BUILDINGS AND AFFORDANCES

ALEXANDER KOUTAMANIS
Delft University of Technology, The Netherlands

Abstract. The notion of affordances has been used to represent functionality and usability in several design areas. The paper considers its applicability to architecture and buildings. It discusses a distinction between the affordances of building elements and spaces, and a number of dimensions for the mapping of different aspects.

1. Affordances

The term ‘affordance’ has been coined by the psychologist James Gibson to indicate the actionable properties the environment offers to an animal (Gibson 1977; 1979). According to Gibson perception does not aim at an internal representation of the visual world but at the detection of such relationships between the environment and the animal. Affordances exist in the environment and can be linked to its physical properties but have to be measured relative to a particular animal. For instance, an approximately horizontal and flat surface that is sufficiently large and rigid for a particular animal affords support to the animal. Nevertheless, the affordances of an environment are independent of the individual animal’s ability to perceive them and do not change when the individual’s needs and goals change. A transparent horizontal surface may afford support to an infant, even though the infant is reluctant to crawl over such a visual cliff (Gibson and Walk 1960). Gibson claims that affordances are independent of the individual’s experience and culture, but in many cases action and interaction arguably presuppose prior experience with a similar environment. Grasping an object, for example, can be generalized from early experiences in infancy to a large number of environments, while writing on an object probably relates to more specific experiences with the same media (writing implements and writing surfaces). Gibson names this type of knowledge *mediated* or *indirect* knowledge, i.e. second-hand knowledge with a strong cultural dimension.

Gibsonian affordances are an attractive notion, primarily because of their immediacy. However, Gibson provides few examples, mostly obvious stereotypes that illustrated his main points. The resulting vagueness of the

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term and its application did little to promote research into the subject until the publication of *POET: The Psychology of Everyday Things* (Norman 1988), republished as *The Design of Everyday Things* (Norman 2002). Norman deviates from Gibson's use of affordances by considering them in relation to both actual and perceived properties which determine how an object could be used. In POET perception by an individual, with all its personal and cultural bias, is a determinant of affordances. The difference between the two definitions becomes evident when we consider the example of a hidden door in a paneled room. For Gibson the hidden door affords passage, while in POET it is seen as a case of a forcing function, i.e. an attempt to reduce the usability of the door in order to achieve another goal. Gibson relates affordances to the action capabilities of the animal, while Norman stresses the mental and perceptual capabilities of the actor (perceived affordances). In POET affordances depend on culture and past experience, i.e. learning through social interaction and experimentation.

Another departure from Gibson is that POET concentrates on man-made objects and relationships between design and use. Affordances provide strong clues to the operations of objects and suggest the range of possibilities for use. Norman's starting point is the apt observation that many people experience trouble with common everyday tasks such as opening a door or turning on a light, while at the same time they prove capable of mastering complex technologies and challenges like computer programming. He proposes that this is due to faulty design rather than the ineptitude of the users, as much of our everyday knowledge resides in the world and not in the head (which is a main argument of Gibson's approach to visual perception). The availability of knowledge in the world means that precision in behavior is not impeded by imprecision of knowledge in the head (combination of declarative and procedural knowledge). POET argues that when designers take advantage of affordances, the user knows what to do just by looking. Although complex objects or situations may require supporting information, simple tasks should not – otherwise the design has failed. Good use of affordances in the design of an object can help reduce the level of cognition and learning time required to use it. This should also be the case in architecture and building: most uses of the built environment should not require any additional information.

POET has been influential in various design disciplines, such as product design and human-computer interaction. There was, however, ambiguity in Norman's original definition and use of affordances that resulted in widely varying uses of the concept, even as a synonym of "advantage" or "property". The main cause of confusion seems to have been that POET "collapsed two very important but different, and perhaps even independent, aspects of design: designing the utility of an object and designing the way in which that utility is conveyed to the user of the object. Because Norman has stressed (but not entirely limited himself to) perceived affordances, he has actually favored the latter of the two" (McGrenere and Ho 2000). Such misunderstandings have stimulated corrective interventions by Norman who made efforts to clarify that POET focuses on *perceived* affordances because "the designer cares more about what actions the user perceives to be possible than what is true" (Norman 1999). He emphasized the distinctions between the user's conceptual model, physical constraints, (cultural) conventions and differences between perceived and real affordances.

