



Cognitive-Cultural Looping Mechanism of Urban Space Conceptualization

Zahra Alinam¹ · Kristian Tylén² · Mohammad Taghi Pirbabaei¹ ·
Minou Gharehbaglou¹

Accepted: 16 August 2021 / Published online: 29 August 2021

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2021

Abstract

A crucial point for urban design is the acknowledgement that urban material structures are not only constituting a set of cognitive-cultural affordances that shapes people's behavior and experiential world, but likewise that the design process itself is an expression of cultural conceptualizations possibly evoked by ongoing cultural practices and perceptions, thus forming a dynamic loop. In this paper, we outline a framework for the study of material, cultural and social mechanisms interacting with human cognition, behavior and emotions. We attempt a conceptual model that integrates dynamic interactions between cognitive-cultural affordances and our conceptualization of the environment and provides a few illustrative case examples. The model proposes a set of dynamic relations between cognitive and cultural processes at shorter time scales modifying conceptualizations and environmental affordances on longer timescales, while these – in turn – come to guide and constrain processes at the shorter timescales. The model has important implications for our understanding of the role of environmental design, especially urban design, as bridging between aspects of human situated experience, behavior, social and cultural norms and material culture.

Keywords Urban design · Affordance · Conceptualization · Human behavior · Cognition

Introduction

Urban environments all around the world engage humans not only as context for various activities and practices, but also mentally by shaping their experiential world, and thereby the way they assign meaning to their material and social surroundings.

✉ Mohammad Taghi Pirbabaei
pirbabaei@tabriziau.ac.ir

Extended author information available on the last page of the article

This has the implication that urban design is not only involved in reinforcing or impeding particular behaviors on a material/physical level, but also influences the dynamic relationship between the material and the cognitive aspects of human life. Beyond a set of physical constraints on human behavior, the urban landscape is thus embodying the social norms and values of our communities, and thereby plays an important role in the social constitution and transmission of culture (Kozma, 2003; Latour, 1996).

Culture is a macro construct providing a framework for understanding the special ecology of humans, and thus assisting us in interpreting and explaining how and why individuals think, feel, and act the way they do (Bond & Leung, 2009; Kashima, 2009). Oyserman and Sorensen (2009) purport that cognition and culture are in a mutually generative relationship making the experienced meaning of any given situation deeply affected by culture. Culture is not a stable set of values, norms or self-representations within individuals' minds, but emerges from the situated interaction between the individual and the context. Beyond cognitive and thus generally latent aspects (i.e., internalized culture), culture manifests itself in observable, non-malleable material features and spaces.

Urban design deals with spaces where different types of activities take place in different frameworks and provide meaning to these spaces (Bahreini, 2002). Culture directly affects urban environments and spaces through its system of practices and activities and its normative and evaluative orientation by providing specific directions and instructions on how to do things. Therefore, as a constructed space, an urban space is a cultural product with deeply social contents. Members of a society practice their culture based on their recognition of the world around them and that practice shapes their world in turn (Morin, 2009). In other words, human-made urban spaces are simultaneously a manifestation of existing cultural practices and a normative transmission of these in the sense of affording these practices (Parsi, 2001).

Although individuals perceive specific environments in their uniquely contextualized and particular way, it is possible to detect reoccurring patterns amongst different representations of the same environment. These similarities are, among other things, due to the structure of the physical, cultural and linguistic environment that induces or stimulates certain apprehensions (Gibson, 1979; Cosmides & Tooby, 1994; Vygotsky, 1980; Donald, 1991).

The concept of "affordance" is increasingly used among designers because it adds conceptual clarity to the understanding of the link between the environments, human behavior, values and need fulfillment (Lang, 1994, Baggs et al., 2019). While affordances refer to the interdependency of organism and environment, that is, how our behavior is shaped by the structure of the environment, conceptualization refers to the way we mentally construe the world. Urban environments are context in which people construct their outside world and within this environmental framework, the spatial organization of urban society establishes the pattern of human behaviors; interrelated to the experience, culture and knowledge (Walmsley, 1988). The way a city is experienced affects how it is continuously transformed, and this, in turn, affects how it is experienced (Ittelson, 1978).

However, according to Hall (1966), individuals might act differently in otherwise identical physical environments due to their cultural norms and backgrounds. Urban design researchers have not typically studied interactive processes between humans and the environment at the cognitive level. Urban design is undergoing an important transformation as the field of cognitive science provides rich and insightful new knowledge of humans' conceptual engagement with the environment. By getting a better grasp on the way people mentally construe their urban environments, urban designers can make more informed decisions when they create places for people.

In this paper, we outline a framework for the study of the cultural and contextual mechanisms interacting with human biology to shape human cognition, behavior, and emotion (henceforth CBE). We start from the assumption that individuals' conceptualization of their urban surroundings is, at least in-part, shaped by their immersion in, and dynamic engagement with the cognitive-cultural affordances of these environments, which are in turn co-constituted and continuously shaped by the behavior of individuals in a circular dynamic.

The integrative framework we propose, bridges urban design and cognitive sciences to provide (i) an elaborated concept of 'cognitive-cultural affordance' that extends to cultural forms of life, and (ii) a multilevel account of the culturally scaffolded forms of affordance learning and transmission in cognitive-cultural practices and regimes of shared expectations. Such a framework is important for understanding how cultural affordances of the urban environment shape the cognitive-cultural conceptualizations through dynamic interactions leading to the long-term coevolution of cultural affordances and conceptualizations.

First, we review influential theoretical work on environmental affordances and conceptualizations with particular emphasis on the intersection between culture and cognition. Then, we suggest a circular-causality model of the interaction between affordances and conceptualization of the environment via CBEs: the cognitive-cultural looping mechanism. Finally, we provide a number of illustrative cases in order to substantiate our claims and inform discussions of the role of the proposed looping mechanism in urban design. Thus, they provide a useful demonstration of how the proposed cognitive-cultural looping mechanism works in the urban context.

The Cultural-cognitive Niche

Environmental Affordances

Much recent work in cognitive science has been influenced by the notion of *affordance* originally introduced by Gibson (1977; 1979). An affordance is a non-deterministic, precondition for activity (Greeno, 1994). In other words, affordances refer to the relations between the abilities of an organism and the environmental features of a *situation* (Goldstein, 1981; Greeno, 1994). The situation provides, that is, *affords*, a certain set of potential activities to living beings that lie in the intersection between the current environmental features and the organism's abilities to perceive them and act upon them (Chemero, 2003).

Contrary to contemporary computational theories of human cognition (e.g. Marr & Poggio, 1976; Fodor, 1975; Anderson et al., 2004), Gibson's theory of affordance puts special emphasis on the contextual embeddedness and dynamic interdependency of the organism and its environment. Rather than considering human cognition, behavior and emotion as mainly a product of individual brain processes, Gibson pointed to the impact of the surrounding physical and social 'ecology' in shaping human behavior.

