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Languages encode space in strikingly different ways (Talmy, 2000): *Satellite-framed* languages (e.g., English) lexicalize *Manner* in verb roots and express *Path* in satellites, whereas *Verb-framed* languages (e.g., French) lexicalize *Path* in verb roots, leaving *Manner* implicit or peripheral; other languages present *parallel* systems in which both *Verb-* and *Satellite-framed* structures are available (e.g., Greek). The present study investigates how speakers of three typologically different languages, English, French and Greek, performed a production task and allocated their visual attention while exploring and describing visual scenes involving motion events. The findings show that participants' verbalizations and eye-movement fixations differed substantially as a function of language-specific factors, arguing that typological constraints have a clear impact not only on linguistic but also on non-linguistic behaviours.

Languages map semantic elements in very different ways when expressing motion. Talmy (2000) classifies languages into: *satellite-framed* (e.g., English) and *verb-framed* (e.g., French); the former are languages that lexicalize the *Manner* of motion in the verb and use satellites (e.g., particles) to express *Path* information within one compact structure (see example 1); the latter are languages that lexicalize *Path* in the verb stem, leaving *Manner* information implicit or placing it at the periphery of the sentence (e.g., gerunds/adverbials), (see example 2).

- Another type of languages can equally manifest structures of both types. Greek displays such a mixed system, as illustrated in (3-4). However, for some authors, Greek is clearly a *verb-framed* language (Papafragou et al., 2006; Selimis, 2007), in which the V-pattern is dominant.

- (3) *Efyge trehontas (pros ta pano)*

	PATH	MANNER	PATH	
	Left	running	(to-upwards)	
	'He left running upwards'			(V-framed pattern)
(4)	<i>Etrekse</i>	<i>mesa</i>	<i>sto spiti</i>	
	MANNER	PATH	PATH	
	Ran	into	to-the house'	
	'He ran into the house'			(S-framed pattern)

An additional issue relevant to the typological classification of Greek is prefixation. Greek exhibits a set of preverbs of motion verbs (e.g., *ανεβάζω*, 'to up-put'; *εξέρχομαι*, 'to out-come'; *κατεβαίνω* 'to down-walk/go'; *ξεγλιστρώ* 'to out-slide') which function as satellites for *Motion*, *Path* and/or *Manner* verb roots. However, little is known about this phenomenon, which may raise important arguments regarding the real typological status of Greek. In the present study I examine preverbs of this type and the option of an additional *S-framed* sub-pattern that may exist as a result of verbal prefixes that share properties of satellites, as illustrated in (5).

(5)	<i>Anevike</i>	<i>trehontas</i>	
	Ana [prefix]-	veno[Manner V-root]	treho[Manner V-gerund]
	PATH	MANNER/MOTION	MANNER
	up-walked/went		running
	'He ascended running'		(S-framed prefixed pattern)

Such striking cross-linguistic differences, apart from their typological interest, are significant for the study of the relationship between language and cognition, and contribute to the debate opposing *universalist* approaches—according to which spatial cognition is based on universal perceptual and cognitive processes that are independent from language-specific properties—and *relativity* approaches—according to which language-specific factors affect how speakers construct spatial representations. In the context of this debate and while most studies showing language effects have been based on language use (Hickmann, et al. 2009; Slobin, 2006), the present study analyses verbal and non-verbal responses of speakers of typologically different languages (cf. Soroli & Hickmann, 2010a) in order to determine the extent to which language properties influence different measures of cognition.

Method

The present study investigated how 42 native speakers of English, French and Greek (14 per language) performed a verbal task and allocated their visual attention while exploring and describing visual scenes (clips)

involving events of voluntary motion. The analysis of the verbal measures examined two aspects of the responses: the types of information selected for expression (*focus*) and the means whereby this information was expressed (*locus*). In Greek (see Soroli & Hickmann 2010b; Hickmann et al., submitted), the data were coded twice (*Verb-* vs. *Satellite-*coding). *V-coding* did not differentiate prefixed and plain verb forms, while *S-coding* decomposed prefixed verb forms into a verbal root and a satellite-like verbal prefix. As a result, verbal prefixes were treated as part of the verb in *V-coding*, but not in *S-coding*. The analysis of eye-movements examined the number, length and timeline of the fixations in specific areas of interest (*Path* vs. *Path±Manner*) in the clips.

Results and discussion

Subjects' verbalizations differed substantially as a function of language-specific factors. English speakers used compact structures that expressed both *Manner* and *Path* information and in which they systematically encoded *Manner* in verbs and *Path* in other devices. In contrast, French speakers mostly focused on *Path* information that was expressed in the verb, and either provided less information about *Manner* in the periphery of the sentence or did not use any other devices in the verbal network to express this information. As for Greek, it seems to present a third pattern, since some utterances seem to be *V-framed*, others are *S-framed*, and a third group seem to belong to an *S-framed* sub-system comprising *Path* prefixes. These patterns directly follow from language-specific factors that typologically differentiate English, French and Greek as *Satellite-*, *Verb-* and *Parallel-framed* languages respectively.

Turning now to eye-movements, although all speakers allocated more attention to *Path* overall, their focus also varied across language groups in all measures. More specifically, French speakers focused their gaze mostly on *Path* areas and this from stimulus onset until the end of the processing timeline. In contrast, the gazes of English and Greek speakers showed no preference for *Path* or *Path±Manner* areas of interest, with the exception of brief *Path* preferences at the onset of the stimuli for English speakers.

Conclusion

Overall the verbal and non-verbal findings point to differences in behavioural patterns as a function of typological language properties. In conclusion, we argue that typological constraints have a clear impact on linguistic behaviour, but also on non-linguistic behaviour. Such results contribute to current debates concerning the language-thought interface. In particular, linguistic analyses based on controlled methodologies, such as the one that was used in the present study, can yield comparable databases

across a number of languages, thereby making it possible to put forth fine-grained and realistic hypotheses concerning the cognitive implications of typological properties.

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