A review of recent research literature suggests that the discussion focuses more on the notion of affordances (using superficial examples) than on thorough analyses of its applicability in different areas. Still, the relevance of affordances to a good design seems to have become an established concept in several design disciplines, despite a number of problems that remain to be solved satisfactorily. These include:

1. Differences in affordances between designers and users or between different types and classes of users (both physically and culturally, e.g. between children, adults and the elderly or between European and Japanese users of a chair).
2. The relationship of such differences with the difference between perceived and real affordances.
3. Ambiguity towards design innovation: POET and subsequent studies of affordances in design tend to overestimate the significance conventional concepts and constraints in an attempt to satisfy apparent user requirements ('natural' designs).
4. Uncertainty concerning the form of design guidance: approaches based on affordances may have proscriptive undertones leading to stereotypical or deterministic designs, while affordances seem to promote a more fundamental analysis of usability and functionality.

Despite such problems, affordances are an interesting notion also for architectural design. In a correlation of affordances and building design Tweed stresses the holistic character of affordances and their potential in integrating different functionalities, including aesthetics (Tweed 2001). Affordance theories suggest that human interaction with the built environment is largely conditioned by the affordances of building elements and spaces. These should allow for direct recognition of possibilities in any setting, efficient fuzzy planning of actions, and a 'natural' manipulation of building elements and spaces. The similarities between these consequences and the casual or cavalier attitude of many designer and users of the building environment with respect to functionality and usability are striking. A frequent objection to analytical tools for supporting design by e.g. explicitly structuring and analyzing a brief or stating detailed accessibility criteria is based on the assertion that the capable architect caters for such aspects intuitively. Equally intuitive and direct are the ways most users approach and manipulate buildings: it appears that they take quite a lot for granted and that their expectations are usually met by the building. Buildings should not require extensive and detailed explanation of how they work (e.g. a user manual) but be immediately evident on the basis of direct, meaningful relationships with the users' expectations (even though travelers may be puzzled by foreign types of fixtures). Most problems in the use of buildings are not due to cultural and individual differences but are caused by design limitations (e.g. the size or shape of a space) or incompatible use specification (e.g. large furniture in a small space). Affordances promise integration of different viewpoints (architects, engineers, clients, users) and continuity, i.e. compatible expressions of functionality and usability throughout the life cycle of a building (briefing, design and use). This holds promise for the codification of design knowledge: affordances could support direct matching of an existing building or type to a specific brief, thus allowing for early evaluation and refinement of design or briefing choices.

2. Building Elements

It is interesting and rather amusing that doors, a basic class of building elements, one of the favorite examples in illustrations of affordances. In POET Norman stresses the simplicity of door functions (one either opens or shuts it) and proceeds to illustrate how designers can eliminate natural signals that reduce the visibility of affordances by allowing aesthetics to get in the way of understanding how to interact with a door (not knowing whether to pull, push, slide etc.). The evaluation of door affordances usually focuses on door handles and their relationships with the way users can open and close a door. The evaluation is based on:

1. The mapping of human anatomy on the form and operation of the door handle: a lever and a pull and push bar are held in a similar manner but in a different orientation; a knob and a lever are held differently but can both turn in order to release the latch, Figure 1.
2. The physical constraints that constrain the mapping: the size of a handle indicates how many fingers or hands could be used to hold and apply the appropriate force to it.

The combination of the two should determine the way a user operates the door: a lever or knob invites the user to turn it and then pull or push, a pull and push bar indicates that one should either pull or push, and a metal plate only affords pushing, Figure 2. Other combinations would confuse the user and should therefore be avoided. This example makes clear that affordance studies tend to focus on design as communication and attempt to promote the integration of visual clues in a framework for perception and action. They realize that the information specifying an affordance is not the same as the affordance itself but at the same time they can be too selective (by focusing on just part of the information) and rather deterministic: in the example of Figure 2, the lever handle actually affords all four possible actions (turn, pull, push, slide), the pull and push bar three (no turn) and the plate one (push). This suggests that an appropriately shaped lever or a pull and push bar that also releases the latch could be used for all types of doors. Such combinations are frequently encouraged in architecture (and product design).

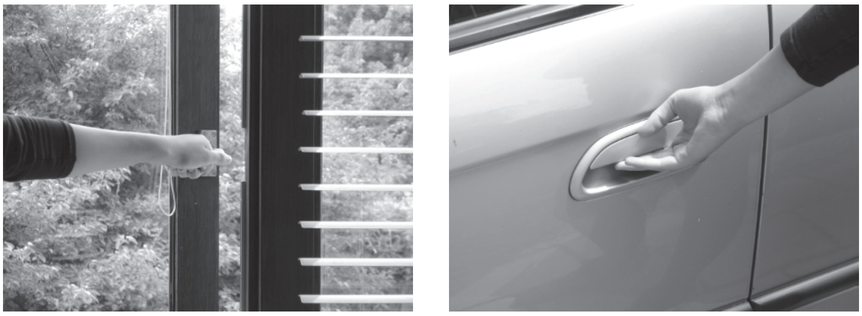

Figure 1. Mapping of hands on different door handles.