Hence, a key aspect of affordances is that they are not just physical properties, but have to be considered relative to the organism perceiving them. This reciprocity between organism and environment is fundamental to the Gibsonian notion of affordances. (Gibson, 1979).

Like other organisms, humans need to adapt to their surrounding environment in order to survive (Darwin, 1909). Different environments introduce different conditions that humans must deal with and adapt to. However, humans are also cultural beings, which means that, more than any other species, we actively influence and construe our environmental niches (e.g. urban environments, Laland & O'Brien, 2011). Culture is thus both the product of human creation, but, in turn, also shapes how people attend to the environment, perceive others, memorize and learn information, and make judgments (Ji & Yap, 2016). In other words, the affordances shaping human behavior can be characterized as 'cognitive-cultural affordances' (Marcus et al., 2016; Ramstead et al., 2016). Several studies point to the influence of socio-cultural contexts on the perception and recognition of environmental affordances (e.g. Rietveld & Kiverstein, 2014; Durning & Artino, 2011; Chemero, 2003).

In their discussion of cognitive-cultural affordances, Ramstead et al. (2016) distinguish between two kinds of affordances: *natural affordances*, which depend on agents' exploitation of reliable correlations between her abilities and the environment, and *conventional affordances*, which depend on a shared set of expectations, norms and conventions. Importantly, there is thought to be a continuum between the two. This view of affordances as a 'graded continuum' is also in accordance with Davis and Chouinard's (2016) recent characterization of affordances, as determined by and depending on a number of not always easily discernable, situational cues. According to Ramstead et al. (2016), both kinds of affordances may be socially constructed. Hence, an affordance may be changed either by altering the ecological context (underpinning potential environmental affordances of the natural type) or human behavior (underpinning potential environmental affordances of the conventional type). Thus, affordances may be shaped and vary in relation to enculturation and social influence.

Human Behavior

Like for any other biological being, human behavior is – at least partly – guided by certain *biological needs* that need to be met in order to survive, including eating, drinking, sleeping, and seeking shelter (Sheldon, 2004). Each of them is ultimately related to reproductive success, that is, survival of the species. However, beyond individual evolutionary conditions, humans are characterized by a set of universal *social motives* (Tomasello, 2009, Tomasello et al., 2005). Sheldon (2004) proposes

that these social motives can be organized around three major themes—autonomy, competence, and relatedness. Similarly, Hogan (1982) posits the importance of the needs to “get along” and “get ahead”. These needs provide humans with the motivation and ability to socially negotiate and solve complex problems (Tomasello et al., 2005) giving rise to a level of socially distributed cognition (Hutchins, 1995).

Beyond these basic aspects of human nature, it has been suggested that human behavior is guided by two complementary sets of cognitive processes, sometimes referred to as *system 1* and *system 2* (Kahneman, 2011). System 1 cognitive processing is implicit, automatic, effortless, relatively fast, and involves parallel processing of large amounts of information. When the environment presents long-standing recurrent problems, specialized cognitive networks evolve to handle task specific inputs and generate particular solutions (Geary, 2005; Geary & Huffman, 2002; Tooby & Cosmides, 1992). Functionally specialized local networks respond automatically to domain-relevant information (Frith and Frith, 2008). In contrast, system 2 cognitive processing is explicit, conscious, controllable, effortful, relatively slow, and involves serial processing of relatively small amounts of information (Frith & Frith, 2008). This explicit processing is – at least to some extent – accessible to voluntary regulation and control (depending, for instance, on individual differences related to meta-cognition, MacDonald, 2008). System 2 processing thus denotes our ability to potentially sidestep our own local affordance-induced behavioral inclinations based on reasoning, or more explicit cultural conventions and values (Clark, 2006). We often carry with us such cultural conventions even when we face a context potentially affording a different behavior (Han & Ma, 2015).

Ecological Context

Culture can be conceived as the solution to the basic life conditions of a group. Once a group conventionalizes a set of practices conceived as a “good enough solution”, they are likely to become relatively stable, with change being incremental, even if alternatives are available (Argote et al., 2000; Chang et al., 2011; Cohen, 2001). Each group’s solution is different from another’s due to differences in the *historical* and *ecological contexts* in which each group exists—the physical environment, resources available, social factors, and types and size of family relations and communities. This implies that even though specific cultural solutions to basic problems might seem haphazard, they are often ecologically motivated and once instantiated, they are likely to remain and become rooted in norms and conventions, yielding a very particular set of practices.

Because different cultures exist in different ecological contexts, cultures differ in the specific contents of their meaning and information systems (Boyd et al., 2011). Cultural differences in meaning and information systems can be observed in two broad aspects of culture—the objective or explicit elements of culture, and the subjective or implicit elements (Kroeber & Kluckhohn, 1952/1963; Triandis, 1972). The former refers to material culture—architecture, urbanism, utensils, and the like, while the latter refer to the cognitive aspects of culture.

The notion that the ecological context influences cognitive-cultural affordances is supported by several lines of evidence. Ecological-level factors such as population

density (Way & Lieberman, 2010), climate (Van de Vliert, 2004., 2006; Van de Vliert et al., 2004; Van de Vliert & Janssen, 2002), and affluence (Triandis, 2001; Kashima & Kashima, 2003) most likely affect cultures because different groups need to create different solutions in order to adapt to their specific ecological contexts. Groups in areas with high population density, harsh weather, and low resource availability will evolve different solutions than groups with low population density, mild weather, and high resource availability. These different solutions produce distinct cultural niches (Matsumoto, 2007, Laland & O'brien., 2011).

Conceptualization of the Environment

One of the functions of human cultures is to give meaning to its social complexity (Matsumoto, 2007). Human culture is thus a meshwork of meaning and information, shared by a group and transmitted across generations, that allows the group to meet basic needs of survival, coordinate socially to achieve a viable existence, transmit social behavior, pursue happiness and well-being, and derive meaning of life.

While affordances refer to the interdependency of organism and environment, that is, how our behavior is shaped bottom-up by the larger ecology of the physical and cultural environment, conceptualization refers to the way we mentally construe the world in a more 'top-down' fashion (Barsalou, 2015). Humans naturally conceptualize their surroundings based on recurrent practices and commonly accessed knowledge. These conceptualizations assist us in quickly applying the same actions and knowledge in similar or familiar situations, but their entrenchment can also potentially prevent us from discovering or developing new ways of perceiving, understanding, and solving problems (Interaction design foundation, 2002). Conceptualizations are organized sets of information and relationships between things, actions, and thoughts that are stabilized in the human mind in recurrent encounters with some environmental stimuli (Slobin, 1987). A single conceptualization can structure a vast amount of information and is a way for our cognitive system to structure an infinite stream of continuous experience in a more manageable set of categories and relations (Lakoff, 2008; Lakoff & Turner, 2009). As these conceptualizations are elicited more or less automatically, the process can also unnoticeably obstruct alternative and perhaps more fitting representation of the situation or prevent us from seeing a problem in a way that would otherwise enable a new problem-solving strategy (Duncker, 1945).

