Affordances: Clarifying and Evolving a Concept

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Abstract

The concept of *affordance* is popular in the HCI community but not well understood. Donald Norman appropriated the concept of *affordances* from James J. Gibson for the design of common objects and both implicitly and explicitly adjusted the meaning given by Gibson. There was, however, ambiguity in Norman's original definition and use of affordances which he has subsequently made efforts to clarify. His definition germinated quickly and through a review of the HCI literature we show that this ambiguity has lead to widely varying uses of the concept. Norman has recently acknowledged the ambiguity, however, important clarifications remain. Using affordances as a basis, we elucidate the role of the designer and the distinction between usefulness and usability. We expand Gibson's definition into a framework for design.

Keywords: Affordance, usefulness, usability, design.

1 Introduction

The *affordance* concept was popularized in the HCI community through Donald Norman's book *The Psychology of Everyday Things* (POET) [14]. The word *affordance* was new to the HCI vocabulary and the concept seemed somewhat novel: an affordance is the design aspect of an object which suggests how the object should be used [14]. It is not widely known that the word *affordance* was first coined by the perceptual psychologist James J. Gibson in his seminal book *The Ecological Approach to Visual Perception* [5]. Gibson and Norman appear at first glance to have similar definitions of the concept. Gibson intended an affordance to mean an action possibility available in the environment to an individual, independent of the individual's ability to perceive this possibility. Norman's definition spread quickly and some inherent ambiguities have lead to widely varying usage in the HCI literature. This inconsistent usage motivated a more thorough look at the similarities and important differences between the two definitions.

We first look at affordances as they were originally defined by Gibson. We turn next to Norman's introduction of affordances into the HCI community and his subsequent coverage of the concept. The differences between the two uses are identified followed by a brief survey of the use of the concept in the HCI literature. We clarify a number of ambiguities that remain today including the meaning of affordances in application software. Lastly we provide a design framework that extends Gibson's definition of affordances.

2 Gibson's Affordances

Gibson's academic career centered on the field of visual perception [5]. He deviated from the classical theories of perception that were based on physics and physical optics because he felt that physics provided an inappropriate frame of reference for visual perception. Gibson made it his life's work to describe an appropriate ecological frame of reference. He believed that studying the animal's visual perception in isolation from the environment that is perceived resulted in false understandings. Gibson claimed that we perceive at the level of mediums, surfaces, and substances rather than at the level of particles and atoms and, in particular, we tend to perceive what the combination of mediums, surfaces, and substances offer us. Thus "…the *affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*, either for good or ill. [5, p.127]"

There are three fundamental properties of an affordance:

1. An affordance exists relative to the action capabilities of a particular actor.
2. The existence of an affordance is independent of the actor's ability to perceive it.
3. An affordance does not change as the needs and goals of the actor change.

To elucidate the first property Gibson gives the example of a horizontal, flat, extended, and rigid surface that affords support. A given surface that provides support for one actor, may not provide support for another actor (perhaps because of a differential in weight or size). There is only one surface in question here, yet the affordance of support exists for one actor whereas it does not exist for another. Note that the affordance is not a property of the experience of the actor but rather of the action capabilities of the actor. Also note that even if the surface is not intended to provide support, if it does in fact support a given actor, then the affordance of support exists. The second and third properties point to the fact that an affordance is invariant.

Defined in this way, affordances cut across the subjective/objective barrier. They are objective in that their existence does not depend on value, meaning, or interpretation. Yet they are subjective in that an actor is needed as a frame of reference. By cutting across the subjective/objective barrier, Gibson's affordances introduce the idea of the actor-environment mutuality; the actor and the environment make an inseparable pair.

Gibson focussed his work on direct perception, a form of perception that does not require mediation or internal processing by an actor. Direct perception is possible when there is an affordance and there is information in the environment that uniquely specifies that affordance (see Figure 1[1]). For example, one will perceive that one can walk forward when one sees a solid, opaque surface that extends under one's feet. The affordance is walkability and the information that specifies walkability is a perceived invariant combination of a solid, opaque surface of a certain size relative to oneself. Direct perception depends on the actor's "picking up" the information that specifies the affordance and may depend on the actor's experiences and culture. Let us be clear, the existence of the affordance is independent of the actor's experiences and culture, whereas the ability to perceive the affordance may be dependent on these. Thus, an actor may need to learn to discriminate the information in order to perceive directly. In this way learning can be seen as a process of discriminating patterns in the world, rather than one of supplementing sensory information with past experience.

