and 队 “team”).

Behavioral results showed significantly faster naming latencies for cc compounds (813 ms) compared to aa compounds (848 ms), demonstrating a clear concreteness effect at the constituent level. ERP analyses revealed a significant modulation in the N400 time window (300–500 ms) over posterior electrodes (Pz, P3, P4, PO3, PO4), with the aa condition eliciting a larger (more negative) N400 amplitude than the cc condition. This N400 pattern contrasts with the typical concreteness effect reported in comprehension studies, where concrete words often elicit larger N400 amplitudes than abstract words[5][6][7]. The reversed effect observed here likely reflects the careful control of additional lexical and sub-lexical dimensions—such as familiarity and imageability—which have been shown to modulate the concreteness effect in previous research[5][8]. Single-trial linear mixed models confirmed significant main effects of concreteness and hemisphere, with hemispheric differences supporting dual-coding theory predictions[9] that concrete constituents engage both verbal and imagery systems.

The behavioral and ERP findings together provide strong evidence against full-listing models, which would predict no constituent effects, and instead support compositional models in which morphemes are retrieved during compound production[10][11]. Specifically, the results indicate that semantic features of individual constituents become active during naming, suggesting a multi-lemma account where each constituent accesses its own lemma-level representation[12]. This compositional view of lemma retrieval challenges the monolithic lemma hypothesis proposed in some versions of Levelt et al.’s model[4]. The findings are discussed in light of the unique properties of the Chinese logographic writing system, where characters map onto morphemes rather than phonemes[13][14], potentially amplifying semantic and morphological processing compared to alphabetic languages. Limitations include the restriction to semantically transparent compounds and a modest number of trials per condition (21), which may have affected signal-to-

noise ratios. Future research should extend these findings to opaque compounds and across different languages to establish cross-linguistic generalizability. The present study advances our understanding of morphological processing in speech production by demonstrating that constituent concreteness modulates both behavioral and electrophysiological responses, thereby constraining theoretical models of lexical access. These findings also have potential implications for educational practices and cross-linguistic equity in psycholinguistic research.

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Table: Experimental stimuli

Stimuli	Pinyin	English	Condition	English translation of each constituent
信封	xìnfēng	envelope	aa	信(letter) + 封(seal)
公主	gōngzhǔ	princess	aa	公 (public) + 主 (master)
囚犯	qiúfàn	prisoner	aa	囚 (prisoner) + 犯
国王	guówáng	king	aa	国 (country) + 王 (king)
士兵	shìbīng	soldier	aa	士 (warrior) + 兵 (soldier)
彩虹	cǎihóng	rainbow	aa	彩 (color) + 虹 (rainbow)
戒指	jièzhǐ	ring	aa	戒 (warn) + 指 (finger)
抽屉	chōuti	drawer	aa	抽 (pull) + 屉 (drawer)
拼图	pīntú	puzzle	aa	拼 (piece together) + 图
教堂	jiàotáng	church	aa	教 (teach) + 堂 (hall)
日历	rìlì	calendar	aa	日 (day) + 历 (calendar)
珍珠	zhēnzhū	pearl	aa	珍 (precious) + 珠 (bead)
皇冠	huángguàn	crown	aa	黄 (emperor/royal) + 冠
算盘	Suànpán	abacus	aa	算 (calculate) + 盘
衬衫	chènshān	shirt	aa	衬 (lining) + 衫 (shirt)
西装	xīzhuāng	suit	aa	西 (west) + 装 (clothes)
贺卡	hèkǎ	greeting card	aa	贺 (congratulate) + 卡
邮差	yóuchāi	postman	aa	邮 (mail) + 差 (messenger)
阳台	yángtái	balcony	aa	阳 (sun) + 台 (platform)
音响	yīnxiǎng	audio	aa	音 (sound) + 响 (loud)
领带	lǐngdài	tie	aa	领 (collar) + 带 (belt)
冰箱	bīngxiāng	refrigerator	cc	冰 (ice) + 箱 (box)
坟墓	fénmù	grave	cc	坟 (grave) + 墓 (tomb)
天鹅	tiān'é	swan	cc	天 (sky/heaven) + 鹅
手掌	shǒuzhǎng	palm	cc	手 (hand) + 掌 (palm)
树叶	shùyè	leaves	cc	树 (tree) + 叶 (leaf)
楼梯	lóutī	stairs	cc	楼 (building) + 梯 (ladder)
水果	shuǐguǒ	fruit	cc	水 (water) + 果 (fruit)
河马	hémǎ	hippo	cc	河 (river) + 马 (horse)
海鸥	hǎi'ōu	seagull	cc	海 (sea) + 鸥 (gull)
火箭	huǒjiàn	rocket	cc	火 (fire) + 箭 (arrow)
灯塔	dēngtǎ	lighthouse	cc	灯 (lamp) + 塔 (tower)
牛奶	niúnnǎi	milk	cc	牛 (cow) + 奶 (milk)
眼镜	yǎnjìng	glasses	cc	眼 (eye) + 镜 (lens)
花瓶	huāpíng	vase	cc	花 (flower) + 瓶 (bottle)
药丸	yàowán	pill	cc	药 (medicine) + 丸 (pill)
蛋糕	dàngāo	cake	cc	蛋 (egg) + 糕 (cake)
雨伞	yǔsǎn	umbrella	cc	雨 (rain) + 伞 (umbrella)

雪山	xuěshān	snow mountain	cc	雪 (snow) + 山 (mountain)
风车	fēngchē	windmill	cc	风 (wind) + 车 (vehicle)
鸟笼	niǎo lóng	birdcage	cc	鸟 (bird) + 笼 (cage)
龙虾	lóngxiā	lobster	cc	龙 (dragon) + 虾 (shrimp)