

A Handbook  
A Model  
An Exploration  
A Summary  
A Survey  
A Theory  
A Philosophy  
An Epistemology

# Of Design

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## Our Goals

Design theory has, in the large, progressed as schools of thought, each proposing a single “solution” to the problem of design. Each school of thought has progressed on the assumption that only by following that one school of thought can “good” design be accomplished. Design schools teach various schools of thought by exposing the aspiring designer to a handful, maybe as many as a couple of dozen, of school's treatises and practises. The student then practises with the school's approach, and tries to take away some fragmentary “feel” for the characteristics and power of the school's approach.

Our purpose here is to provide the student and teacher of design with a framework in which to discuss the relative approach and merit of the various schools. The framework we have chosen, an understanding of human perceptual and cognitive processes, may seem strange. Consider, however, that “understanding human nature” has always been a key to great design. Designers attempt to change the world to affect people, and to affect people effectively the designer must know something about people, and their experience of their world.

A designer must understand the human condition, and to understand that condition fully, the designer should understand the mind that experiences the condition. There are two major advantages to understanding the human condition for the designer; having something meaningful to say, and knowing how to say it to make it meaningful to others.

Obviously, this thin book will not teach you all there is to know about the human condition. It is intended to serve as a way-post on a journey, and possibly even a guidebook to give you a survey of that part of the human condition that surrounds ideas on the synthesis and generation of form.

## Philosophical Background

Why are we going to spend time discussing philosophers? After all, what do such abstract writings have to do with deciding where to put a wall? It seems more productive to read the works of designers or theorists who are writing explicitly about the topic of creating form. Of course, many philosophers discuss aesthetic considerations, but generally in quite abstract, almost impenetrable prose, and generally with focus and limitations that makes their conclusions of little use to practising designers.

What discussing philosophy allows us to do is to see the subtle connections between the schools of design that arise in the context of the major philosophers of the day. While few “design thinkers” reference philosophers by name or work, designers tend to absorb the philosophical stance of their society and reflect it in their work. Of particular importance to the modern designer are the last two great philosophers of the renaissance, Hume and Kant.

David Hume presented a problem to philosophers. He proposed that no “true” knowledge, that is knowledge which is absolutely and unarguably true<sup>1</sup>, could be based upon the information provided by our senses. In other words, there could be no objective truth which relied upon a perception of a human being, as our perceptions are fundamentally non-objective. Thus, there could be no universal ideal of beauty or morality, nor could we necessarily derive any universal laws governing the operation of the universe by examining the universe. All statements about the real world were contingent, flawed and fallible.<sup>2</sup>

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1 “*a priori*” knowledge, or knowledge which can be known before all experience.

2 Hume was not the first philosopher to propose nihilism, but he was the most successful in being willing to posit situations which logically showed that there was little or no “path around” the argument. In effect he argued that if an all-powerful deceiving demon were to be feeding you perceptions that matched those of a coherent world, then that demon could reasonably change the perceptions it was feeding you at any time. As a consequence, while the world

Kant, in his “Critique of Pure Reason”, set forth a proposal that obviated much of the difficulty in Hume's proposal, while accepting its core thesis. Though we cannot make true judgements about the real world based on our perceptions because they are often fallible with respect to objective truth, we can discover truth of a sort based on our perceptions. While we cannot necessarily know what the objective world is like, our own mental model of the world can be used just as readily for making judgements regarding “truth”, as long as we always keep in mind that we are discussing truths related to our mental model of the world, not the world itself. While Hume made it impossible to discover a universal bedrock, Kant provided a life raft of sorts.

For designers, the shift brought about by Kant and Hume was fundamental. While previously designers could believe in an absolute truth, a perfect proportion, an ultimate style, in the wake of Kant they were faced with the idea that anyone's perception of “good” was just as valid as anyone else's, that there could never be a universally “good” thing, only things that were good for those who share a particular perception.