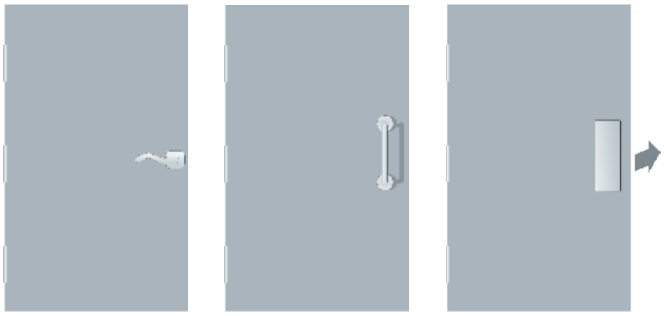

Figure 2. Affordances of door handles: lever, pull and push, plate (source: www.infovis.net).

The affordances of building elements such as doors and windows have a similar scale and user interaction to the majority of objects discussed in affordance studies. However, architectural design generally involves a wider functional scope and greater flexibility requirements. We can distinguish between two levels of functional abstraction (Tweed 2001):

1. *Spatial level*: a door affords communication between two spaces, as well as separation between two spaces optically, acoustically etc.
2. *Interaction* with the door itself in order to achieve this communication or separation.

The spatial level is important for the formulation of use expectations and goals, as well as for the recognition of visual clues pertaining to affordances. The former is arguably a main point of convergence for designers and users: the design of a building should also generate consistent affordances that improve functionality and usability. Spatial aspects should inform users in a direct and non-trivial manner about the intentions of the architect and the behavior of the design. Figure 3 is a popular illustration of a misaffordance: by designing both fixed and opening parts of the opening in the same way, the door is inadequately indicated and the user has no idea where to go (Evans and Mitchell McCoy 1998). However, if the approach to the door is clearly indicated by e.g. the paving, users experience little uncertainty in moving towards and through the door, despite its vague design.

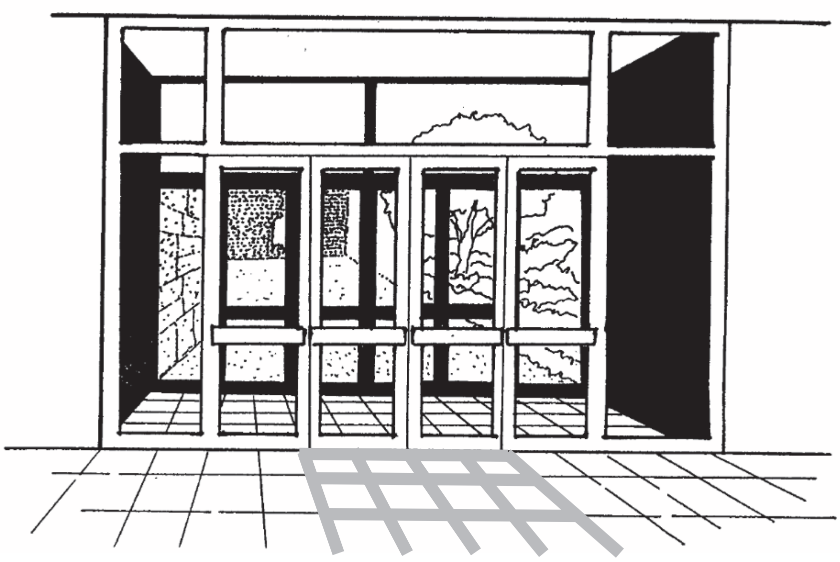

Figure 3. Contextual clues: the approach to the door as a correction of misaffordance –adapted from (Evans and Mitchell McCoy 1998).

Recognition of relevant visual clues involves not merely the door handle but also other critical features of a door, e.g. the visibility of hinges (which are strangely ignored in affordance studies). These may indicate the type of the door with more accuracy than the handle, as well as additional characteristics such as the swing of the door. From a spatial viewpoint the position of the door in the wall is probably more interesting. Of the two most popular types, an inwards opening hinged door is usually placed on the same plane as the interior surface of the wall, Figure 4, while an outwards opening hinged door is recessed, Figure 5. In the outwards opening case this results into a cavity that is readily perceived and a known clue. The origin of the cavity most probably lies in construction, but one cannot ignore the association of the small cavity with the bigger hole behind it (the space).

Figure 4. Inwards opening door.

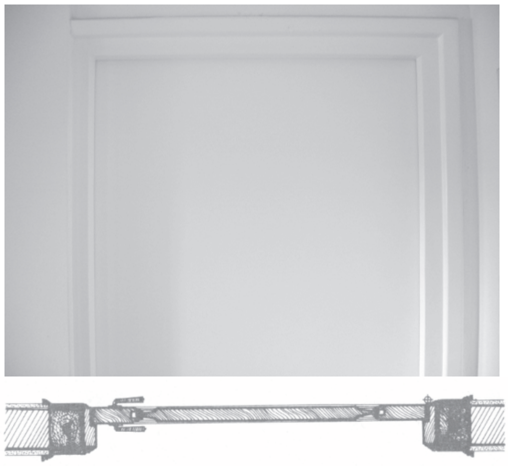

Figure 5. Outwards opening door.