People often differ in their conceptualizations of the same environmental structures, relations and affordances, based on their history of interactions with the physical, social, and linguistic environment (Barsalou, 2015). Members of cultural groups are thus found to share certain conceptualizations based on their common cultural and linguistic history, which leads to what one could call "cognitive-cultural conceptualizations" (Tylén et al., 2013). Several studies have suggested that environmental factors can motivate subtle differences in conceptualizations that become gradually entrenched over time through mechanisms of cultural transmission. Examples include cultural and linguistic differences in how we parse up the color space in basic color terms (Brown and Lindsey, 2004; Regier et al., 2016), linguistic sound

inventories (Everett, 2013, 2017; Maddieson & Coupé, 2015), spatial relations (Nölle et al., 2020; Majid et al., 2004; Levinson, 1996), or event structure (Christensen et al., 2016; Malt et al., 2008; Majid et al., 2008).

Although most explicitly concerned with social interchange, once developed, cultural practices permeate all aspects of behavior and come to guide and constrain perceptions and behaviors across a variety of situations even outside the social realm. The impact of culture on aspects of group membership, relationships and innovation, thus has downstream influences even on seemingly unassociated cognitive processes related to, for instance, low-level attention, visual search and judgments (Henrich et al., 2010). In other words, culture come to shape the way people experience their environment. There is a rich body of research in visual perception, spatial cognition, attention and spatial navigation strategies, which seem to be potentially modulated by urban characteristics (e.g., Robinson & Pallasmaa, 2015; Zeisel et al., 2003; Wells et al., 2007; Kaplan et al., 1998; Kaplan & Kaplan, 1983; Hollander & Foster, 2016; Foo et al., 2005). As a meaning-making framework, culture both constrains and enables perception and reasoning (Nisbett & Norenzayan, 2002). Culturally appropriate situations seem right; culturally inappropriate situations seem wrong or off-key (Triandis, 2007). These effects are dynamic and situated and can be studied systematically in priming experiments evoking cultural frames (Markus & Oyserman, 1989; Oyserman et al., 2009). People are thus sensitive to cues as to which cultural mindset is situationally relevant (e.g. an individualistic or collectivistic mindset, Oyserman, 2015). When contextually evoked, a mindset influence how ambiguous situations are perceived by activating an associative network of constructs (Oyserman, 2017).

Beyond directly observable links between material structure and human behavior is the intangible concept of value. Most of our emotional relations to our environmental surroundings belong to this implicit level of cognition (Mesquita, 2003). An individuals' sense of preference for - or rootedness in - an environment over others is an example of this (Clark & Uzzell, 2005). These emotional dimensions are examples of an automatic system 1 response elicited not alone by material affordances, but also by the personal and social history within a space. Rootedness refers to unconscious sense of place and the most natural and unmediated kind of individual place bonding, a feeling of unreflective security and comfort in a particular location (Stegner, 1992). Several urban studies have examined the concept of "home" and "neighborhood", which provides an individual with a secure point of significant spiritual and psychological attachment (e.g., Alinam et al., 2017; Pirbabaei et al., 2016; Comstock et al., 2010; Walker & Ryan, 2008; Lewicka, 2005).

In addition, the feeling of pleasure and beauty can be considered as environmental affordances (Grahn & Stigsdotter, 2010) because they reflect an assessment of the environment in terms of its compatibility with human needs and purposes, which affects effective human functioning in the settings (Kaplan & Kaplan, 1989). We can explore the environmental affordances and attributes through preference research to learn about those that are more important and meaningful to people. Over the last four decades a large experimental literature has been conducted on preferences and some have focused on affordances in urban settings as the predictor of preference (e.g., Payne et al., 2002; Clark & Uzzell, 2005; Kytä, 2004; Min & Lee, 2006).

Thus, human cultures prescribe meanings to situational contexts, and because human social life is complex, the myriad of situational contexts in which individuals exist is associated with a myriad of cultural meanings. The meanings of the various situational contexts create expectations for normative behaviors, that is, the behaviors that a member of a culture experience as implicitly expected and appropriate in certain situational contexts (see Goffman, 1959). There are many examples of culturally-distinct behaviors. For instance, some cultures have stronger divisions between, for example, the public and private sphere, and members of such cultures regulate their behaviors much more in public than in private (Kaya & Weber, 2003). The regulating effect of public settings may be due to the fact that being in public is associated with the cognitive representation of a reputation that one has to “manage” (Frith & Frith, 2007, Baumeister, 2005; Tomasello, 2009). Thus, people watch what they do because they are concerned about how they will be judged by others. This concern is also likely activated in the mirror effect—the fact that individuals often regulate various aspects of their behavior when they imagine themselves as others see them (Mor & Winquist, 2002). Other examples address more locally constrained contextual differences in signaling behavior between national groups (e.g., Krieg, 2020; Hanel et al., 2018).

Thus, cultural differences in the meaning attributed to situational contexts have the implication that there are also differences in the specific role expectations associated with situations across cultures. While the situational context provides the general scripts of behavior, cultures adjust those scripts according to their context-specific frameworks (Matsumoto, 2007).

An Operational Model of the Human-environment Interaction

In daily life, people continuously update or even form new cognitive-cultural conceptualizations as they encounter different situations with their contextual affordances. There is ample evidence that people acquire culturally-distinct conceptualizations from exposure to local affordances (Richerson & Boyd, 2005; Slobin, 1987; Majid et al., 2004; Levinson & Levinson, 2003). While some of this evidence is descriptive and correlational, there are also several laboratory experiments on cultural priming that provide causal evidence for influences of affordances on contextualized CBEs. For example, priming individuals with specific cultural affordances altered behavioral performance during tasks that required causal attribution (Hong et al., 2000), memory recall (Morris & Mok, 2011), or spatial navigation (Nölle et al., 2020).

Furthermore, studies suggest that activity in certain areas of the brain varies as a function of recent access to specific cognitive-cultural affordances or knowledge (Sui & Han, 2007; Chiao et al., 2010; Tylén et al., 2016). The findings indicate that both long-term and short-term cultural experiences influence the brain activity involved in multiple mental processes, and provide evidence for interactions between specific mental cognitive-cultural conceptualizations and environmental affordances. Together, the findings suggest that our conceptualizations of the environment are not

biologically determined, but acquired through experience and thus highly sensitive to culturally contextualized affordances.

Just as our conceptualizations of the surroundings are influenced by the affordances of the surrounding environment, the affordances themselves are not static but continuously constituted, reinvented and changed through our cultural practices and the material traces they leave behind in the environment (Latour, 1996; Tylén & McGraw, 2014; Tylén et al., 2016). The interaction between conceptualizations and affordances allows the development of culturally-specific affordances and provides a contextual basis for cognitive, behavioral and emotional acculturation (Zuo & Han, 2013; Cao et al., 2015).