In the sphere of morals, the results of Hume's nihilism was to abrogate any absolute claim to “goodness” or “virtue”. Hume made it difficult or even impossible for any particular moral statement to be made. If all is contingent, and even the very nature of cause and effect is subject to question, is there any reason to imagine that what you see as moral has any bearing on what someone else sees as moral. Kant's rehabilitation served merely to make it possible to reason about your own actions as related to your particular goals for society, it did not introduce a coherent shared model of morals.<sup>3</sup>

Hume and Kant after him resulted in many designers and commentators throwing up their hands and declaring that there is no point discussing design at all; that all is merely taste. They have decided that without an absolute knowledge of an external world, there is no point discussing what might be useful in that world.

This state is not particularly comfortable for those designers who like simple, rational, absolute situations. Cast into the sea of relativism, some have tried to lash together various rafts of common perception in order to build a stable foundation on which to build. Le Corbusier, for instance, simply ignored Kant and Hume and constructed a proportional scheme (Le Modular) based on absolute ideals inherited from the renaissance.<sup>4</sup> Aestheticians try to argue Kant down to finding a “perfect” beauty with headache-inducing logic, discovering little of value from a practical standpoint.

Of particular interest is the work of Van der Laan. He attempted to construct a coherent “absolute” model of beauty and proportion by measuring the perceptions of populations in order to determine that which was shared among observers. His resulting proportion system (the Plastic Number) is one of the few proportional systems in architecture which has such an experimental basis<sup>5</sup>.

This approach, however, still attempts to discover an absolute truth in design. Van der Laan's model of architecture encodes any number of cultural and social assumptions into his guidelines for his followers. He looks for balance, harmony, rest-fullness and the like.

What if we were to more fully embrace the idea of perception as the measure of design, and the

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seems coherent and “real”, it could at any point in time be changed by the deceiving demon. True knowledge is only that which does not rely on the evidence of the senses or habits of thought based on the accumulated experience of the evidence of the senses. He argued convincingly that even such basic ideas as “cause and effect” could be ascribed to mere habits of perception, rather than necessary truths.

- 3 Kant's “categorical imperative” is formulated as (loosely) “act according to rules (maxims) by which you would like all members of society to abide”, or even more loosely, choose your actions based on principles which, were they to be adopted by everyone in society, would create the type of society you would like to see.
- 4 Mixed with a healthy dose of self promotion, in the use of his own proportions as the model for an ideal man.
- 5 Dom Hans Van der Laan, a monk from the Netherlands with a considerable current following.

implications of Kant and Hume regarding what is “moral” or “right” in design. How would we define design in this light:

Design is the process of creating some thing in order to affect a user or users perception of their environment in some way.

Any time one tries to define design, they are bound to offend most designers. So it will be necessary to explore this explanation somewhat to address the most obvious objections.

Does this formulation allow for certain types of design where the product has to accomplish a task, such as architecture, or industrial design? It does, but it can be non-obvious as to how. While we normally think of “perceptions” in fairly limited “seeing where we are” terms, we are here using the broader definition which includes our understanding of our own needs and desires.

Following from Hume, we cannot really know our environment, all we know is what we perceive of the environment. So while it is practical to say that a house must keep the rain off the user's heads, it is as correct to say that the house must eliminate the perception of rain falling on our heads. Almost; the house should also eliminate the perception of pneumonia which tends to result if we, for instance, merely render our users unconscious so that they cannot feel the rain. In effect, we have here a set of consequences which we have learned<sup>6</sup>, we know from experience that long term exposure to rain in cold climates will tend to cause pneumonia. Our mental model of reality tells us that to avoid pneumonia a home must keep the rain off of its occupants. We perceive this connection between cause and effect as a need; a condition that will bring about a desirable result.

Needs are part of our perception of our environment. Similarly, the feelings and promptings of our body feed into our perception of our environment. When we satisfy needs of any type, we are changing the user's perception of their environment. Thus functionalism is an approach to design which tends to focus primarily on the satisfaction of physical needs.

What about “pure” art; is art which is created solely for the creator of the piece of art, with no attempt to accomplish any task, a form of design under this definition? The “user” in the formulation above does not need to be another human being. The creator themselves can quite readily be the “user” of a design, as could be an animal, or even a (conception of a) deity. Nor does the “user” need to be fully understood or articulated (though practising designers often spend a great deal of time attempting to understand their users).