Interaction with the door remains based on the mapping of the users' anatomy and actions onto critical features, including the interfaces with the user (e.g. door handle). Mapping involves several interrelated dimensions:

1. *Physical/mechanical:* this dimension refers to the constraints that determine the way an object can respond directly to the actions of a user, e.g. size considerations or the matching of degrees of freedom

between the user's hand and the door handle, Figure 6. These limit the relationship of an object to other objects in specific ways.

2. *Perceptual:* purely formal features that indicate general preferences and possibilities, e.g. that the extremities of an object usually afford handling, Figure 7. It is important that the identification of such features relies on universal principles such as transversality or colinearity (Hoffman and Richards 1985; Kim et al. 1987). It is not accidental that the user interface of a door is normally a small protruding subpart, i.e. something that can be readily recognized against a background of flat panels, Figure 8.
3. *Semantic* constraints refer to the interpretation of an object on the basis of expectations that may have a physical, perceptual or cultural background. Visually and mechanically a lever-type handle suggests two possibilities for mapping a hand but also a clear preference order, Figure 9. This order is reversed in the case of a door knob. Semantic constraints also underlie the identification and repair of missing or misaligned parts, e.g. a door handle that has fallen off.

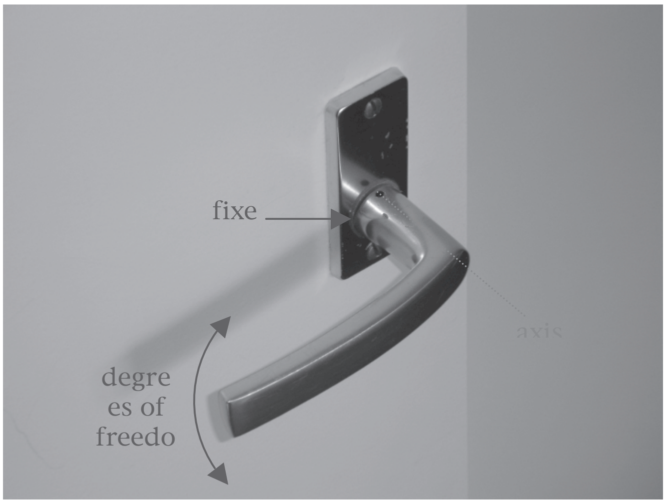

Figure 6. Physical / mechanical constraints.

4. *Cultural:* the relationship between affordances and cultural constraints remains troublesome, even when we account for the influence of design (Ingold 1992). There are, however, constraints that can only be called cultural, e.g. that a red sign by a door indicates an emergency exit, the strong preferences for canonical views, the expectation that text signs are the right way up and that arrows indicate the direction one should follow in order to reach the indicated place. The roles of cultural constraints and especially

custom may not be always apparent in a slow, old area such as architecture – at least not in the spectacular way other areas are experiencing frequently arbitrary changes (e.g. the form of thumb keyboards for text messaging), which derive more from the adaptability of the user than good design. Still, there are some clear examples of cultural influences in building affordances, e.g. the expectation that most doors in an air terminal open automatically as the user approaches in relation to the absence of user interfaces on these doors. Few adults experience discomfort with such doors, unless of course the automatic doors fail to match their speed.

Figure 7. Perceptual constraints: extremities are for grasping.

Figure 8. The user interface of a door is recognizable as a small protruding part.

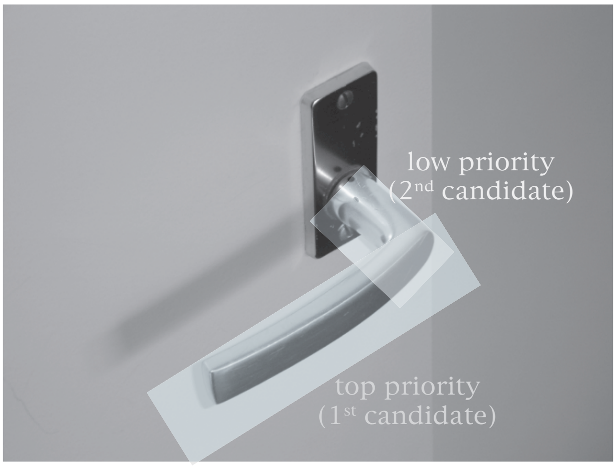

Figure 9. Semantic constraints.