While the influence of cultural affordances on our conceptualizations belong to the faster timescales of online interaction and cognition, the continuous adaptive change of affordances mostly unfolds in a more incremental way on slower timescales. Socio-cultural conventions, traditions, and practices along with their supporting material structures, are generally more durable, but are constantly affected by processes at the faster times scales of human interaction. Some of these changes are subtle and emerge from the interaction of many factors. Others are the product of more deliberate acts of creativity and innovation, or imports of conventions or developments from other societies (Wager, 1981). New social values can thus modify environmental affordances and are thereby transmitted from one generation to the next.

A Cognitive-cultural Causal Loop

Cultural contexts influence our behaviors, for instance, through socially transmitted cognitive-cultural affordances, conceptualizations, and norms. These, in turn, are themselves products of human activity and are embodied in material culture belonging to different timescales of evolution. In an attempt to descriptively capture these circular dynamics, we propose a *cognitive-cultural looping model* (illustrated in Fig. 2). It posits that cognitive-cultural affordances (e.g. in an urban environment) are picked up by individuals and diffused in a population through formation of shared beliefs, behavioral and emotional practices (CBEs). The resulting local practices can potentially again affect conceptualization processes, with the consequence of absorbing and stabilizing new cognitive-cultural expectations that shape future encounters with the environment. The modified CBEs thus come to shape the conceptualizations that guide individuals' cognition, behavior and emotion and can lead to modification of the concurrent sociocultural and material environments providing individuals with *new* environmental affordances.

On the behavioral plane, a local cultural contextualization may implicitly prime certain choices. In other words, our behavior is partly shaped by moment-to-moment adaptations to cues from the surrounding environment. In the field of urban studies, it has been observed how affordances in the urban environment influences and constraints the behaviors and interactions happening within it. However, at the same time, aspects of the environment are themselves incrementally modified by the continuous activities and transactions within them.

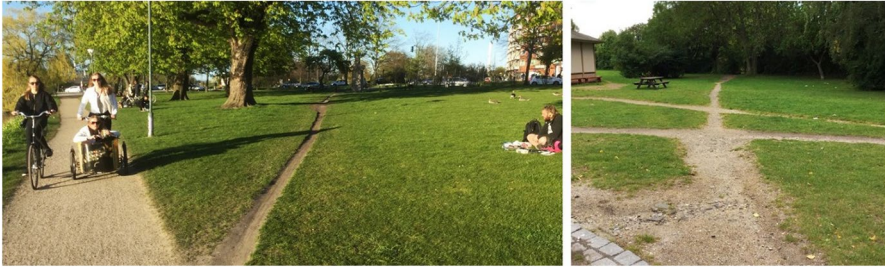
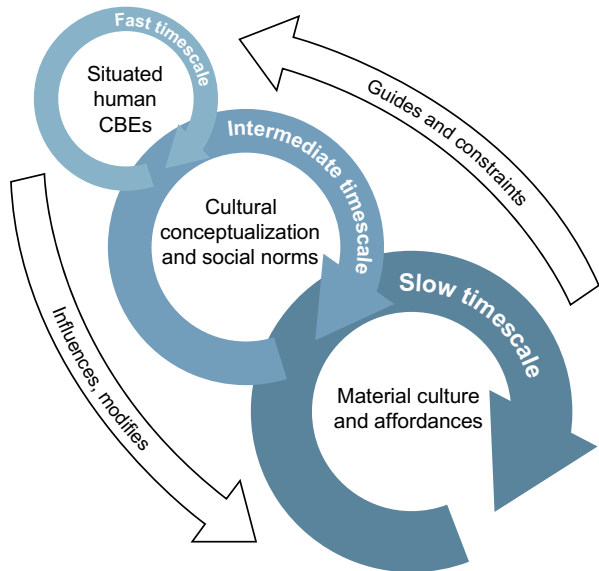


Fig. 1 An example of desire lines diverging from the designed paths, generated by cyclists and pedestrians across the grass of public parks, Copenhagen (photo by Dorato & Lobosco, 2017)

Fig. 2 Illustration of cognitive-cultural looping mechanism of urban space conceptualization. Abbreviations: CBE, Cognition-Behavior-Emotion



An illustrative example of the circular nature of such dynamic systems is the phenomenon of *desire-lines*. As a pedestrian - for more or less incidental reasons - decides to cross a green area taking a particular route, she leaves a temporary trail consisting of grass pressed down under her feet. Another, pedestrian heading in the same direction might in principle pick any other path over the same green area, but the faint path already laid out possibly has an immediate attraction priming the second pedestrian to take the same route and thus reinforce it. As this process is repeated, a more durable path emerges (see Fig. 1). And new pedestrians might now perceive the path as normative: this is the “appropriate” route to take. The example illustrates how local behavior on faster time scales of situated action can come to shape more permanent material structures that - in turn - govern future behavior and action and motivate cultural conceptualizations (Helbing et al., 1997, Tylén et al., 2016). Similar dynamics are thought to guide more explicit examples of

urban design. Here the urban designer might design structures that in a similar vein embody and reinforce existing latent conceptualizations in the culture without being fully aware of this.

As we discussed above, complementary constraints on human behavior comes from cultural conceptualizations, social norms, and material affordances, belonging to different time scales and characterized by different degrees of flexibility. In order to map these interrelationships and their dynamics, the cognitive-cultural looping model proposes a human ecology connecting three levels of organization affecting and shaping human cognition, behavior and emotion: (i) the fast time-scale of situated human CBEs, (ii) an intermediate time-scale of conceptualizations and social norms going beyond the here-and-now, and (iii) the time scale of slowly-evolving material culture and its affordances (Fig. 2).

When approaching the dimension of flexibility and processes of change, we notice some nuances to the model: As we have seen in previous sections, although cultural conceptualizations belong to an intermediate time scale and generally change rather slowly at the population level, they are still rather flexible at the individual level and can be primed in situated behavioral contexts. Social norms, on the other hand, are often deeply entrenched, robust, and less susceptible to influences or manipulation. Interestingly, however, despite their durable and material anchoring, material affordances are – at least in principle - malleable through design, and thus in some sense more directly manipulable than social norms.