Regarding the lack of a readily identifiable task in “pure art”, altering the user's perception of their environment is not limited to satisfaction of physical needs; communicating ideas or allowing expression and contemplation of thoughts are all ways of altering perceptions. Thus such “pure” art is a form of design, as would be “art therapy”.

What about “performance art”; does design exist if there is no structure or work created? The “thing” described in the formulation above is intended to include the ephemeral just as much as the concrete. A “thing” is something which can be perceived, whether it be an event, a physical object, sound, light, scent, heat, taste, or texture. The “thing” being created may be the event of “destroying” something else. When we act to affect perceptions we are designing.

Doesn't that make everything a form of design? What sets design apart from any other action in this model? In the formulation above, the key words are “in order to”. Design is action taken in order to effect a change in perception. It is a planned effect, based on our understanding of how humans

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<sup>6</sup> Consequences, to Hume are not necessarily true. At any point in time the deceiving demon might decide to change the “law” of cause and effect, but Kant allows us to reason within our model of the world, which seems to suggest that such events will follow one upon the other.

understand their world, it attempts to change those perceptions. To be clear, though, the plan may be half-unfinished, the eventual goal unknown or ambiguous, yet there is an intention to change something within the user's perception through an act.

Design is an intention to change perception.

This formulation brings up the obvious question of “paper designs” or other unrealized plans; design doesn't necessarily require realization (execution) to be design? The action of making the plan itself, is a form of design. The plan's job is to change its viewer's perception of their environment; to demonstrate a possible future course of action, or an idea to be integrated into the user's world-model.<sup>7</sup>

There are likely other objections to the formulation, but we will take it as a functional definition for now, and move on to considering the scope of design more directly. As may be understood from the previous discussion, design as formulated here is extremely broad, we use “design” in its definition closest to “plan” or “intention”. However, our primary research focus being on education in the practise of architectural design, we will tend to focus on those aspects of design related to the creation of built environments, with notes regarding differences for other design disciplines.

How does design, as practised by architects, graphic designers, chefs, industrial designers, furniture makers, visual artists and similar practises differ from the more general definition of design?

Traditional “design” disciplines tend to focus on the creation of physical objects. They are focused on the creation of “form”, and are thus “concrete” in their operation. They tend to include a physical functional component along with more ephemeral concerns.

Non-traditional designers, such as actors, musicians, novelists, politicians, and philosophers, tend to produce ephemeral or ideological “things” to affect their audience, often with a very explicitly desired effects. These “things” are often rendered into physical form by recording or writing, but the form itself is not integral to the thing created. Whether a symphony is recorded on a compact disk or a computer file doesn't change the symphonic creation, though it may change the user's perception should they have their experience of the event mediated by that recording.<sup>8</sup>

“Pure artists”, such as painters, performance artists or sculptors will often create physical things, but with very ambiguous models of the effects they wish to have upon their users. They generally have no physical “needs” of the user that must be satisfied, concerned solely with internal mental processes of the user.

It would be overstating the issue to imagine that the split between the formal and the ephemeral designer, or between the designer and the artist are so broad as to constitute a different type of design. The choice of media for expression has many consequences, but the process of design, and the process of perception it attempts to influence remain constant.

## **Good Design**

We have skirted the issue of “better” and “good” design in the previous discussion for good reason, but will here begin to address it. Again, we will precede from Kant, for simplicity's sake. Particularly, Kant's Categorical Imperative proposes that an action should be viewed according to whether the

<sup>7</sup> By way of example, the architect Etienne-Louis Boullée designed a cenotaph for Sir Isaac Newton, the design was never realized, yet it is still widely studied in schools of architecture. The design (intention) itself changed the minds of those who perceived it, though in a different manner than would the building had it been constructed.

<sup>8</sup> This is Marshall McLuhan's formulation that the “medium is the message”, which suggests that the mode of delivery alters the experience of the designed work, that the media of expression changes the experience of the design in subtle and important ways, so that the experience of a symphony “in the hall” versus being played back over a laptop computer speaker from a highly compressed file is an entirely different experience of the design.

action, were its impact to be magnified across the entire society, would create the type of society that would be desirable to the members of the society. In short, actions which move to achieve your goals, and the broader goals of your ideal of society, are “good”, while those which would tend to produce an undesirable situation are “bad”.