Any analysis of affordances in building elements should not fail to identify the distorting adaptability of users and the resulting increase of flexibility. The ways we treat building elements may deviate from their intended uses but remain nevertheless well within what we would consider as 'normal' behavior, Figure 10 and 11. In most cases the functionality and usability of building elements contain substantial gray areas that are completely unrelated to misaffordances. Users are notorious for effortlessly recognizing and exploiting the affordances hidden in such gray areas, even though this might conflict with the designer's intentions and norms.

3. Spaces

Spaces deviate from the common examples and subjects of affordance studies. They offer few tangible forms that permit the mapping of individual human functions. Moreover, they generally lack the handy interfaces that allow interaction with 'solid' objects. Even worse, such interfaces tend to adopt a naive view of space and architecture. For instance, POET praises the 'natural' mapping of an entity onto relevant controls (e.g. light switches on a scaled floor plan instead of an array). One could claim that a higher degree of abstraction is necessary for dealing with the complexity that is caused by the flexibility and adaptability of space in relation to user activities.

The two main levels of abstraction proposed for building elements also apply to the functional patterns that are accommodated in a space:

1. The *spatial* level refers primarily to the internal structure of these patterns and includes their basic relationships with the environment, i.e. relationships with the basic surfaces of a space like the floor.

2. The *interaction* level concerns the mapping of these patterns to the spaces that accommodate them in a correlation of form and function.

Figure 10. Sitting affordances of a bench.

Figure 11. Sitting affordances of a fence.

The mapping dimensions proposed for building elements (physical/ mechanical, perceptual, semantic and cultural) also apply to spaces and have the same characteristics. The main problem is which information should be mapped onto spaces and how. Reducing space to the surfaces of building elements that bound them is a minimal option that allows definitions such as that a floor affords walking, standing and placing furniture on it or that a wall affords leaning against it and hanging pictures on it. However, this returns a rather incoherent network of loosely connected basic affordances that does little justice to the spatial thinking of both designers and users.

Adding users as independent entities in a design representation offers a less deterministic alternative to activity modeling. This can be achieved by means of user interfaces that permit e.g. walkthroughs in a virtual environment and allow different users to experience the affordances of a design. Similar results can be achieved with virtual users, e.g. analysis of a design on basis of user representations to identify areas accessible to a user type or occupiable by an activity (Koutamanis et al. 2001; Tweed 2001). Such techniques can make affordances explicit but mostly in a procedural manner that aggregates user experiences and local analyses. This arguably weakens the immediacy of affordance recognition and utility.

An alternative to such representations and analysis can be derived from conventional architectural knowledge and technology. The orderly collection of verifiable information on use patterns and their functional requirements has been one of the priorities in both architectural research and practice. The results have formed the basis for professional handbooks such as Neufert's *Bauentwurfslehre*, Figure 12 and drafting templates, Figure 13. These are more than indications of sizes for various objects or handy drawing aids. They also incorporate information on relationships between objects and spatial arrangements based on explicit use constraints. For instance, they indicate how many chairs can be placed around a table of a given size and form on the basis of the space required for the affordances of e.g. sitting in a chair at a dining table. Architects use such information as reference for the design and analysis of functionally intricate situations that require precision in behavior and unambiguous recognition of affordances, Figure 14. It provides an insightful and operational correlation of form and function which is further enhanced by the mental aggregates designers form through the integration of multiple patterns and constraints (Koutamanis 1997).

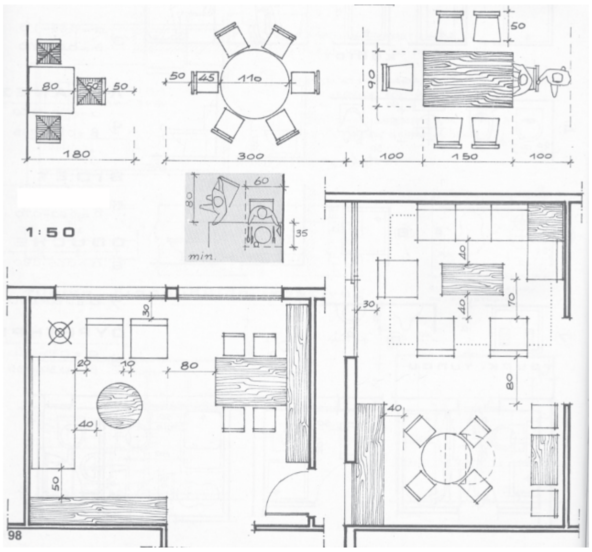

Figure 12. Spatial arrangement examples from an architectural handbook.

