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## An integrated model of achieving social sustainability in urban context through Theory of Affordance

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### Abstract

The concept of “Affordance” is increasingly used among urban designers because it adds theoretical clarity to the understanding of the link between the environment, human behavior, and human needs fulfillment. Affordances emerge only when the different characteristics of individuals, such as their physical dimension and abilities, social needs and personal intentions are matched with the features of the environment. However, in formalizing social sustainability, a central issue to be addressed is the relation between people and their environment in social sustainability processes. The definition of “Affordance ” of a particular urban context will provide the means to make precise the opportunities for achieving social sustainability. With reviewing the related literature, it is concluded that the multidisciplinary relations between “Human Needs “ and “Social Sustainability” with the aim of “Theory of Affordance” has been out of scholar’s agenda. This paper fills this gap with proposing an integrated model of fulfilling human needs in urban context through achieving social Sustainability with the aim of cognitive affordance.

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## 1. Introduction

Sustainability is a multi-dimensional issue, it's not only limited to the concept of environment, but also it pays attention to various factors such as culture, generation, religion and people habits simultaneously. To achieve this purpose, designers need more concentration on people and society's demands by listening to the voice of local community and consider what they want from urban spaces. So, diverse needs of all users are very important key for achieving social sustainability in public spaces. Today, there is a little consensus over the definition of social sustainability, and many varied definitions have been proposed [1]. Such variation can be explained by following reasons extracted from previous works [2,3]; Ghahramanpouri and others (2015) categorize the reasons as follows: concept intangibility, multi-disciplinary approaches, multifaceted nature and context dependent [4]. In formalizing social sustainability, a central issue to be addressed is the relation between people and their environment in social sustainability processes [5]. Indeed, urban form engages humans not only through locations for different physical activities and uses, but also mentally by giving opportunities for creation of meaning. The definition of the "affordances" of a particular social context will provide the means to make precise the opportunities for achieving social sustainability in that particular context. With reviewing the literature, it can be concluded that, this concept and multidisciplinary relations between "Human needs" and "Social Sustainability" "with the aim of "Social Affordance" has never been analyzed practically in an urban context. So this paper aims to investigate the concept of social sustainability through evaluating the relation between "Human Needs" and "Social Interaction", it tries to fill this gap with proposing an integrated model of fulfilling human needs in urban context through achieving social Sustainability with the aim of social affordance.

The paper has four consecutive sections. First, there is a short recap of the theoretical concepts of main keywords and concepts in the research to highlight and extend their meaning. In the Literature Review part, the theory of Affordance, Urban Social Sustainability, Human Needs in urban context and finally Human Behavior and Built Environment relation, will be discussed to clarify their meaning, usage and interrelations. This is followed by a review of some of the basic underpinnings of space syntax research that it is argued has the ability to translate from spatial science to the practice of urban design. Subsequently, the second section provides an introduction to relate the theory of Affordance and social sustainability in urban context. The final section concludes by assessing the potentials of an alternative epistemological model of achieving social sustainability in urban context through theory of affordance.

## 2. Literature Review

### 2.1. The Theory of Affordance

The theory of affordance originates from the perceptual psychologist J. J. Gibson (1979), who expands the ideas into an ecological definition of space relating to the human perception of the environment, in opposition to the broadly applied isomorphic definition of space in physics based on the Cartesian grid [6]. Affordance refers to the relational and functionally significant properties of the environment [7]. Different patterns of the built environment afford different behaviors and aesthetic experiences. The affordances of the environment thus limit or extend the behavioral and aesthetic choices of an individual depending on how the environment is configured. People have changed and continue to change the natural and the artificial environments to alter set of affordances they possess [8]. 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 needs fulfillment [9]. Affordances emerge only when the different characteristics of individuals, such as their physical dimensions and abilities, social needs and personal intentions, are matched with the features of the environment [10]. Gibson's theory enables the functional properties of the environment and the psychological/behavioral response to the environment to be examined together. In *Gibson's* theory the physical environment and the social environment are brought together in order to account for functional significance [11]. Affordance refers to the relations between the abilities of an organism and the environmental features of a situation (Fig. 1). In a general sense, an affordance is non-deterministic 'preconditions for activity' [12]. Gibson's concept of affordances suggests: 'An affordance is neither an objective property nor a subjective property; or it is both if you like' [13]. Categories of Affordance based on corresponding behaviour are shown in Table 1. This table shows that each environment has potential physical, emotional, cognitive and social affordance, which led to activity if being utilized.