Urban Design in the Context of the Cognitive-cultural Looping Mechanism

As we discussed above, modification to the material affordances can happen bottom-up, as new activities evolve that are not already accommodated by the structure of the environment and thereby excerpt pressure for changes to regain “congruence” or “fit” (Lang, 1987, Gehl, 1987). They can also happen top-down. An illustrative case of the interaction between situated human behavior, cultural conceptualizations and material affordances can be found in the design of streets. Streets and their sidewalks, the main public spaces of a city, are its most vital organs (Jacobs, 2016). Their physical structure potentially reveals interesting cultural differences



Fig. 3 a: (left) street with integrated space for vehicles and pedestrians, Stockholm (photo by Kodransky, 2009) b: (right) street with segregated space for vehicles and pedestrians, Vancouver (photo by Krueger, 2011)

in the conceptualization of *urban life* and signals a particular conceptualization of the perceived role of the street. In a cultural setting where the public space is often conceived of as a meeting place for social interaction, the street's design features incorporate a shared surface and the use of streetscapes including on-street parking to restrict vehicle dominance (see Fig. 3a). The purpose of this structure is to create 'rest and play' areas to enhance liveability and improve sense of community (Karndacharuk et al., 2014). A very different design of a street environment is seen in Fig. 3b, evoking different connotations and conceptualizations in terms of the role of the street space. Rather than a meeting place, the physical structure is motivated by a transition and circulation principle. The purpose of this structure is to improve street traffic quality through separation of vehicles and pedestrian and the use of traffic signs and road marking which reduces the potential social interactions of pedestrians by limiting the activity space.

In other words, the material affordances embody a very different conceptualization of the societal and functional role of the street and how it interacts with users. How did this come about? While the physical design of streets could seem to be a salient starting point, this material change is motivated in other cultural changes preceding it. The urban designer is thus often not the ones "inventing" cultural changes, but are rather recognizing and responding to them by adjusting the material space to better support the socio-cultural and cognitive reality. However, as the emergent new conceptualization of street activity finds increasing material expression, it is reinforced by those physical constraints and feedback into, and stabilize the conceptualization.

The suggested cognitive-cultural looping mechanism gives prominence to the dynamic features of human-environment interactions that allow continuous changes of cognitive-cultural affordances, conceptualizations and situated CBEs. The cognitive-cultural mechanism proposes cultural and cognitive modifications of conceptualizations and environmental affordances along different timescales, and this has important implications for understanding the role of environmental design, especially urban design. As the basis of human-environment interactions, urban design bridges the gap between current and culturally appropriate situations by providing the context for formation of CBEs according to the community culture. The proposed mechanism predicts that the modification of environmental affordances will potentially affect cognitive-cultural conceptualizations. Meanwhile, cognitive-cultural conceptualizations are a source of activity with the potential to modify the contemporary cognitive-cultural affordances in urban environment.

Through the cognitive-cultural mechanism, urban design intends to create and promote cognitive-cultural affordances to elicit culturally appropriate CBEs, while discouraging or even suppressing events that lead to culturally inappropriate CBEs. Importantly, an understanding of the relevance of CBE-eliciting affordances in terms of the cognitive-cultural mechanism renders the design process more transparent. Approaching events as derived from cognitive-cultural mechanisms makes the subsequent CBEs comprehensible and through the effects of antecedent designs, the urban designer may render certain CBEs prevalent and others rare.

Conclusions

Grounded in ecological psychology and embodiment theory, this conceptual investigation integrates insights from cognitive science and urban design in a new epistemological framework intended to guide researchers and practitioners in urban design. Central to the framework is the assumption of a dynamical reciprocity between humans and the environment (rather than a mechanistic subject-object relation) constituted by a deep and continuous dialectic exchange between processes unfolding on different timescales. More specifically, we suggest that professional practices in urban design can be productively informed by awareness of dynamic relations between material affordances, cultural-cognitive conceptualizations, and human situated CBEs. Such an epistemological framework may enable professionals to consider cognitive affordances that affiliate people with culture as an essential context of urban design in the broad aim of redirecting urban processes into more sustainable trajectories.

In line with what has been presented above, urban forms not only facilitate the ‘functions’ or ‘demands’ for which they have been created, but inevitably also embeds cognitive and emotional meaning. In this sense, urban design is a professional practice where the central material, spatial form, is a medium that ‘mold’ the life of the city. Hence, the designer’s implicit and explicit decisions about what is made manifest in public space through the structuring of spatial form, has a direct impact on people’s daily experiences and emotions, and in extension also on the development of our expectations and appraisals.

The crucial point for urban design is that the set of affordances that a person cognizes in these processes are shaped through urban design, both by way of who and what is present and who and what is absent by making it or not making it part of public space. What a person encounters in public space is, in this sense, not simply something given but something that has evolved, either as traces left behind by past CBE practices or through processes of deliberate design. In this regard, the potential of this much-needed alternative epistemological framework for sustainable urban design is difficult to ignore.

This study has taken a step towards mapping the complex relationship between human behavior, cognition and the urban environment, and illustrates the possible role of urban designers in not only guiding human behavior but also cultural conceptualizations through the design of urban environments. Future research should seek to test the proposed model and examine the impact of material affordances on cognitive-cultural processes, and, in turn, how these are motivated in conceptualizations of urban environments.

Acknowledgements This article is an extraction from a PhD dissertation in Islamic Urbanism by the first author- Zahra Alinam (titled " Explaining Conceptual Environment of the City in Islamic Culture using Cognitive Science Tools") under the supervision of the third and the fourth authors at the Tabriz Islamic Art University, Iran. It’s written on her sabbatical leave to Aarhus University, Denmark under the supervision of the second author.

Author Contributions *Conceptualization:* Zahra Alinam, Kristian Tylén. *Methodology:* Zahra Alinam, Kristian Tylén. *Investigation - evidence collection:* Zahra Alinam, Kristian Tylén, Mohammad Taghi

Pirbabaei. *Writing - original draft preparation*: Mohammad Taghi Pirbabaei, Minou Gharehbaglou. *Writing - review and editing*: Zahra Alinam, Kristian Tylén. *Supervision*: Kristian Tylén, Mohammad Taghi Pirbabaei, Minou Gharehbaglou. *Final approval of the version to be published*: Zahra Alinam, Kristian Tylén, Mohammad Taghi Pirbabaei, Minou Gharehbaglou.