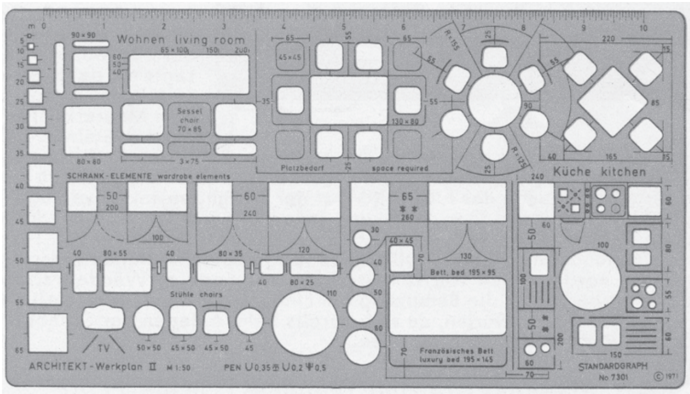

Figure 13. Architectural drafting template (Standardgraph).

By mapping such patterns and their constraints onto the form of a design we can recognize affordances at a number of abstraction levels that permit quick, transparent changes of focus from e.g. a single user's interaction with a space to a group of users and their interaction with the built environment and each other. This multi-level abstraction and the flexibility of choice implied by the underlying functional patterns are essential for the correlation of designers' and users' perception of affordances. The feeling of helplessness users experience with misaffordances in the built environment is often the unnecessary consequence of insufficient understanding of spatial aspects, leading to e.g. doors bumping into each other and other problems that a designer should resolve by default. Architects can also be insensitive to practical problems that conflict with higher, usually aesthetic norms. In both cases it is important that correlation of designers' and users' perceptions also promotes design innovation or at least reduces the danger of falling back to stereotypical solutions and arrangements.

The correlation of functional patterns and form is frequently based on transformations and affordances that require professional design knowledge and experience but many aspects of a design solution also refer to a general understanding of space. On the basis of universal principles such as transversality and colinearity both design professionals and lay users are able to segment the built environment into more or less the same components and arrive at an objective description that underlies many semantically or culturally enhanced interpretations (Biederman 1987; Hoffman and Richards 1985; Kim et al. 1987). The affordances of many of these components are common to both designers and users and can add to the constraints of a design. For instance, an alcove generally invites activities characterized by a higher degree of privacy. Placing a bed or a solitary armchair in an alcove is therefore a more or less standard reaction that may influence the overall arrangement of activities in a building.

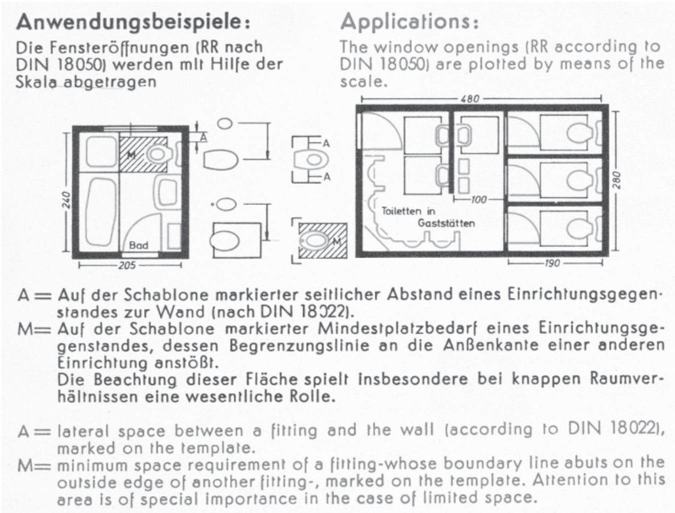

Figure 14. Application instructions for a drafting template (Standardgraph).

A primary aspect of affordances is their static character, even though they refer to dynamic activities and situations. This can be seen as a form of informational economy that agrees with the idea of information being available in the world and permits higher abstraction and efficient processing without loss of specificity. Still, mapping dynamic use patterns especially onto spaces probably has significance for building design and in particular for the adjustment of goals and actions on the basis of direct feedback from user-building interaction. Making explicit a sequence of actions in these dynamic patterns makes possible the verification and refinement of expectations concerning functionality and usability. For example, the constraints indicated in Figure 14 are generally sufficient for the mapping of critical points such as opening the door of a WC cubicle but may obscure difficulties like having to walk sideways after closing the door so as not to collide with the walls of a small cubicle or what happens two persons have to move in the same bathroom. Designers can be selective in what they consider to be critical and rather negligent of what they deem to be less important simply because users can be flexible, adaptable and tolerant to design limitations despite constant irritation and frustration. However, reactions to such selectivity should not lead to overestimation of the influence of architecture. The built environment is generally background to human goals and actions – rarely the subject itself.