Table 1. Categories of Affordance based on corresponding behaviour

Basis for Categorization	Category	Description
Based on the nature of the corresponding action/behavior	Physical/Functional Affordance	Affordance for Physical transaction with the environment
	Cognitive Affordance	Environmental cues that afford thinking and/or knowing about something
	Emotional Affordance	Environmental qualities that provide one with beauty, or other emotions
	Social Affordance	The possibilities the physical environment and/or people offer for social interaction
Based on the level of the organism's involvement	Potential Affordance	Affordances that exist independent of the organism's perception or action
	Actualized Affordance	Affordances manifested as result of the organism's individual relationships with the environment

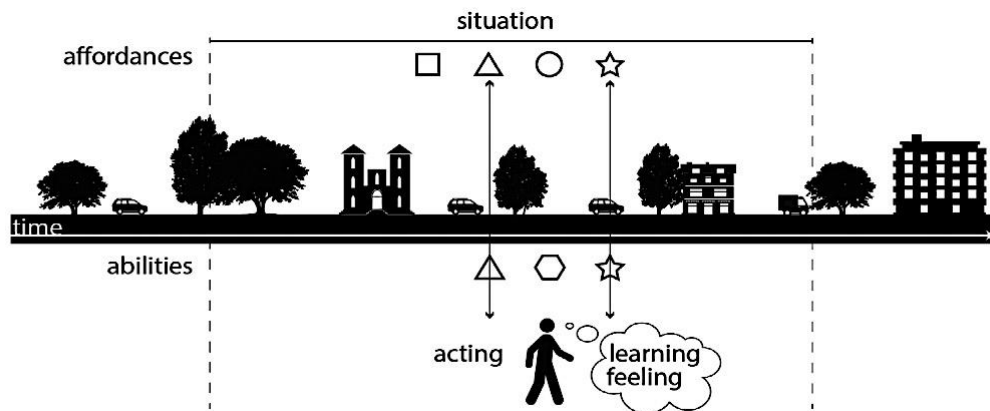


Fig. 1. Model of the theory of affordances explained in the urban context. The figure shows the interdependences between the spatial configuration of cities with its embedded affordances and situations, and linked behavioral, emotional and cognitive processes of an inhabitant [14]

## 2.2. Urban Social Sustainability

Nowadays, what can be considered as Social Sustainability in urban studies arises from social approaches. In fact, after the top styles which had been developed in recent decades and after modernism became weak, attention to the human-oriented architecture as the production which meets human needs in different dimensions, leads to the formation of approaches in architecture that known as social approaches [15]. So, it seems reasonable to explore some parts of the history of social sustainability in the environmental psychology. Environmental psychology is that area of psychology, which brings into conjunction and analyzes the transaction and interrelationships of human experiences and actions with pertinent aspects of the socio- physical surroundings [16]. In the existing literature about those investigational approaches in architecture which human and his or her mental and emotional comfort are important, the following cases are often examined: Human needs; Human activities; Human relationship with built environment and vice versa. Since the starting point of such investigations is human, it can be an appropriate start for achieving to the meaning of social sustainability in urban context.

2.3. Human Needs in Urban Context

On the subject of human needs in urban studies, generally, Maslow’s hierarchy of human needs (1954) is popular. The classified “Human Needs” by the Maslow, make a hierarchy in which the needs are organized from the strongest to the weakest and the strong ones are prior to weaker ones (Fig. 2) [17]. Ralph (1976) introduced three components of place: physical setting, activities, and meaning. For him meaning of the physical environment is a consequence of human interaction and experiences of place [18]. Agnew (1987) also identified three components: locale, location, and sense of place [19]. Punter (1991) produced a diagram for enhancing the identity of place (Fig. 3). In this model, the physical factors, improve the meaning and activities and meeting the biological, mental and social needs of human which will lead to sense if place [20]. Meanwhile researchers investigate how design of space can contribute to sense of place. Whyte (2009) discovered three main factors for successful public spaces: accessibility, comfort and sociability [21]. Marcus and Francis claim the most important factor for successful space is its ability to accommodate multiple needs [22]. On the other hand, it was mentioned that the spatial qualities are defined based on the human needs. In other word, spatial qualities can be made by reflecting these needs to space designing. Table 2 provides a translation of Maslow’s hierarchy of needs to the qualities that are intermediated in designing.