Declarations

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

- Alinam, Z., Pirbabaei, M. T., & Gharehbaglou, M. (2017). Investigation of the place attachment process in neighborhood with a cognitive psychological approach (Case study: The Gharebaghis' neighborhood of Tabriz). *International Journal of Architectural Engineering and Urban Planning*, 27(2), 115–125
- Anderson, J. R., Bothell, D., Byrne, M. D., Douglass, S., Lebiere, C., & Qin, Y. (2004). An integrated theory of the mind. *Psychological Review*, 111(4), 1036
- Argote, L., Ingram, P., Levine, J. M., & Moreland, R. L. (2000). Knowledge transfer in organizations: Learning from the experience of others. *Organizational Behavior and Human Decision Processes*, 82(1), 1–8
- Baggs, E., Chemero, A., & Penn, A. (2019). Designing cities for humans. In *Proceedings of the 12th International Space Syntax Symposium*. Space Syntax Symposium
- Bahreini, H. (2002). *Process of Urban Design. Tehran*. Tehran University [In Persian]
- Barsalou, G. P. (2015). Situated conceptualizations: theory and application. In *Foundations of Embodied Cognition* (pp. 11–37). Psychology Press
- Baumeister, R. F. (2005). *The cultural animal: Human nature, meaning, and social life*. Oxford University Press
- Bond, M. H., & Leung, K. (2009). Cultural mapping of beliefs about the world and their application to a social psychology involving culture: Futurescoping. In *Understanding culture* (pp. 109–126). Psychology Press.
- Boyd, R., Richerson, P. J., & Henrich, J. (2011). The cultural niche: Why social learning is essential for human adaptation. *Proceedings of the National Academy of Sciences*, 108(Supplement 2), 10918–10925
- Brown, A. M., & Lindsey, D. T. (2004). Color and language: worldwide distribution of Daltonism and distinct words for “blue”. *Visual Neuroscience*, 21, 409–412
- Cao, Y., et al. (2015). Racial bias in neural response to others' pain is reduced with other-race contact. *Cortex*, 70, 68–78
- Chang, L., Mak, M. C., Li, T., Wu, B. P., Chen, B. B., & Lu, H. J. (2011). Cultural adaptations to environmental variability: An evolutionary account of East–West differences. *Educational Psychology Review*, 23(1), 99–129
- Chemero, A. (2003). An outline of a theory of affordances. *Ecological Psychology*, 15(2), 181–195
- Chiao, J. Y., et al. (2010). Dynamic cultural influences on neural representations of the self. *Journal of Cognitive Neuroscience*, 22(1), 1–11
- Christensen, P., Fusaroli, R., & Tylén, K. (2016). Environmental constraints shaping constituent order in emerging communication systems: Structural iconicity, interactive alignment and conventionalization. *Cognition*, 146, 67–80
- Clark, A. (2006). Material symbols. *Philosophical Psychology*, 19(3), 291–307
- Clark, C., & Uzzell, D. L. (2005). The socio-environmental affordances of adolescents. Environments. In C. Spencer, C., & M. Blades (Eds.) *Children and their Environments*. Cambridge University Press
- Cohen, D. (2001). Cultural variation: considerations and implications. *Psychological Bulletin*, 127(4), 451

- Comstock, N., Dickinson, L. M., Marshall, J. A., Soobader, M. J., Turbin, M. S., Buchenau, M., & Litt, J. S. (2010). Neighborhood attachment and its correlates: Exploring neighborhood conditions, collective efficacy, and gardening. *Journal of Environmental Psychology, 30*(4), 435–442
- Cosmides, L., & Tooby, J. (1994). Beyond intuition and instinct blindness: Toward an evolutionarily rigorous cognitive science. *Cognition, 50*(1–3), 41–77
- Darwin, C. (1909). *The origin of species* (pp. 95–96). PF Collier & son
- Davis, J. L., & Chouinard, J. B. (2016). Theorizing affordances: From request to refuse. *Bulletin of Science, Technology & Society, 36*(4), 241–248
- Donald, M. (1991). *Origins of the modern mind: Three stages in the evolution of culture and cognition*. Harvard University Press
- Dorato, E., & Lobosco, G. (2017). Designing desire. A parametric approach to the planning of landscape paths. *Convergências-Revista de Investigação e Ensino das Artes, VOL X* (20)
- Duncker, K. (1945). The structure and dynamics of problem-solving processes. *Psychological Monographs, 58*(5), 1–112
- Durning, S. J., & Artino, A. R. (2011). Situativity theory: a perspective on how participants and the environment can interact: AMEE Guide no. 52. *Medical Teacher, 33*(3), 188–199
- Everett, C. (2013). Evidence for direct geographic influences on linguistic sounds: the case of ejectives. *PLoS One, 8*, e65275
- Everett, C. (2017). Languages in drier climates use fewer vowels. *Frontiers in Psychology, 8*
- Fodor, J. A. (1975). *The language of thought* (Vol. 5). Harvard University Press
- Foo, P., Warren, W. H., Duchon, A., & Tarr, M. J. (2005). Do humans integrate routes into a cognitive map? Map-versus landmark-based navigation of novel shortcuts. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31*(2), 195
- Frith, C. D., & Frith, U. (2007). Social cognition in humans. *Current Biology, 17*(16), R724–R732
- Frith, C. D., & Frith, U. (2008). Implicit and explicit processes in social cognition. *Neuron, 60*(3), 503–510
- Geary, D. (2005). *The origin of mind: evolution of brain, cognition, and general intelligence*. American Psychological Association
- Geary, D. C., & Huffman, K. J. (2002). Brain and cognitive evolution: forms of modularity and functions of mind. *Psychological Bulletin, 128*(5), 667
- Gehl, J. (1987). *Life between buildings: using public space*, [trans by Jo Koch. Van Nostrand] Reinhold
- Gibson, J. J. (1977). The theory of affordances. In R. Shaw, & J. Bransford (Eds.) *Perceiving, Acting, and Knowing* (pp. 67–82). Lawrence Erlbaum
- Gibson, J. J. (1979). *The ecological approach to visual perception*. Psychology Press
- Goffman, E. (1959). *The presentation of self in everyday life*. Doubleday
- Goldstein, E. B. (1981). The ecology of JJ Gibson's perception. *Leonardo, 14*(3), 191–195
- Grahn, P., & Stigsdotter, U. K. (2010). The relation between perceived sensory dimensions of urban green space and stress restoration. *Landscape and Urban Planning, 94*(3–4), 264–275
- Greeno, J. G. (1994). Gibson's affordances. *Psychological Review, 101*(2), 336–342
- Hall, E. T. (1966). *The hidden dimension* (Vol. 609). Doubleday
- Han, S., & Ma, Y. (2015). A culture–behavior–brain loop model of human development. *Trends in Cognitive Sciences, 19*(11), 666–676
- Hanel, P. H., Maio, G. R., Soares, A. K., Vione, K. C., de Holanda Coelho, G. L., Gouveia, V. V., & Manstead, A. S. (2018). Cross-cultural differences and similarities in human value instantiation. *Frontiers in Psychology, 9*, 849
- Helbing, D., Keltsch, J., & Molnar, P. (1997). Modelling the evolution of human trail systems. *Nature, 388*(6637), 47–50
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and brain sciences, 33*(2–3), 61–83
- Hogan, R. (1982). A socioanalytic theory of personality. In M. Page (Ed.), *Nebraska symposium on motivation* (Vol.30, pp.55–89). University of Nebraska Press
- Hollander, J., & Foster, V. (2016). Brain responses to architecture and planning: A preliminary neuro-assessment of the pedestrian experience in Boston, Massachusetts. *Architectural Science Review, 59*(6), 474–481
- Hong, Y. Y., Morris, M. W., Chiu, C. Y., & Benet-Martinez, V. (2000). Multicultural minds: A dynamic constructivist approach to culture and cognition. *American Psychologist, 55*(7), 709
- Hutchins, E. (1995). *Cognition in the Wild* (No. 1995). MIT Press
- Interaction Design Foundation. (2002). <https://www.interaction-design.org/>