Given that the existence of an affordance and the information that specifies the affordance are independent, there are cases where an affordance exists but there is no information to specify the affordance. Take, for example, a hidden door in a paneled room. The door affords passage to an appropriately sized individual even though there is no information to specify that passage is in fact an action possibility. Here direct visual perception is clearly not possible.

There are two properties of affordances that Gibson implies but never directly states. The first is that affordances are binary; they either exist or they do not exist. For example, a stair is climbable by a particular individual or it isn't. Gibson does not address the gray area where an action possibility exists but it can only be undertaken with great difficulty: for example, a stair that

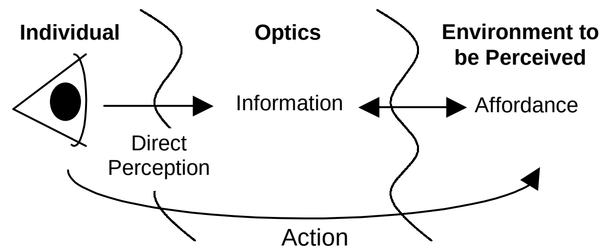

Figure 1: Direct perception is the act of picking up information to guide action.

is climbable but only with great difficulty. Second, Gibson implies that affordances can be nested when an action possibility is composed of one or more action possibilities. For instance, an apple affords eating, but eating is composed of biting, chewing, and swallowing, all of which are afforded by the apple. Gibson describes the environment as being composed of nested objects and he describes the nesting of information that specifies affordances but he never specifically uses the term *nested affordances.*

3 Norman's Affordances

Affordances, as Gibson described them, can be contrasted with Norman's affordances introduced in POET. Norman described affordances as follows:

> …the term *affordance* refers to the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used. A chair affords ('is for') support and, therefore, affords sitting. A chair can also be carried. [14, p.9]

This quotation points to some apparent differences between Norman's affordances and Gibson's affordances. Norman talks of both perceived and actual properties and implies that a perceived property may or may not be an actual property, but regardless, it is an affordance. Thus, he deviates from Gibson in that perception by an individual may be involved in characterizing the existence of the affordance. Further, Norman indicates that an affordance refers primarily to the fundamental properties of an object. Gibson, on the other hand, does not make the distinction between the different affordances of an object. Another important difference is that for Norman there is no actor as a frame of reference.

Norman makes clear in an endnote in POET that he is deviating from the Gibsonian definition of affordances:

> The notion of affordance and the insights it provides originated with J.J. Gibson, a psychologist interested in how people see the world. I believe that affordances result from the mental interpretation of things, based on our past knowledge and experience applied to our perception of the things about us. My view is somewhat in conflict with

[1] This diagram is a simplification of Gibson's view of direct perception. See Gibson, 1979 [5] for a more complete description.

> the views of many Gibsonian psychologists, but this internal debate within modern psychology is of little relevance here. [14, p. 219]

This quotation identifies another difference between Gibson and Norman. Gibson claims that the existence of affordances is independent of an actor's experience and culture. Norman, on the other hand, tightly couples affordances with past knowledge and experience. The frame of reference for Gibson is the action capabilities of the actor, whereas for Norman it is the mental and perceptual capabilities of the actor.

It is important to clarify Norman's position that affordances are perceived properties. He states that affordances "provide strong clues to the operations of things" [14, p.9] and that they "suggest the range of possibilities" [14, p.82]. He argues that when designers take advantage of affordances, the user knows what to do just by looking. Although complex things may require supporting information, simple things should not. If they do, then design has failed.