This formulation pushes the “moral question” to what our goals should be, but while that is an interesting philosophical question, it lies outside of the scope of our discussion of design. Design is action taken to effect a change in the user's perception. The goal of the change doesn't alter the operation of the design process, design can as readily be bent to “evil” ends as “righteous” ones, so while we may feel that our communities should be tight-knit and friendly, and wish to alter our user's perceptions to support that idea, the goal is just a goal within the process, it doesn't affect whether the design itself is well done or effective. The process of design is amoral.

“Good” design is design which is effective in achieving its goals, whatever they may be.

Determining the “right” goals for design may be considered a different branch of the philosophy of design, “design morality”. Here we are interested in what may roughly be termed “design epistemology”, a study of how we understand and form models of our world and how we act to change those models of the world within our audiences. While a morally sound model for design is important, our focus here is on the way in which goals are transformed into intentions.

Similarly, we will not focus here on the practise and craft of design. We will not discuss ergonomics, economics, materials science, or office work-flow patterns, save as they alter the nature of the actions taken and their perception by the user. While craft is important, it is well covered in other texts.

Lastly on this topic, we are not here going to attempt a study of aesthetics. Aesthetics attempts to find a universally “good” form of design. As we are proceeding from Kant, we can see that any attempt to find a universally “good” form must reduce down to discovering artefacts of the human perceptual system. While this can be useful in informing the design process as part of our craft, it's extremely limited scope cannot hope to encompass the breadth of design.

## **The Study of Perception for Designers**

Designers are those whose intention is to alter a user's perception of their environment.

Normally, the user targeted in this intention is a human, or something which perceives in a manner similar to a human such as an animal, a human conception of a deity's wishes, or an artificial intelligence patterned after the intelligence of humans. So normally a design is attempting to influence a human-like user's perception of their environment. To be effective in manipulating the workings of any process, it is useful to understand how the process works. Thus to be more effective in design, one should attempt to better understand how one's users (normally humans) perceive their environment.

From a less abstract perspective a better understanding of the perceptual system allows the professional designer to better meet their contract with society. Society rewards designers when they are able not only to meet the immediate physical needs of direct sensory input, but also to bring to the everyday some echo of the nature of the human condition, some hint or prodding toward an understanding of the world at large. We solved the problem of keeping rain off our heads when we moved into caves, we've refined that aspect of design into R-2000 homes that entirely exclude changes in the weather from their occupants, yet still we ask designers to build new forms of shelter because we want to explore the deeper pools of meaning in our lives.

The designer is a societal coping mechanism.

Each design discipline shares this characteristic regardless of their medium of expression, the value they add beyond mere physical craft is their ability to work within the media of perception, to provide a window into a greater understanding of the world. They allow society to explore deeper and more complex questions than would be possible without specialization. While they often have a particular task to accomplish (such as keeping rain off of heads), it is the reflection of the universal in these everyday tasks which makes them valuable to society.

The model of perception we will be exploring is chosen primarily for its simplicity and ability to readily model observed human reactions. It is not, however, intended to perfectly model the operation of the human brain. The model closely matches that used by Artificial Intelligence researchers in their attempts to simulate human perception and cognition.

Of course, the Artificial Intelligence model is largely based on studies of human cognition where the model is reduced in complexity to something that can be modelled readily enough to consider building it. We don't want to force every designer to learn neurobiology, this simplified model should serve us as well. However, always keep in mind that the description here is a simplified and rationalized model, not an exhaustive exploration of human cognitive processes. We use the model to gain insight into design. We are not attempting to rigorously explore the field of perceptual psychology.

## **Coping**

We will not draw any strong line between perception and cognition here, as their operation is similar, and arguments for drawing a sharp distinction are rather poor. To understand perception (and cognition) we will once again apply an expansive description:

The goal of perception is to allow us to cope with our environment.

It is somewhat problematic to state that there is a “goal” to perception, as that implies that something has established that goal at some point. However, for now, given the focus of our studies, it is reasonable to imagine that our goal in perceiving and thinking is to allow us to better survive and thrive within our environment. Similarly, we might suggest that the purpose of our eyes is to see, that the purpose of our ears is to hear, and the purpose of our nose is to smell.