5. Implementation

In an experimental implementation of affordances that explored the inclusion of the notion in a design representation and the connection between affordances in briefing and designing, the mapping of the spatial dimension was based on the mechanism of *local coordinating devices* (Koutamanis 1997). This was developed for the representation of local constraints into autonomous entities focused on (configurations of) critical architectural elements – as opposed to turning the constraints into properties of these elements. Local coordinating devices allow for a higher degree of abstraction and generalization than plain constraint networks because they express requirements on classes of entities and related activities.

In the design representation the implementation investigated the differences between affordances of building elements and of spaces, i.e. the actionable properties of critical building elements and the accommodation potential of spaces. The affordances of building elements derived primarily from the same functional and structural constraints that define a local coordinating device but also related to the perceived affordances of an element in a specific context, for example the visibility of an entrance. The spatial mapping of these affordances returned a number of fuzzy zones indicating varying degrees of acceptability and tolerance for activities relating to the class of each element, Figure 15, left. These can be linked to quantitative analyses of e.g. daylighting or ventilation. Qualitative aspects are expressed in relational terms (e.g. view as visual access to windows).

Space affordances derived jointly from programmatic requirements and general (or alternative) uses of the spaces. This allowed for a combination of the accommodation of the activities in the brief and general concerns with space use and quality. The resulting functional and spatial patterns were also mapped as local coordinating devices that represented fuzzy zones but without a precise focus on building elements. Instead, they were bounded by the limits of spatial entities (generally individual spaces but possibly also wings or whole floors) and linked to the affordances of building elements on the basis of programmatic or general requirements, Figure 15, right. This meant that e.g. a workplace was linked to a window for daylight and view, to walls for acoustic isolation and to a door for pedestrian access for communication with other activities in the building or fire safety.

The links between spaces, activities and were generally sufficient for making explicit the potential of a design solution with respect to particular aspects from early on. In the example of Figure 15 the combined affordances of critical building elements defined areas amenable to different activities (left). The accommodation of required activities within these areas revealed a preference for particular workplace orientations, which in turn determined the spatial arrangement of workplaces and provided feedback to the brief with respect to the clustering of workplaces and the expectations concerning the size and facilities of spaces that accommodated the workplaces.

Adding affordances to design representations as abstract coordinating devices proved an interesting alternative to realistic simulations of use, especially those involving virtual users. The spatial zones and functional relationships returned by affordance mapping were more economical in terms of time and computation and provided a transparent overview of possibilities and limitations. Affordances could also be complementary to user simulation, as they can guide interaction of autonomous virtual users with the building to the zones of interest or critical areas and thus reduce the number of iterations necessary for an adequate analysis.

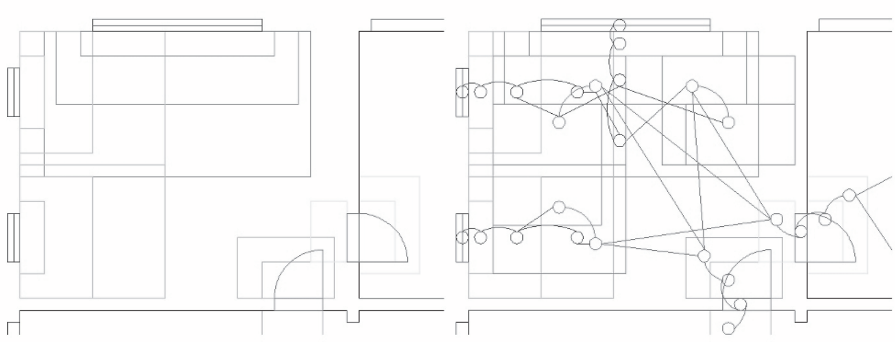

Figure 15. Affordance zones of openings (left) and correlation with affordance zones of activities (right).

The main prerequisite to the integration of affordances in design representations and analyses of especially programmatic requirements is the development of an extensive repertory of affordance definitions which express the different priorities and capabilities of a wide variety of users under different conditions. As the spatial representation of affordances can be cumulative, these variations can be accommodated in a few definitions which can be constantly augmented and refined with the viewpoints of different actors (e.g. sitting affordances at a desk could be enriched with the viewpoint of wheelchair users). In other words, affordances should not be exclusive or selective but inclusive and comprehensive. This may initially reduce apparent consistency but as understanding of the structure of underlying constraints and dimensions improves we are increasingly capable of identifying fundamental common elements.

6. Discussion

The use of affordances in architecture promises a compact, direct and transparent treatment of functionality and usability, which moreover agrees with the architects' intuitive handling of such issues. In deciding on the form and size of a space or the way users could move from one space to another, architects arguably make use of affordances rather than extensive and detailed analyses to arrive at a satisfactory solution. The main advantage of affordances lies in the integration of information concerning functionality and usability into comprehensive structures which can be applied throughout the life cycle of a building. This should facilitate continuity of functional criteria and a better understanding of building performance.