In more recent books, Norman stresses the importance of perceived affordances [15, 16, 17] and differentiates them from real affordances:

> It's very important to distinguish *real* from *perceived* affordances. Design is about both, but the perceived affordances are what determine usability. I didn't make this point sufficiently clear in my book and I have spent much time trying to clarify the now widespread misuse of the term. [17, p. 123]

This clarification will likely help to mitigate future misuse, but it still does not clearly separate the affordance from the information specifying the affordance.

In a recent article on the topic of affordances [18], Norman begins to separate affordances from their visibility and thus deviates from his original usage. Unfortunately, some misconceptions about affordances and the role of the designer remain in that article. We address these in the discussion section.

4 Highlighting and Interpreting the Differences

We will use what has become the canonical example of affordances in the HCI literature, namely the affordance of a door, to elucidate the differences between Gibson's and Norman's original use of the concept. Consider a door with no handle and no flat panel. Without prior knowledge of how the door operated, an actor would find it difficult to know the direction of opening. Following Gibson's definition, the fact that the door can be opened by a given actor is sufficient to determine that it has an affordance. (Perhaps the door can be pushed and it will swing away from the actor or the actor can grasp the door edges and pull.) There does not need to be any visual information specifying the correct direction to the actor for there to be an affordance. According to Norman's use, on the other hand, the affordance would only exist if there was information to specify the possibility for action and the actor had learned how to interpret the information. In this case, there would need to be a door handle that signaled the direction of opening to the actor. If we were to redraw Figure 1 using Norman's definition, the two sections on the right, Optics and the Environment to be Perceived, would be collapsed into a single section.

Table 1 highlights the different meanings assigned to affordances by Norman and Gibson.

Gibson's Affordances • Offerings or action possibilities in the environment in relation to the action capabilities of an actor • Independent of the actor's experience, knowledge, culture, or ability to perceive • Existence is binary – an affordance exists or it does not exist
Norman's Affordances • Perceived properties that may or may not actually exist • Suggestions or clues as to how to use the properties • Can be dependent on the experience, knowledge, or culture of the actor • Can make an action difficult or easy

Table 1: Comparison of affordances as defined by Gibson and Norman.

The most fundamental difference between the two definitions is that for Gibson an affordance is the action possibility itself whereas according to Norman's use it has been both the action possibility and the way that that action possibility is conveyed or made visible to the actor. Norman's "make it visible" guideline actually maps quite nicely to Gibson's statement that there must be perceptual information that specifies the affordance for the affordance to be directly perceived. We believe that this difference has caused confusion in the HCI community. In his original definition, Norman 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. In Gibsonian terms, these two aspects are labeled: design of the affordances of an object and design of the perceptual information that specifies the affordances.

It is important to note that Norman and Gibson had two related yet different goals. Gibson was primarily interested in how we perceive the environment. He acknowledged that both people and animals manipulate (that is, design) their environment to change what it affords them, but the manner of manipulation was not his focus. Norman, on the other hand, is specifically interested in manipulating or designing the environment so that utility can be perceived easily. We speculate that, given Gibson's focus, he made the simplifying assumption that affordances are binary. Recall the example of a stair being climbable or non-climbable by a particular individual. Reality obviously isn't this black and white; a gray area exists that is meaningful to the stair climber. For a particular individual one stair may be climbable with great difficulty whereas a different stair may be climbable with ease. Gibson doesn't address this range; they are both climbable and thus they both qualify as affordances. From a design perspective, an affordance that is extremely difficult to undertake versus one that is undertaken with ease can hardly be put in the same category. In the design of everyday things, the goal should be to design information that uniquely specifies an affordance and also to design useful affordances that can be undertaken with ease.

Warren [26], an ecological psychologist, moves beyond binary affordances. He defines π numbers to be dimensionless ratios that provide measurements of the actor in relation to the environment. He has done detailed analysis of the affordance of stair climability, for which he uses $\pi = R/L$ as the intrinsic measure, where R is the riser height of the stair and L is the climber's leg length. For climbers of different heights, Warren was able to determine a single optimal point (π_0) at which the energy expenditure required to climb through a given vertical distance is at a minimum and a single critical point (π_{max}) at which point a stair becomes impossible to climb bipedally. Using Warren's terms, the goal of design should be to achieve the optimal point for the target user.