- Ittelson, W. H. (1978). Environmental perception and urban experience. *Environment and Behavior*, 10(2), 193–213
- Jacobs, J. (2016). *The death and life of great American cities*. Vintage
- Ji, L., & Yap, S. (2016). Culture and cognition. *Current Opinion in Psychology*, 8, 105–111
- Kahneman, D. (2011). *Thinking, fast and slow*. Macmillan
- Kaplan, R., & Kaplan, S. (1983). *Cognition and Environment: functioning of an uncertain world*. Ulrich's Bookstore
- Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. Cambridge University Press
- Kaplan, R., Kaplan, S., & Ryan, R. (1998). *With people in mind: Design and management of everyday nature*. Island Press
- Karndacharuk, A., Wilson, D. J., & Dunn, R. (2014). A review of the evolution of shared (street) space concepts in urban environments. *Transport Reviews*, 34(2), 190–220
- Kashima, Y. (2009). Culture comparison and culture priming: a critical analysis. In R. S. Wyer, C. Chiu, & Y. Hong (Eds.), *Understanding culture: theory, research and application*. Psychology Press
- Kashima, Y., & Kashima, E. S. (2003). Individualism, GNP, climate, and pronoun drop: Is individualism determined by affluence and climate, or does language use play a role? *Journal of Cross-Cultural Psychology*, 34, 125–134
- Kaya, N., & Weber, M. J. (2003). Cross-cultural differences in the perception of crowding and privacy regulation: American and Turkish students. *Journal of Environmental Psychology*, 23(3), 301–309
- Kodransky, M. (2009, June 24). *Stockholm Shared Space* [Photograph]. <https://www.flic.kr/p/6R49JL>
- Kozma, R. (2003). External and internal representations in multimedia learning: the material features of multiple representations and their cognitive and social affordances for science understanding. *Learning and Instruction*, 13(2), 205–226
- Krieg, A. (2020). A Contextual behavioral account of culture: Example implementation of a functional behavioral approach to the study of cultural differences in social anxiety. *Frontiers in Psychology*, 11, 418
- Kroeber, A. L., & Kluckhohn, C. (1952/1963). *Culture: A critical review of concepts and definitions*. Harvard University
- Krueger, P. (2011, July 23). *Hornby separated bike lane* [Photograph]. <https://www.flic.kr/p/a6PtPG>
- Kyttä, M. (2004). The extent of children's independent mobility and the number of actualized affordances as criteria for child-friendly environments. *Journal of Environmental Psychology*, 24(2), 179–198
- Lakoff, G. (2008). *Women, fire, and dangerous things: What categories reveal about the mind*. University of Chicago Press
- Lakoff, G., & Turner, M. (2009). *More than cool reason: A field guide to poetic metaphor*. University of Chicago Press
- Laland, K. N., & O'Brien, M. J. (2011). Cultural niche construction: An introduction. *Biological Theory*, 6(3), 191–202
- Lang, J. (1987). *Creating architectural theory: The role of the behavioral sciences in environmental design*. Van Nostrand Reinhold
- Lang, J. (1994). *Urban design: The American experience*. John Wiley & Sons
- Latour, B. (1996). On interobjectivity. *Mind, Culture, and Activity*, 3(4), 228–245
- Levinson, S. C. (1996). Language and space. *Annual Review of Anthropology*, 25(1), 353–382
- Levinson, S. C., & Levinson, S. C. (2003). *Space in language and cognition: Explorations in cognitive diversity* (No. 5). Cambridge University Press.
- Lewicka, M. (2005). Ways to make people active: The role of place attachment, cultural capital, and neighborhood ties. *Journal of Environmental Psychology*, 25(4), 381–395
- MacDonald, K. (2008). Effortful control, explicit processing and the regulation of human evolved predispositions. *Psychological Review*, 115, 1012–1031
- Maddieson, I., & Coupé, C. (2015). Human spoken language diversity and the acoustic adaptation hypothesis. *Journal of the Acoustical Society of America*, 138, 1838–1838
- Majid, A., Boster, J. S., & Bowerman, M. (2008). The cross-linguistic categorization of everyday events: A study of cutting and breaking. *Cognition*, 109(2), 235–250
- Majid, A., Bowerman, M., Kita, S., Haun, D. B., & Levinson, S. C. (2004). Can language restructure cognition? The case for space. *Trends in Cognitive Sciences*, 8(3), 108–114
- Malt, B. C., Gennari, S., Imai, M., Ameel, E., Tsuda, N., & Majid, A. (2008). Talking about walking: Biomechanics and the language of locomotion. *Psychological Science*, 19(3), 232–240