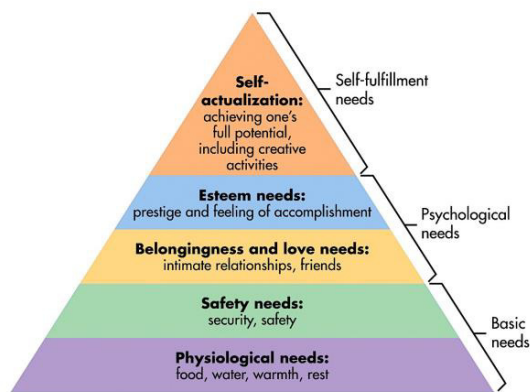


Fig. 2. Maslow human needs hierarchy [17]

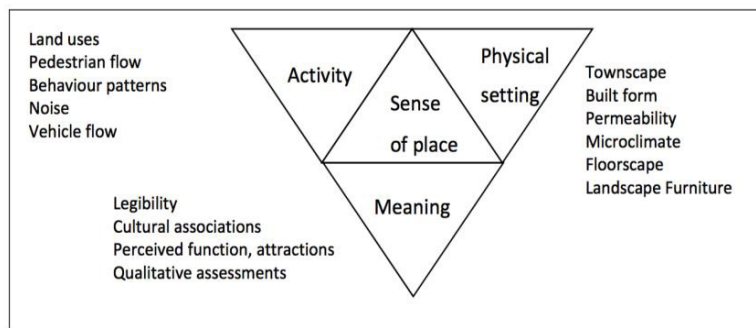


Fig. 3. Components of sense of place [20]

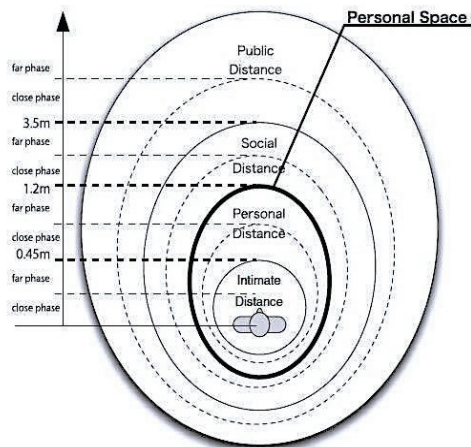
Table 2. Translation of the Human needs to the Design Qualities [23]

Human Needs	Spatial Qualities in Design
Physiological Needs	Sufficient facilities / Comfort (temperature, sun, rain, microclimate adaption.) / Firmness and Balance based on ecology
Safety Needs	Safety of Passage/Privacy/ Permeability and flexibility
Belonging Needs	Social facilities/ Visual properties Sense of place and Identity
Esteem Needs	Place attachment /Personalization and Belonging to groups
Self-Actualization Needs	Diversity / Participatory Design
Beauty Needs	Façade and sight/ Visual Richness

2.4. Built Environment and Human Behavior

In the study of the relationship between the built environment and the human behavior, perceiving “spatial qualities” has an important role. Built environment with its specific design, can leads to perform or omit some of the human behaviors and thus encourages some particular senses in the users of a space. “Spatial qualities” do not merely depend on spatial geometry (i.e. the size of the components, quantitative distance between the components and so on), but they pertain to some factors raised from geometrical relations such as how adjacent elements and their order, segregation and integration [24]. In 1960, Kevin Lynch in his book *The Image of the city* described the cognitive spatial qualities of the built environment (i.e., environmental legibility), which allow humans to navigate successfully through complex spaces such as cities and towns. Lynch’s contribution was to make evident that spatial qualities of cities are the result of dialectic relations between the physical urban landscape and the inhabitants’ qualities [25]. Both individual perception and social experience inform psychologist Robert Sommer’s notion of personal space (Fig. 4). Personal space is a mediating, cognitive construct, which is psychologically regarded as one’s own. According to Sommer, both psychological needs and social conventions are affecting human spatial interactions [26].

Fig. 4. Three Dimensional Model of Personal Space [27]



Empirical studies of urban space indicate that place must fulfil human needs within a physical setting, however in these studies the relationship between physical setting and meaning is rarely discussed. Reviewing the literature about “Sense of Place” shows physical setting as a place of gathering has meaning for people and affect people’s activity. However, the role of socio-physical design features in socially sustaining public spaces through meaning has been neglected. In extension of Gibson’s physical affordances and in efforts to create ‘sense of place’, ‘cognitive affordances’ have recently entered the realm of urban design. Marcus et al (2016) argues that ‘Cognitive affordances’ (1) cannot exist in isolated places but typically emerge as an effect of particular relations between places; (2) cannot be imposed by expertise themselves but need to consider the ‘meanings’ of the local community; and (3) cannot be implemented as abstract ‘demands’ but have to cognitively engage and motivate people, even if on a low key [14].