Regarding “coping” as used in the definition, we need to expand somewhat on this term. In the common usage, “coping” tends to imply dealing with a difficulty or problem and generally refers to an overt problem, such as substantial pain or emotional stress. While our usage includes this usage, it also applies to less intense situations, such as coping with the desire to know “why good things happen to bad people” or “how to feel physically safe while living in a big city”. It also deals with more mundane problems such as keeping ourselves from starving, freezing to death, dehydrating or otherwise perishing.

Coping here is the process of satisfying our needs and/or desires as we perceive them.

Similarly, we must expand the definition of “environment” here. We have already looked at the inclusion of our needs in our perception of the environment, but we glossed over the idea of what else is included in our environment. Certainly the physical environment around our body is included in our definition. We should also include our body itself in our definition of the environment, our internal senses constantly inform us of our body position, pains, hungers and other appetites, and these are generally associated with “needs” with which we must cope, though we might, for instance, cope with a hunger by denying or ignoring it. Within the external physical environment, we should make special mention of other people, as dealing with the social environment is often a complex driver in design projects.



Our environment includes our internal physical, external physical, social and ideological reality.

To expand our description, the goal of perception (and cognition) is to allow us to better satisfy our needs and/or desires as we understand them from our perception of our physical, social and ideological environment. Note the circularity of the description; perception and cognition are inherently cyclic and refining processes. As we perceive, we generate new perceptions with which we must cope.

## ***Perceptual Fields***

The first concept we need to treat is that of “perceptual fields”. A perceptual field can be thought of as “that which is presented to the perceiving individual”. The easiest form of perceptual field to imagine is the simple combination of all current input for a given sense. For instance, that which can be seen with the eyes, or that which can be heard with the ears. The perceptual field here is quite simple in its structure, and can be understood as something like what a camera or microphone might pick up when exposed to the same environment.

However, a visual or auditory field is seldom perceived without input from other senses. A door appearing to open in a moving picture is perceived quite differently if creepy music and a loud squeak accompany it. Our minds combine the input from multiple senses into a combined sensory experience. This combination of effects is not confined to the traditional 5 senses. Our internal bodily “senses”, such as pain, hunger, muscular tension and the like also feed into our perception of our environment. We perceive the duration of a wait in line as being much longer if our bladder is constantly prompting us that it is full. Our immediate perceptual field thus includes that which we may consider immediate “needs” and bodily feedback regarding, for instance, our current posture and respiration rate.

This is not to say that all perceiving individuals suffer from synaesthesia.<sup>9</sup> Rather, most individuals perceive the source of a given stimuli, but their perceptual systems allow them to appreciate phenomena which affect multiple senses as being coherent.<sup>10</sup> We associate seeing a pair of hands clapping with the sound made, the same perceptual system operates on both sets of stimuli.

Of course, to recognize “clapping” as a phenomena, we must have another source of information available to our perceptual system, namely some knowledge of our history of perceptions, or the conclusions we have reached about those perceptions. We are fairly good at perceiving temporal patterns among percepts. We hold patterns in mind which may be satisfied and if they are satisfied those patterns themselves become part of our perception.<sup>11</sup> Beyond the immediate pattern recognition, our mind retains a model of its expected environment, and those expectations are available to the perceptual system to determine whether new stimuli match or do not match expectations.

To summarize, our perceptual field is the sum of all of our current and past sensory input and the traces of our past perceptions. Together they form the raw material against which our perceptual systems “run” to attempt to provide us with the information we need to better cope with our environment.

## ***Neurological Basis of Perception***

We'll take a brief excursion here into a sketch of how human physiology appears to be constructed with

<sup>9</sup> An alternate mode of perception where individuals report “smelling words” or “seeing sounds”.

<sup>10</sup> Kant has argued at length that this coherent perception of “objects” in our environment is a requirement for consciousness of the type that we appear to have.

