Incremental referential processing and redundancy: An eye-tracking study

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A common assumption is that redundancy is detrimental to communication (e.g., Grice, 1975). Yet in referential communication redundancy is ubiquitous (e.g., Pechmann, 1989). Under what situations can redundancy help or hinder communication? We examined this issue, focusing on the mechanisms operating when listeners use multiple attributes to identify a referent.

Much evidence suggests that listeners process linguistic input incrementally. Specifically, when the visual context is concurrently available, the attributes in a referring expression are immediately and sequentially mapped onto the referential context (Eberhard et al., 1995). One possibility is that, with a concurrently available display (*concurrent display* condition), the properties of earlier-mentioned attributes determine the role of later-mentioned ones: if the first adjective fully and saliently discriminates, the redundant second adjective will not facilitate its identification. By contrast, if the referring expression is heard before the visual display (*auditory first* condition), listeners are free to use any attribute in any order, so a redundant second adjective could facilitate referent identification, depending on its relative salience in the description.

We tested these hypotheses in five visual-world eye-tracking experiments (48 subjects, 48 items per experiment). Participants mouse-clicked an object in a visual array, in response to pre-recorded spoken instructions starting with *Click on the…*. In Experiment 1, the visual display was concurrently available and referring expressions always mentioned two adjectives when one adjective was sufficient. We assessed how the first and second adjective guide referent identification, by varying (1) the relative salience of the adjectives, by using color-pattern (*green spotted bow*) or pattern-color (*spotted green bow*) orders (assuming that color is more salient than pattern), and (2) their ambiguity (ambiguous vs. unambiguous) (Table 1). Relative to pattern-color orders, color-pattern orders shortened mouse-clicking latencies and showed more target fixations, indicating that the higher salience of the first adjective (i.e., color) aided referent selection. For both orders, unambiguous first adjectives shortened mouse-clicking and boosted target fixations relative to ambiguous first adjectives, whilst the ambiguity of the second adjective affected mouse-clicking latencies and eye movements only in pattern-color orders.

Experiment 2 examined if the redundant mention of a color adjective would always facilitate identification or if this depends on whether color can be used early. We compared pattern-color descriptions (*spotted green bow*) with pattern-only descriptions (*spotted bow*); pattern was always mentioned first and was fully discriminating, whereas color was either fully or partially discriminating (Table 2). Under concurrent display (Exp2A), the mention of fully discriminating color increased looks to the target, but it generally delayed mouse clicking. Under the auditory-first condition (Exp2B), however, color mention increased target fixations and sped up mouse-clicking, both when color was fully or partially discriminating. Experiment 3 examined if listeners ignore pattern when color alone can fully discriminate, comparing color-pattern descriptions (*green spotted bow*) with color-only descriptions (*green bow*); the first-mentioned color was always fully discriminating, whilst pattern was either fully or partially discriminating (Table 3). In both the concurrent display (Exp3A) and the auditory-first condition (Exp3B), the mention of pattern delayed mouse-clicking and reduced looks to the target, regardless of its discriminability, showing that listeners attend to all mentioned attributes, so the redundant mention of a less salient attribute hamper referential processes.

In sum, the impact of redundancy depends on how the attributes can be mapped onto the referential context. Under incremental processing, a later-mentioned redundant attribute is unlikely to speed up referent selection. By contrast, when all the attributes are heard in advance, the same attribute can facilitate early referent selection if it denotes a salient discriminating cue. Hence, redundancy can facilitate identification, but only if the redundant attribute is highly salient (e.g. color) and critically, it can be used early.

Table 1. Experiment 1 design

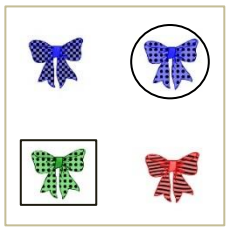
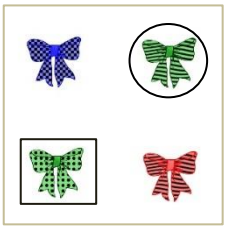
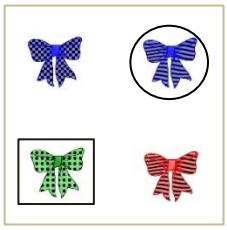
	Pattern partially discriminating	Color partially discriminating	Both fully discriminating
			
Pattern-Color: *Spotty green bow*	ADJ1 AMBIGUOUS	ADJ2 AMBIGUOUS	NO AMBIGUITY
Color-Pattern: *Green spotty bow*	ADJ2 AMBIGUOUS	ADJ1 AMBIGUOUS	NO AMBIGUITY

Table 2. Experiment 2 design

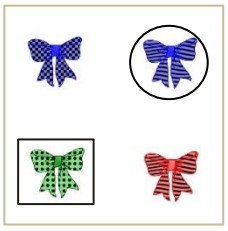
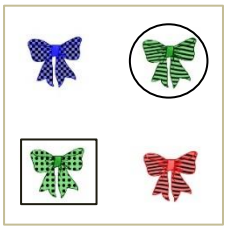
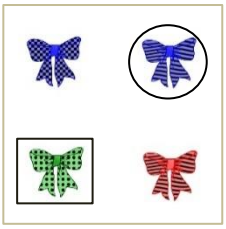
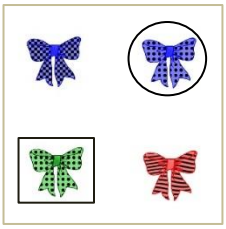
Color discriminability	
discriminating (unambiguous)	partially discriminating (ambiguous)
	
Pattern-only: *Spotty bow*	
Pattern-Color: *Spotty green bow*	

Table 3. Experiment 3 design

Pattern discriminability	
discriminating (unambiguous)	partially discriminating (ambiguous)
	
Color-only: *Green bow*	
Color-Pattern: *Green spotty bow*