### 3. Relating Theory of Affordance and Social Sustainability in urban context

With the increasing recognition of the importance of social interaction for sustainable urban significant theoretical and practical advances has been made in the last decades in designing cities for and with people [28,29]. According to Heft & Chawla (2006), the spatial ecological approach accords well with the fundamentals of sustainability and participation because of its emphasis on person-environment transactions [30]. Thus, for proposing an integrated model of achieving social sustainability in urban context through theory of Affordance (Fig. 5), various methods and tools in the field of Environment Psychology should be evaluated and compared.



Fig. 5. Proposed Model of Social Sustainability System

Environment psychologist researchers use several observation methods to evaluate human social behavior in public urban spaces. For instance, Canter (1977) used empirical methods such as informal discussions with people and users of places and formal in-depth interviews with focus groups and conceptual mapping of places. Analyzing people’s behavior and revealing cognitive process of their interaction with place needs to examine both emotional responses in place and action description [16]. Whyte used time-lapse filming (2009), Gehl and Gemzo used time sampling (1996), Marcus and Francis (1998) used activity mapping in their post-occupancy evaluation techniques and combined behavioral mapping with GIS techniques [21, 31, 22]. Hillier and Hansen (1984) developed space syntax, based on analysis of line of accessibility and visibility of spaces, to predict occupancy of space [32]. Turner et al. (2001), Campos and Golka (2005) used space syntax to show there is a relationship between visual properties and type of activity that occurs in a place [33, 34]. In table 3 some of the selected methods in previous studies for measuring cognitive affordance have been collected.

Table 3. Selected methods and tools in Environmental Psychology

Methods	Behavioral mapping	Space Syntax	Questionnaire	Group Interview	Archival Study	Informal discussions
Measuring Cognitive Affordance	Potential	Potential	Potential	Potential	Potential	Potential
	Actualized	<b>Actualized</b>	Actualized	Actualized	Actualized	Actualized

In relation of human and environment, Space Syntax Theory bases its specific form of analysis of spatial form on a cognitive definition of space related to the Gibson's concept of affordances [35]. Hillier (2012), maintains that we interact with space in cities both through our bodies and through our minds. Hence we need to think of distance in two ways: 'in bodily terms the city exist for us as a system of metric distances' but cognitively we primarily interact with the city through seeing: 'the city comes to exist for us also as a more or less complex object, with more or less visual steps required to see all parts from all others, and so as a system of visual distances' [36]. Linking space syntax theory with theory of affordance in urban context enables possibilities to assess how spatial forms support or inhibit accessibility to affordances that promote social sustainability [37]. In linking humans to the environment through affordances, Marcus (2015) states that space syntax urban modeling concerns ecological space rather than physical space. Marcus emphasizes that situated affordances is the central object of study that emerge at the encounter between human abilities and built environmental features. Marcus added that the link between humans and the environment in space syntax modeling is not part of the highly criticized subject-object dualism typical for most urban modeling. According to Marcus, the idea of affordances as particular situations where relations between humans and the environment emerges directly connects to the idea of situations, which is central to establish for space syntax methodology [38].

#### 4. Conclusion

This paper emphasized on the multidisciplinary relations between "Human Needs " and "Social Sustainability" with the aim of "Theory of Affordance". In this regard, the related concepts and theories in the field of "Environmental Psychology" have been investigated and research findings are listed as below:

- After modernism became weak, attention to the human-oriented architecture as the production, which meets human needs in different dimensions, leads to the formation social approaches in urban studies. In formalizing social sustainability, a central issue to be addressed is 'human needs'. In this sense, the concept of "affordance" is increasingly used among designers because it adds conceptual clarity to the understanding of the link between the environments, human behaviour, values and needs fulfilment.
- Reviewing the related literature on theory of affordance suggests that based on the nature of corresponding behavior there are Physical, Social, Emotional and Cognitive affordances. However, based on the level of the organism's involvement there are potential and actualized affordances.
- Environment psychologist researchers uses several methods to evaluate cognitive affordance in public urban spaces such as Behavioural Mapping, Space Syntax, Questionnaire, Group Interview, Archival Study and Informal Discussions. In relation of human and environment, Space Syntax Theory bases its specific form of analysis of spatial form on a cognitive definition of space related to the Gibson's concept of affordances.
- The cognitive affordance in urban context introduced by Space Syntax methodology combined with scientific innovation in spatial cognition, creates a tool that promises support in extension of Gibson's theory of affordances and in efforts to create 'sense of place', which leads to a Socially Sustainable community. Linking space syntax theory with theory of affordance in urban context enables possibilities to assess how spatial forms support or inhibit accessibility to affordances that promote social sustainability. So it can be introduced as the integrated model of achieving social sustainability in urban context through theory of affordance.

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