<sup>11</sup> The mechanism for perceiving rhythm appears to be that neurons are stimulated such that they enter a partially activated state, pending activation by another stimuli. If the stimuli arrives at the correct time, then the neuron fires, if not, then the neuron returns back to the neutral state. This “expectation” of a stimuli (and subsequence “let down” if not met) is a fairly strong effect, and can be used to great effect by the designer seeking to provoke unease in the subject.

regard to perception and cognition. Our goal here is to have a basic model of how the processes we will be discussing are coming about, rather than to have a particularly deep understanding of the functioning of neurons with respect to phosphate pumps and action potentials.

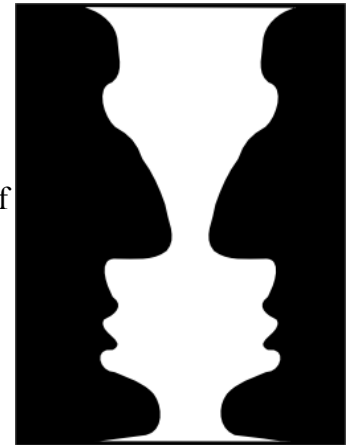
Human minds are pattern matching machines which attempt to predict future events.

When presented with a perceptual field, we process the field using a huge number of neurons, which are presented with the information in the field and which act to pick out those features of the field which match the pattern the neuron (or set of neurons) encodes. When a neuron is stimulated, it in turn may stimulate other neurons. Those neurons in turn may be stimulated if the pattern of incoming neurons matches the pattern they embody.

Neurons have the potential to become “partially excited”, and may have temporal qualities, such as resisting further stimulation until a given time has elapsed, then being available for stimulation for only a short period before reverting to a ground state. Groups of neurons are “watched” by other neurons, so that patterns among lower levels of perception can be detected by higher levels of perception.<sup>12</sup>

In any given “concept” there may be hundreds to millions of neurons involved, with incredibly complex chains of patterns and enormously complex and potentially redundant operations involved in identifying the concept. We learn very early to identify, for instance, objects moving in our visual field, and the faces of human beings and their expressions. We learn to detect the effects of light on surfaces and become so good at picking out “objects” in our environment that these operations happen far below our level of conscious activity when we are adults.

For an adult, seeing an uninterpreted visual field, without any interpretive operations is extremely difficult. We “see”, instead objects arranged in space. This low-level interpretation is demonstrated quite nicely with the classic image of two faces forming a vase. Our low-level perceptions resolve the image into a figure and a ground at a level below conscious thought, but we can change how the resolution occurs by having a different expectation of what we will see. What we cannot readily do is get our low-level perceptual system to see both “figures” at the same time.<sup>13</sup>



What does the biological view of perception provide us? For instance, do we perceive the effect of a partially excited neuron? Is this “expectation”? Do we feel the potential draining away from a neuron that was waiting for a stimuli that never arrived? Is this “disappointment”? Does the “fuzzy” nature of our pattern matching affect how we understand our environment? Will a sufficiently strong set of stimuli X and Y for a neuron that normally mediates X, Y and Z overwhelm the neuron and cause it to fire as though all stimuli were present?

It is interesting to consider whether our understanding of “sets” is based on our neurology. That is, does the idea of “belonging” or “not belonging” reduce down to the question of whether a neuron or group of neurons fires? Are these high-level concepts that we can write about at some length really just a single cell pumping some ions across a cell membrane? It seems far too crude a modelling, and in

12 An interesting, but off-topic consideration is whether these are actually “higher level” neurons, or merely neurons excited during later cognition. That is, do we perceive similarity among patterns because the patterns are being processed by the **same** neurons through a unified processing model where “ideas” are presented to the same neurons as “senses”, or does each pattern-of-patterns get recognized individually. Metaphoric thought is of particular concern for designers, so it is an interesting area for exploration.

13 Consider the case of a graphic artist who is able to present visual fields in a way which does not match the “normal” operation of adult humans; by providing us with an alternate view of our reality they can give us new insights into the nature of our world. “Seeing with the eyes of a child” is a strong path available to create powerful, moving images.

fact, we can see that most patterns we deal with in our life seem to be quite complex, made up of dozens of conflicting and subtly weighted sub-patterns. But is all that complexity just feeding into a single neuron at a higher level. Could there really be a neuron that matches the idea “truth” without which we would lose the ability to understand that particular pattern? It seems too simple to be true, and indeed, likely is.