It should be stressed that the main target of affordances in architectural design is the enrichment of the architects' perception. Use of affordances to guide use through design so as to reduce error margins is probably too deterministic for most uses of built environment beyond direct interaction with a building element. Moreover, buildings are tolerant to user errors. Taking the wrong route in a complex building can add to the inefficiency of pedestrian circulation, disorientation etc. but is not critical, unless under extreme conditions (e.g. fire escape). Other than encouraging errors and causing mild irritation, most misaffordances pose few dangers for the user outside such critical conditions (Evans and Mitchell McCoy 1998). Affordances are more important for design guidance through understanding, i.e. the combination of (a) the precision and independence required by objective analysis and (b) the subjective, meaningful qualities of human experience (Heft 1997). Unfortunately conflicts between constructivist and positivist positions tend to confuse the role of affordances in this combination (Oliver 2005).

A recent comparison between functions and the affordances in designing (Brown and Blessing 2005) suggests that affordances are primarily applicable once a conceptual design has been developed. Prior to that functional reasoning provides a higher focus on the goals and intentions of the design. This conclusion is consistent with emphasis on the intended function of a design that probably characterizes the majority of design and engineering disciplines. Architecture is arguably less successful with the sharp definition of intended functions, presumably because of the complexity of human activities in the built environment. The brief of a building is inevitably a very partial and elliptical document that stresses particular aspects while assuming substantial levels of complementary common sense and professional knowledge. Moreover, users of the built environment are particularly skilled at bypassing intended function without altering the form of a designed object, as in Figure 11. Consequently, in contrast to Brown and Blessing (2005) I propose that affordances are more than an addition to functional reasoning in building design: affordances are capable of integrating the unintended with the intended in general representations of functionality, usability and performance that also allow for direct and objective analysis and evaluation.

A prerequisite to achieving design guidance through affordances is the correlation of perceptions of the different parties involved in a building. POET stresses that designers and users have different conceptual models, which communicate only indirectly through the system image (the physical image built on the basis of the designer's specifications, complemented with use indications such as documentation). To these two parties we should also add clients and authorities, with their own particular conceptual models and reference frames. At a basic level the affordances perceived by all these parties are common and derive from everyday use of the built environment. Distortion comes from differences in priorities and related semantic and cultural constraints. These differences are less pronounced in the perceived affordances of building elements, even though knowledge of architecture and building helps explain several constraints and adds more clues. The perception of space affordances is the weak point of most users (who may rely too much on trial and error), clients and authorities (who may be too selective) but also of architects (who may rely on stereotypical user profiles and be unable or unwilling to communicate and serve use). All parties may also suffer from false causality, i.e. coincidences. Such problems often lead to stereotypes and misconceptions due to limitations of the common sense users and clients rely upon or to professional / scientific assumptions that designers use to simplify problems, even when they conflict with everyday experience.

One of the principal contributions of affordances to architectural design is the potential ability to understand and utilize different aspects of users, including different degrees of mobility, perceptual or cognitive capabilities. By studying the affordances that relate such aspects and the resulting types to building elements and spaces, architects can go beyond vague, stereotypical user profiles, gross generalizations and arbitrary selections. The resulting insights should lead not to deterministic design solutions but to better understanding of space as a flexible and adaptable arrangement of multiple, overlapping opportunities (as opposed to the adjustability of a mono-functional object like a bicycle). Designers should be able to develop and communicate such opportunities through transparent devices such as feedback. Unfortunately buildings are not explicitly designed to provide feedback in the same way that a telephone button gives tactile or auditory feedback. Elements such as doors have locks that click but spaces have no feedback means other than potentially harmful conflicts (e.g. bumping one's head on a low beam). Spatial inconvenience tends to be mild (e.g. limited leg space) and may only become obvious over time.

From a technical point of view, the most striking aspect of affordances is mapping and in particular the selectivity of mapping. Affordances involve a direct correlation of user functions with objects that should be of interest to architecture. The immediacy of matching for example the whole hand in a particular orientation to a door handle, a finger to a button and the thumb and index finger to a key is not simply a matter of experience but also involves complex cognitive processing of form and scale. This could address some of the fundamental weaknesses in architectural analysis, like resolution limitations due to normative thinking, and relates to the use of variable resolution and abstraction in design and affordance representations, such as multilevel, modular hierarchical representations (Marr 1982; Rosenfeld 1984; 1990). In computer vision these support simultaneous attention for e.g. different parts of a person's anatomy at various levels of abstraction. In architectural design they could support similarly simultaneous treatment of abstract entities, relationships and critical details, such as the inclusion of interfaces like door handles in early, abstract representations of doors.

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