Size Matters. Grounding Quantifiers in Spatial Perception

S. Pauw

Words like *many* and *few* have a dual nature: though traditionally analyzed as quantifiers (“many of the houses”), they also behave like gradable adjectives (“few/fewer houses”). In fact, such terms pattern syntactically and semantically with both quantifiers and adjectives. Why aren't they confined to one grammatical class? What is the cognitive basis for their dual behavior? And how might such conceptual and linguistic duality have evolved?

Historical evidence suggests that the dual syntax of these terms (henceforth, *gradable quantifiers*) might be the result of a grammaticalization process where they originate as adjectives and later become quantifiers, as illustrated by the quantifier *few*, based on the Old English adjective *feawe*. This dissertation explores the hypothesis that this grammaticalization path might be the result of the cognitive relationship between size and number. Judgments of size (underlying modifiers such as *big* and *small*) depend on perceptual features of objects (or sets of objects) in the environment. Judgments of approximate number (underlying terms like *few* and *many*) exploit a combination of spatial features that apply exclusively to sets of objects, such as their size and density. This cognitive overlap between the concepts of size and number may account for the duality observed in gradable quantifiers: the dependence on size motivates their adjectival uses, while their exclusive application to sets of objects motivates their quantificational uses.

This dissertation describes a series of experiments that captures the insight above within an evolutionary language games framework, in which robotic agents self-organize the means for describing objects (or in this case, groups of objects) in their perceived environment. The model allows the exploration of the specific conditions under which the hypothesis might hold. In particular, agents equipped with an approximate number sense that incorporates size can be shown to develop linguistic terms with the dual functions observed in gradable quantifiers.

A first set of experiments show that gradable quantifiers are indeed likely to emerge as adjectives due to their cognitive overlap with size predicates such as *big* and *small*. But, gradable quantifiers are not only cognitively related to size predicates but also to quantifiers such as *all* or *three* (they exclusively apply to sets). A second set of experiments show that this cognitive overlap will invite the (initially adjectival) gradable quantifiers to grammaticalize into quantifiers. Overall, this dissertation shows that the syntactic duality of gradable quantifiers might be reflecting an underlying cognitive duality. More generally, it suggests how the inclusion of cognitive constraints may illuminate the origins of both conceptual and linguistic duality.