5 Affordances as They Appear In the HCI Community

In order to understand how the affordance concept has been adopted by the HCI community we conducted a survey of the literature. We focussed mostly on the proceedings from the annual CHI conferences[2] because we felt these proceedings to be generally representative of the HCI literature. Nineteen papers were reviewed. The goal was to identify and loosely categorize how the term *affordance* has been used. Three high-level categories emerged:

- 8 papers adhering to Gibson's definition – an action possibility or offering [1, 2, 4, 6, 20, 22, 23, 27]
- 6 papers adhering to Norman's original definition – a perceived suggestion [3, 7, 8, 10, 13, 19]
- 5 papers deviating from both Gibson and Norman [11, 12, 21, 24, 25]

For reasons of brevity we only highlight a couple of papers in each category.

5.1 Gibson's Affordances - An Action Possibility

Papers that used Gibson's definition fall into two categories: the affordances of software applications [1, 2, 4, 23] and the affordances of physical objects [6, 20, 22, 27].

Action Possibility in Software Applications

Gaver [4] published the first paper in the CHI Proceedings that included the concept of *affordances*. This paper goes beyond the mention of affordances; it is specifically about affordances. Because Gaver's contribution is substantial, we discuss his work in depth at the end of this section. Another example of a paper in this category is by Smets, Overbeeke, and Gaver [23]. They show how the design of forms can convey complex non-visual information such as sound, taste, smell, and texture. They postulate that this research could be applied to the design of icons that represent complex information and activities and thereby improve the information that specifies the affordance.

Action Possibility in a Physical Object

Zhai, Milgram, and Buxton [27] document a study that strongly suggests that high-degree-of-freedom input devices should be designed so that they can be manipulated by the fingers because finger movements often provide more accurate control than do arm movements. Thus, these input devices should be shaped and sized so as to afford finger manipulation.

5.2 Norman's Affordance – A Perceived Suggestion

Mihnkern [10] describes affordances as the means of communicating a design model to the user. He says that when a metaphor is applied to a system, it gives the system a particular set of affordances and that the metaphor inevitably breaks down leaving some of the system's features affordance-less or invisible. [In Gibsonian terms, even if there is no information to specify the affordance, it still exists.]

Johnson [7] compares a number of techniques for panning, in particular, moving the scene under the window or moving the window over the scene (GUIs do the latter):

> … it is clear that the appearance of the touch-display can influence what people suggest [is the panning method]. This is what Gibson and, later, Norman refer to as an 'affordance': when an aspect of an artifact's design suggests how it is to be used. We thought that adding a brightly colored border around the displayed image might

2 Papers were selected using the ACM Digital Library and Gary Perlman's HCI Bibliography with the search string "affordance." All those papers that appear in the CHI proceedings have been reviewed and a few others were also selected based on availability.

suggest ‘touch here’ to users, and might therefore suggest Touch Edge panning (camera or background). [7, p.219]

5.3 Neither Gibson’s nor Norman’s Affordances

With the exception of the first paper in this category [11], the use of affordance in the papers is unclear [12, 21, 24, 25].

An Interface Object

Mohageg et al. [11] equates an affordance with an interface object: “all of this functionality is mapped onto a single affordance on the dashboard.” [11, p.468] Here, they are referring to a virtual joystick.

Unclear Usage

Vaughan [25] provides a confusing account of affordances. She seemingly identifies the affordance of movement. She talks about the movement of a butterfly affording chasing and that when movement becomes more prominent the affordance of emotion becomes more evident. She cites Gibson, yet her use of affordances appears different from both Gibson’s and Norman’s.

5.4 Acknowledging Gaver’s Contribution

As noted above, there are a number of authors who are aware that affordances originated with Gibson and have read Gibson’s work. Yet most who cite Gibson and perhaps even quote him resort to using the meaning given by Norman. One author in particular, Gaver, makes a significant attempt to bring Gibson’s ideas into the HCI community in his paper entitled “Technology Affordances”, [4] which is illuminating and therefore needs to be outlined in some detail. This was the first paper in the CHI Proceedings that discusses affordances; but, it has gone largely unnoticed.

