

INVITED ARTICLE

What spatial environments mean

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Abstract: Language is one of the most prominent means of representing human thought. Spatial cognition research has made use of this fact for decades, exploring how humans perceive and understand their spatial environments through language analysis. So far, this research has mainly focused on generic cognitive aspects underlying everyday purposes such as knowing where objects are, how they relate to each other, and how to find one's way to a familiar or unfamiliar location. However, human concepts about space can be threatened by change, as the environment changes. Across the globe, people become increasingly aware of climate-change related threats to their surroundings. For spatial language research, this calls for a fundamental shift in focus, towards the ways in which humans relate to space *meaningfully*—what spatial environments mean to us, how we respond to them and how we cope with changes and threats to our habitual space. This paper lays out how linguistic research can support building resilience on the basis of meaningful relationships to spatial environments.

Keywords: spatial language, place, environment, climate change, appreciation, spatial relations, resilience

1 Spatial language and cognition, change, and emotion

How do humans understand and relate to their spatial environments? Over several decades, research in this area has provided a host of insights on spatial thinking, much of which is based on language analysis. Systematic investigation of route descriptions across diverse contexts has identified key principles underlying wayfinding: humans orient to landmarks [21], (the main features of which have also been addressed systematically [2]), chunk the routes into useful portions [18], switch perspectives according to a number of principles [41], use qualitative and schematic rather than precise metric measures of distances and angles [31], and use diverse heuristics depending on the situation [13]. Likewise, systematic investigation of spatial object reference has shown how humans conceptualize the location of objects relative to themselves or to other objects or locations [33], again using qualitative and schematic measures and relying on diverse reference frames [19]. All of

these language-based insights, and many more, are central to understanding how humans think about space. Insights of this kind are understood to be generic, highlighting cognitive principles that remain fairly stable over time, although the specifics of some aspects may differ according to culture [20] and situation [27].

While the need to explore such cultural and situational diversity is widely recognized [5, 23], what seems to be less clearly understood is a further source of variation: the changeability of the environment itself. With increasing awareness of climate change related threats, this issue becomes more prominent. Humans have a certain mental model of their environment [42]—a way of understanding and relating to it that is based on and affects their daily interactions with it. If this same environment is threatened, the mental model inevitably loses stability. However, which aspects of spatial thinking are affected, and in what ways, is unclear to date.

If a road is blocked, keeping us from following the planned route, we may be able to think of an alternative route if we have access to the relevant survey knowledge [15]. If a landmark changes, for instance a prominent shop ceases to exist, we have a tendency to still refer to it as it is firmly placed in our memories. But the more the environment is distorted, the greater the challenge. In disaster scenarios, if a building collapses, humans have a hard time making sense of the remaining structures, faced as they are with debris, clutter, and distorted and unclear views [37].

The latter scenario highlights a further point, which is too central to a catastrophic scenario to be ignored: the emotional effects, a high degree of stress, along with a sense of urgency ensuing from a highly unsettling scenario. To some extent, these effects will be triggered by any type of undesired change, no matter whether sudden and catastrophic (such as a disastrous storm flood) or slow and gradual (such as constantly rising water levels). Climate related threats affect our spatial environment, and the effects of the experienced or observed changes will affect both cognitive and emotional levels [8, 29].

In part, emotional distress caused by changing environments may be directly related to uncertainty in relation to spatial behavior. Road blocks cause distress if we don't know a good alternative route; generally, feeling lost (not knowing where we are or how to get to our destination) is a highly unsettling experience [14]. However, emotional reactions to environmental change further relate to a very different aspect of human spatial experience in which linguistic representation remains rather underexplored to date: the fact that we deeply appreciate our environments, that we relate to them not only cognitively but also emotionally. This relates to the notion of *place* rather than *space*, which we will explore briefly in the next section.

2 Research on place

The notion of place is well-known and widely investigated in the realm of human geography [4] and elsewhere (such as literary analysis [12]), exploring human sentiments about specific locations. However, systematic linguistic analysis has so far mainly focused on the cognitive rather than emotional aspects of human understanding of space [36].

In an excellent recent review of the various facets of the notion of place, Hamzei, Winter and Tomko [10] spell out how the original notion of 'space overlaid with meaning' [26, 40] has expanded (particularly over the last decade) into heterogeneous terminologies and conceptualizations, contributing different aspects concerning how humans relate to places.