- Marcus, L., Giusti, M., & Barthel, S. (2016). Cognitive affordances in sustainable urbanism: contributions of space syntax and spatial cognition. *Journal of Urban Design*, 21(4), 439–452
- Markus, H., & Oyserman, D. (1989). Gender and thought: The role of the self-concept. *Gender and thought: Psychological perspectives* (pp. 100–127). Springer
- Marr, D., & Poggio, T. (1976). From understanding computation to understanding neural circuitry. *A.I. Memo*, 357
- Matsumoto, D. (2007). Culture, context and behavior. *Journal of Personality*, 75(6), 1285–1319
- Mesquita, B. (2003). Emotions as dynamic cultural phenomena. In R. Davidson, H. Goldsmith, & P. Rozin (Eds.), *The Handbook of the Affective Sciences*. Oxford University Press
- Min, B., & Lee, J. (2006). Children's neighborhood place as a psychological and behavioral domain. *Journal of Environmental Psychology*, 26(1), 51–71
- Mor, N., & Winquist, J. (2002). Self-focused attention and negative affect: A meta-analysis. *Psychological Bulletin*, 128, 638–662
- Morin, E. (2009). Une mondialisation plurielle. *Synergies Pays Riverains de la Baltique*, 6, 19–24
- Morris, M. W., & Mok, A. (2011). Isolating effects of cultural schemas: Cultural priming shifts Asian-Americans' biases in social description and memory. *Journal of Experimental Social Psychology*, 47(1), 117–126
- Nisbett, R. E., & Norenzayan, A. (2002). Culture and cognition. In H. Pashler & D. Medin (Eds.), *Steven's handbook of experimental psychology* (Vol. 2): *Memory and cognitive processes* (3rd ed., pp. 561–97). Wiley.
- Nölle, J., Fusaroli, R., Mills, G. J., & Tylén, K. (2020). Language as shaped by the environment: linguistic construal in a collaborative spatial task. *Palgrave Communications*, 6(1), 1–10
- Oyserman, D. (2015). Culture as situated cognition. In R. Scott & S. Kosslyn (Eds.), *Emerging trends in the social and behavioral sciences: An interdisciplinary, searchable, and linkable resource*. Wiley.
- Oyserman, D. (2017). Culture three ways: Culture and subcultures within countries. *Annual Review of Psychology*, 68, 435–463
- Oyserman, D., & Sorensen, N. (2009). Understanding cultural syndrome effects on what and how we think: A situated cognition model. In R. S. Wyer, C. Chiu, & Y. Hong (Eds.), *Understanding culture: theory, research and application*. Psychology Press
- Oyserman, D., Sorensen, N., Reber, R., & Chen, S. X. (2009). Connecting and separating mind-sets: Culture as situated cognition. *Journal of Personality and Social Psychology*, 97(2), 217
- Parsi, H. (2001). Understanding the content of urban space. *Journal of Honar-ha-ye-Ziba*, 11, 41–49 [In Persian]
- Payne, L. L., Mowen, A. J., & Orsega-Smith, E. (2002). An examination of park preferences and behaviors among urban residents: the role of residential location, race, and age. *Leisure Sciences*, 24(2), 181–198
- Pirbabaei, M. T., Gharehbaglou, M., & Alinam, Z. (2016). An investigation on the effects of individual factors in process-oriented study of place attachment with a cognitive psychological approach. *Journal of Honar-ha-ye-Ziba_Memari-Va-Shahrsazi*, 21, 55–68 [In Persian].
- Ramstead, M. J., Veissière, S. P., & Kirmayer, L. J. (2016). Cultural affordances: Scaffolding local worlds through shared intentionality and regimes of attention. *Frontiers in Psychology*, 7, 1090
- Regier, T., Carstensen, A., & Kemp, C. (2016). Language sufficient communication about the environment: words for snow revisited. *PLoS One*, 11, e0151138
- Richerson, P. J., & Boyd, R. (2005). *Not by Genes Alone: How Culture Transformed Human Evolution*. The University of Chicago Press
- Rietveld, E., & Kiverstein, J. (2014). A rich landscape of affordances. *Ecological Psychology*, 26(4), 325–352
- Robinson, S., & Pallasmaa, J. (Eds.). (2015). *Mind in architecture: Neuroscience, embodiment, and the future of design*. MIT Press
- Sheldon, K. M. (2004). *The psychology of optimal being: An integrated, multi-level perspective*. Erlbaum
- Slobin, D. I. (1987). Thinking for speaking. In *Annual Meeting of the Berkeley Linguistics Society* (13: 435–445)
- Stegner, W. (1992). *The Sense of Place*. Random House
- Sui, J., & Han, S. (2007). Self-construal priming modulates neural substrates of self-awareness. *Psychological Science*, 18(10), 861–866
- Tomasello, M. (2009). *The cultural origins of human cognition*. Harvard University Press
- Tomasello, M., Carpenter, M., Call, J., Behne, T., & Moll, H. (2005). Understanding and sharing intentions: The origins of cultural cognition. *Behavioral and Brain Sciences*, 28(5), 675–691

- Tooby, J., & Cosmides, L. (1992). The psychological foundations of culture. In J. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: evolutionary psychology and the generation of culture*. Cambridge University Press
- Triandis, H. C. (1972). *The analysis of subjective culture*. Wiley
- Triandis, H. C. (2001). Individualism and collectivism: Past, present, and future. In D. Matsumoto (Ed.), *Handbook of culture and psychology* (pp. 35–50). Oxford University Press
- Triandis, H. C. (2007). *Culture and psychology: A history of the study of their relationship*. Guilford Press
- Tylén, K., & McGraw, J. J. (2014). Materializing mind: the role of objects in cognition and culture. In *Perspectives on social ontology and social cognition* (pp. 135–148). Springer
- Tylén, K., Fusaroli, R., Bundgaard, P. F., & Østergaard, S. (2013). Making sense together: A dynamical account of linguistic meaning-making. *Semiotica*, 2013(194), 39–62
- Tylén, K., Philipsen, J. S., Roepstorff, A., & Fusaroli, R. (2016). Trails of meaning construction: Symbolic artifacts engage the social brain. *NeuroImage*, 134, 105–112
- Van de Vliert, E. (2004). Chinese and Dutch interpretations of supervisory feedback. *Journal of Cross-Cultural Psychology*, 35, 417–435
- Van de Vliert, E. (2006). Autocratic leadership around the globe: Do climate and wealth drive leadership culture? *Journal of Cross-Cultural Psychology*, 37, 42–59
- Van de Vliert, E., & Janssen, O. (2002). “Better than” performance motives as roots of satisfaction across more and less developed countries. *Journal of Cross-Cultural Psychology*, 33, 380–397
- Van de Vliert, E., Huang, X., & Levine, R. V. (2004). National wealth and thermal climate as predictors of motives for volunteer work. *Journal of Cross-Cultural Psychology*, 35, 62–73
- Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*. Harvard University Press
- Wager, R. (1981). *The invention of culture*. University of Chicago Press
- Walker, A. J., & Ryan, R. L. (2008). Place attachment and landscape preservation in rural New England: A Maine case study. *Landscape and Urban Planning*, 86(2), 141–152
- Walmsley, D. J. (1988). *Urban living: The individual in the city*. Pearson Education
- Way, B. M., & Lieberman, M. D. (2010). Is there a genetic contribution to cultural differences? Collectivism, individualism and genetic markers of social sensitivity. *Social Cognitive and Affective Neuroscience*, 5(2–3), 203–211
- Wells, N. M., Ashdown, S. P., Davies, E. H., Cowett, F. D., & Yang, Y. (2007). Environment, design, and obesity: Opportunities for interdisciplinary collaborative research. *Environment and Behavior*, 39(1), 6–33
- Zeisel, J., Silverstein, N. M., Hyde, J., Levkoff, S., Lawton, M. P., & Holmes, W. (2003). Environmental correlates to behavioral health outcomes in Alzheimer’s special care units. *The Gerontologist*, 43(5), 697–711
- Zuo, X., & Han, S. (2013). Cultural experiences reduce racial bias in neural responses to others’ suffering. *Culture and Brain*, 1(1), 34–46

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Authors and Affiliations

Zahra Alinam¹  · Kristian Tylén²  · Mohammad Taghi Pirbabaei¹  ·
Minou Gharehbaglou¹ 

Zahra Alinam
z.alinam@tabriziau.ac.ir

Kristian Tylén
kristian@cc.au.dk

Minou Gharehbaglou
m.gharehbaglou@tabriziau.ac.ir

- ¹ Architecture & Urbanism Faculty, Tabriz Islamic Art University, Tabriz, Iran
- ² Department of Linguistic, Cognitive Science and Semiotics, School for Communication and Culture, The Interacting Minds Centre, School for Culture and Society, Aarhus University, Aarhus, Denmark