Gaver’s discussion of the door example illustrates that his understanding of affordances differs from Norman’s. Where Norman and all who followed talked about the affordance suggesting the action, Gaver talks about *the design that suggests* the affordance of the door. Here he uses the term *design* as the information that specifies the affordance. He uses the door example to demonstrate nested affordances, which he defines as “affordances that are grouped in space.” The affordance of pulling a door handle is nested within the affordance of opening the door. Gaver recognizes the importance of distinguishing two aspects of design:

> Distinguishing affordances and the available information about them from their actual perception allows us to consider affordances as properties that can be designed and analyzed in their own terms. [4, p. 81]

Gaver identified apparent affordances:

> In general, when the apparent affordances of an artifact match its intended use, the artifact is easy to operate. When apparent affordances suggest different actions than those for which the object is designed, errors are common and signs are necessary. [4, p.80]

These match what Norman has termed *perceived affordances*. Gaver provides a framework for separating affordances from the perceptual information available about them (Figure 2). Note that Gaver’s perceptible affordance is not the same as his apparent affordance or Norman’s perceived affordance, as we have shown by overlaying the latter two on Gaver’s framework.

Perceptible Affordance and *Hidden Affordance* make sense but *False Affordance* is problematic. It is not the affordance that is false; rather, it is the information that is false. Gibson uses the term misinformation to describe this phenomenon. When misinformation is picked up by an actor, then misperception results. Gibson acknowledges that the “line between the pickup of misinformation and the failure to pick up information is hard to draw.” [5, p.244]

Interestingly, Gaver does seem to contradict himself part way through his paper when he finally gives a concrete definition of affordances:

> The concept of affordances points to a rather special configuration of properties. It implies that the physical attributes of the thing to be acted upon are compatible with those of the actor, that information about those attributes is available in a form compatible with a perceptual system, and (implicitly) that these attributes and the action they make possible are relevant to a culture and a perceiver. [4, p.81]

Here he seems to be lumping in the information that specifies the affordance with the affordance itself. Gibson’s affordances only cover the first of these three points.

Gaver then addresses the problem of complex affordances. He extends the notion of *affordances* to explicitly include exploration. He introduces the concept of sequential affordances, which refers to situations in which action on a perceptible affordance leads to information indicating new affordances (e.g.,

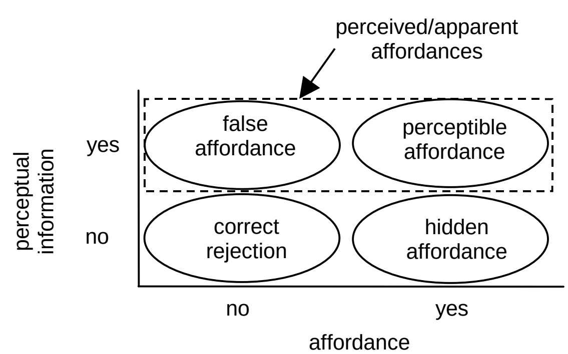

Figure 2: Separating affordances from the perceptual information that specifies affordances (adapted from [4]).

after mousing-down on the scrollbar, it can then be dragged). Sequential affordances explain how affordances can be revealed over time. As previously mentioned, Gibson implies the existence of nested affordances but never actually identifies them. Gaver, on the other hand, specifically defines nested affordances to be affordances that are grouped in space. He provides the example of manipulating the scrollbar widget as being nested within the affordance of scrolling within a window. Here Gaver is exploring affordances for low-level interaction in GUIs, which we deal with in greater detail in the next section.

6 Discussion

6.1 Does it matter?

In the end, does establishing a clear meaning of affordances really matter? We argue that it does matter. At the most basic level, establishing a concrete meaning will prevent widely varying uses of the term. Norman, in his latest article, also sees the need for clarification: "Sloppy thinking about the concepts and tactics often leads to sloppiness in design. And sloppiness in design translates into confusion for users. [18, p. 41]"

In the same way, we are motivated to further clarify affordances in terms of design, and specifically in the area of software design. To this end, we return to Gibson's definition of affordances and discuss its impact on design.