The most salient or frequently mentioned facets of place comprise name, type, location, affordance, activity, meaning, place identity, and sense of place. Clearly, these facets reflect central elements of human everyday life. We relate to places, and identify with them, because they are meaningful for what we do, who we are, and where we live. Spatial environments are thus not simply challenges to be understood (cognitively) and dealt with (behaviorally, as in wayfinding) but also, and possibly primarily, they are filled with meaning—and if they change, this meaning is challenged and threatened.

Language, as highlighted by Hamzei et al.'s review [10], provides access to various central elements of this complex notion of place. For instance, central insights can be (and have been, to some extent) gained by investigating how places are referred to [25], by their names (such as toponyms) or in various other ways [46]. More extended descriptions such as narratives about places (or, in fact, route instructions) highlight further aspects as to how these places are conceptualized. However, as becomes implicitly clear from the review, the differentiation between space and place has not been spelled out sufficiently in the area of linguistic analysis.

The language of place can be expected to represent the various facets of meaning beyond spatial location or spatial relationships. Thus, linguistic representations of place should reflect deeper notions of meaning, place identity, affordance, sense of place and the like—all of which go beyond a mere understanding of spatial relationships. To my knowledge there is no systematic account available to date spelling out how language accomplishes this. However, most of the available insights on place from other disciplines relate to language in some way, and many have used language as a data source [6]. This is unsurprising as language is the most prominent way in which meaningful human relations to place become manifest. Looking more closely and systematically at the ways in which people express their appreciation of place(s) in natural discourse is therefore a promising way forward in the endeavor to understand notions of place [36].

3 Understanding and harnessing meaningful relations to environments

Intuitively, there is a straightforward relationship between the discourse about place and the ability to deal with changes, building resilience in the face of climate change and related threats. We talk about what is important and relevant to us [28], we act on the basis of affordances [9]—i.e., on our perception of what can be done with a particular object or place, and we share insights through language and align to each other's thoughts on this basis [24]. This alignment on basic values is central to our ability to act jointly in the face of threats and emergency [45]. The ability to express our appreciation of environment is therefore key to the ability to act to preserve it.

To capture these effects in more depth, the following central challenges, at least, will need to be addressed, paralleling those that have been recognized and resolved (to varying extents) for spatial language.

- **Systematic account of the repertory of the language of place.** How do humans linguistically represent the meanings that they associate with places? What are the generic principles regarding the semantics and discourse of place? For spatial language, this challenge has been addressed, for instance, in terms of cognitive seman-

tics [32], linguistic ontologies [1], and conceptual reference frames underlying spatial language use [19,34]. For the language of place, only a few initial insights are so far available to elucidate the relevant linguistic repertory [7].

- **Contextual factors.** Which generic aspects of the environment affect the extent to which, or the ways in which, humans attribute meanings to spatial environments? For spatial language, relevant insights include the effects of functional relations between objects in object reference [3], effects of scale [22], cultural and individual variation [11], and current purpose (e.g., referring to a location or spatial object vs. distinguishing it from others [43] or reaching it spatially [39]). For the language of place, decisive contextual factors can be expected to include personal relevance [35], societal histories and networks, affordances (things to do in an area), and the like [16].
- **Temporal aspects.** How do notions of place change over time, in what ways can they be dynamic, and what are the challenges in this respect? Research on dynamic aspects of space includes motion concepts [44] and spatiotemporal reference frames [34]. For notions of place, change can often be coupled with threat, for instance to one's identity when a home environment is at risk.
- **Dialogue and communication.** Humans relate to places individually, based on their personal interests and background. To what extent, and in what ways, are notions of place transferable, and how do humans align their sentiments to agree on specific actions to preserve the environment they appreciate? For spatial language, interaction partners have been shown to align to each other in terms of reference frames and perspectives [27], and level of detail or granularity [38]; also, there are culturally established principles of spatial communication such as how route descriptions are formulated and structured [30].

For the language of place, aligned meanings can be observed, for instance, in social movements [17]. Sharing of sentiments and insights about environments and supportive actions is doubtlessly central to our modern world, supported by traditional as well as social media, and movements that strive to raise awareness for environmental issues through communication. Future work on the linguistic representation of place should investigate how people communicate their sentiments regarding spatial environments and how negotiation processes help to develop resilience jointly in the face of threats.

Since the language of place represents meaning associated with space in addition to understanding and dealing with space, there are limits to the parallels that can be drawn from traditional spatial language research. However, there are also overlaps; a range of insights about place have come out of the analysis of spatial discourse [10]. Most importantly, in-depth understanding of the language of place has the potential to add a layer of *meaning* to associated research: the aim to harness the multi-faceted insights towards resilience that are represented in the ubiquitous manifestations of what spatial environments mean.

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