6.2 Usefulness *and* Usability

Clearly differentiating the two aspects of design is critical: designing affordances and designing the information that specifies the affordance should not be confounded. Said in another way, designing the utility of an object is related to but separate from designing the usability of an object. This is a distinction of usefulness versus usability [9].

The HCI community has largely focussed on usability at the expense of usefulness. Norman also emphasizes usability: "The designer cares more about what actions the user perceives to be possible than what is true" [18, p. 39]. A designer must also be concerned with creating the useful actions of the design, creating what is truly possible in the design. A useful design contains the right functions required for users to perform their jobs efficiently and to accomplish their goals. The usefulness of a design is determined by what the design affords (that is, the possibilities for action in the design) and whether these affordances match the goals of the user and allow the necessary work to be accomplished. The usability of a design can be enhanced by clearly designing the perceptual information that specifies these affordances. Usable designs have information specifying affordances that accounts for various attributes of the end-users, including their cultural conventions and level of expertise. Of course, usability is also enhanced by following principles such as providing appropriate feedback, being consistent, and providing error recovery. Figure 1 can be redrawn to show the relationship between usefulness and affordances and the relationship between usability and the information specifying an affordance (see Figure 3).

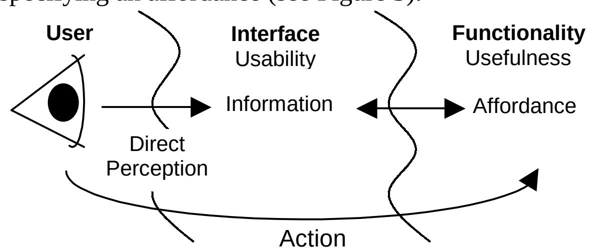

Figure 3: Usefulness and Usability.

6.3 Clarifying Affordances in Software Design

It is necessary to clarify the meaning of an affordance in the context of application software. There was considerable ambiguity on this in the reviewed HCI literature and there is additional confusion in Norman's latest article [18]. An affordance is an action possibility or an offering. Possible actions on a computer system include physical interaction with devices such as the screen, keyboard, and mouse. But the role of affordances does not end with the physical aspect of the system, as Norman implies [18]. The application software also provides possible actions. A word processor affords writing and editing at a high level, but it also affords clicking, scrolling, dragging and dropping. The functions that are invokable by the user are the affordances in software. Functions may include text-editing, searching, or drawing. The information that specifies these functions may be graphical (buttons, menus) or it may not exist at all.

Norman claims that a scrollbar is a learned convention and implies that it is not an affordance [18]. We disagree. The fact that the object affords scrolling is an affordance that is built into the software. The information that specifies this affordance is in fact a learned convention – we have all come to recognize a scrollbar.

In general, an underlying affordance or function can still exist regardless of correct interpretation or even perception by the user. A low-level user action triggers the execution of the function. The action could be the input of some obscure command (e.g., "ls -la") at a prompt or it could be clicking on a button in a GUI. In the first case, there is little or no information to specify the affordance. In the second case, there is some information. This case relies on the notion of nested affordances. The button has a clickability affordance, which is specified by a raised-looking push button. But users are not interested in clicking on a button for its own sake; they are interested in invoking some function. It is generally the icon or the label on the button that specifies the function to be invoked. Therefore, button clickability is nested within the affordance of function invokability. This is much the same as we would describe a piano as having an affordance of music playability. Nested within this affordance, the piano keys have the affordance of depressability.

It is important to note that affordances exist (or are nested) in a hierarchy and that the levels of the hierarchy may or may not map to system functions. In other words, affordances do not necessarily map one-to-one onto system functions. Taking a standard GUI-based word processor as an example, we can say that it affords document editing. Editing includes affordances for text addition and deletion, margin adjustment, font selection, and many others.

As Gaver identified, there are also sequential affordances, that is, affordances that are only available at certain points in time. Although such affordances also exist outside GUIs and applications, they are perhaps more obvious here given the dynamic nature of software and the ability to update the display quickly. The information that specifies an affordance can be updated as new affordances become available. Once a user clicks a visible button, a drop down menu may appear, from which the user can then make a selection. This is not to say that all applications update the visual information to specify the available affordances. The UNIX text editor vi, for example, gives the user no visual information about whether text entry is possible. In command mode, a user must first switch to input mode before entering text. It is impossible to discern from simply looking at the screen whether the system is in command mode or input mode.

6.4 Affordances as a Framework for Design

To use affordances to evaluate and improve design, it is useful to think of the degree of an affordance. To regard affordances as binary is to oversimplify them. Warren's [26] work on π numbers, and specifically the optimal and the critical points, began to address what we call the degree of an affordance. However, we still require language to describe affordances that exist between these two points and we need to incorporate the information that specifies the affordance. We can think of a two-dimensional space where one dimension describes the ease with which an affordance can be undertaken and the second dimension describes the clarity of the information that describes the existing affordance. Each of these dimensions is a continuum. The goal of design is to first determine the necessary affordances and then to maximize each of these dimensions. If both dimensions are of equal importance for a given affordance, improvements in design should be seen to move along the diagonal given in Figure 4. Note that while determining the necessary affordances is related to usefulness, making an improvement in either of these dimensions is related to usability.

Personal customization of an interface provides a good example of how a user can improve the design of a system to make the affordance easier to undertake. For instance, a user may make an alias for a long command string (for example, turning "lpr –Pmyprinter" into "lpm") or may add a button to a toolbar for a frequently used command. Thus, an affordance is easier to undertake when the time to perform the action is reduced. It can also be made easier by increasing the physical comfort or reducing the exertion required. A command that requires a single key to invoke is physically easier than one that requires the simultaneous pressing of multiple keys.

By comparing a GUI to a command-line interface we can understand how the degree of information specifying the affordance can be varied. Command-line interfaces often provide little or no information about the options that are available to the user. GUIs, on the other hand, provide significant information. Despite the available information in a GUI, expert users tend to prefer command-line interfaces. Their preference can be understood in the context of this two-dimensional framework; it is faster to enter a short command via the keyboard than to move the hand to the mouse, position the pointer, and click. Expert users have committed these commands to memory and so the visual information is clutter and the mouse access is a slow-down. For novice users, having visual information and mouse access is easier than committing a series of command strings to memory. This same information

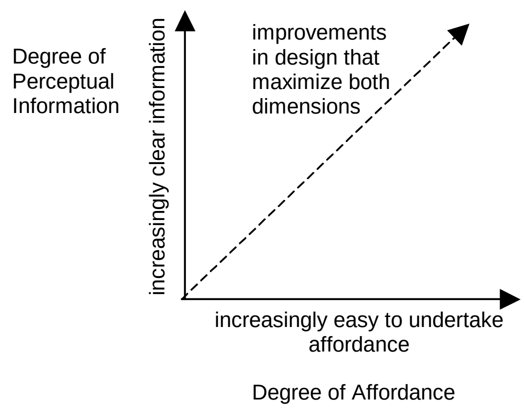

Figure 4: Representing the affordance and the information that specifies the affordance on a continuum.

comes at the cost of making the affordance more difficult to undertake for expert users. Thus, the degree of an affordance exists relative to a particular user.

7 Conclusion

Without Norman's adoption of affordances in POET and his ongoing writing, affordances would likely be unfamiliar to many of us. It has been necessary for us to be detailed with respect to Norman's use of affordances because otherwise it would not be possible to sort out the misuse and the current confusions that remain. We applaud Norman's efforts in bringing this important concept to our community and continuing to clarify it.

As the concept of *affordances* is used currently, it has marginal value because it lacks specific meaning. Returning to a definition close to that of Gibson's would solidify the concept and would also recognize that designing the utility or functional purpose is a worthwhile endeavor in its own right. In order for the *affordance* concept to be used fully in the design world, however, Gibson's definition needs to incorporate the notion of varying degrees of an affordance. We have provided a framework for design that is based on this expanded notion of an affordance.

8 Acknowledgments

We are grateful to Kim Vicente for many engaging discussions on affordances and his thoughtful comments on earlier drafts of this paper. This research has been supported by the Centre for Advanced Studies at the IBM Toronto Laboratory and by NSERC.

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