I will end this excursion with this caveat; while understanding the biological (neurological) basis of cognition may be helpful in pointing out general features of cognition that we can exploit to improve our designs, we are primarily interested in manipulating much higher-level cognitive operations than fall directly out of such knowledge. Neurology raises interesting questions that we may want to address in our designs, and it may help us model perception, but we have not yet begun, as a society, to truly understand the inner workings of the mind.

### ***Object Orientation in Perception***

Consider what a new-born infant sees when first opening their eyes. The first visual field they are presented with is essentially just a jumble of colour. Possibly they can detect various fragmentary effects in the visual field, continuous swaths of single colours, contours between colours, and gradients among colours. There is much debate regarding whether infants have any pre-existing patterns, or whether everything is learned anew by each individual<sup>14</sup>. Still, there are no associations to tell the infant what those colours or contours mean.

Collections of colours and contours in the visual field will move, and the infant will begin to differentiate between those colours and contours and the rest of the visual field. Sometimes the collection will change shape as it moves, the infant's pattern for that “figure” will expand to include the new shapes. In this process of expanding models, the perceptual system will allow for “loose” interpretations of patterns. It will attempt to force matches when no other appropriate match is available for a stimuli.

As the infant grows and learns, it becomes ever better at picking out figures against the “ground” of the visual field. By the time the infant reaches adulthood the process of picking out figure and ground is so deeply ingrained in their perceptual system that, as shown with the vase/face graphic, it is almost impossible to prevent the process with conscious thought. So, for design targeting adult humans, it can generally be assumed that the user will automatically pick out object “figures” in their environment.

The above example focused on visual perception for a reason. The effect of the binary “belonging or not belonging” to an object judgement is more difficult to pick out when dealing with, for instance, sound, or scent. We can certainly see that in interpreting music, we have the ability to pick out rhythms, beats and individual instruments, but we don't necessarily do this. It is quite possible for an adult human to listen to a classical orchestra and not pick out the various fragments in any formal way. However, the perceptual system will tend to pick out fragments from the sound scape, trills, crescendos, the pounding of a drum. The “objects” may be fleeting and transitory, but the mind will tend to organize the experience according to “things” against a background.

The process of picking out “objects” or patterns in a perceptual field might be thought of as “whether a neuron fires” or not, but let's go back to our infant for a moment. Recall our infant learning to pick out figures against a ground. The infant has, we will suppose, been watching a red ball which is sitting on

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<sup>14</sup> The “nature” versus “nurture” debate is still hotly contested by developmental psychologists, though it seems likely that the truth lies somewhere between the two extremes, that is that some set of patterns are “hard coded” into the structure of the brain, while others are learned by exposure to our environment. One thing to keep in mind is that infants have been shown to learn a great deal while in the womb, so any nature/nurture debate needs to take this learning into account.

a shelf above their head, and has gained some rudimentary understanding of “objects” as things that change in her environment. At some point the parent picks up the ball and places it in the child's crib, we will assume this is done while the child watches.

The ball moves from the shelf. This causes it to no longer match the “position” which is part of the ball, but the infant saw the ball move, that is, there was a continuity to the perception of the ball which would suggest that it's the same ball. However, the ball is no longer the “ball there”, as it is no longer there. When the ball has moved only a few centimetres it could quite readily still match “ball there”, and the concept of “ball there” might expand a little, letting it match any configuration where the ball is largely obscured by the shelf (seen from below).

Now, at this point, were the parent to put down the ball, the infant would still perceive the ball as the “ball there”. Presented with the ball in a slightly different place, she would try to find the most similar pattern she knows, and decide to weight the set of lower-level patterns which match (such as the amount of the ball hidden by the shelf) with more weight than some other set of patterns which do not match (such as how far down the shelf the ball is).

It is interesting to consider whether the mind figures out the concept of “objects” from changes in the environment, or whether the concept of “objects” already exists in the mind and the mind is constantly searching for objects from the moment it first is presented with a perceptual field.<sup>15</sup> It might be possible for the mind to discover the idea of “objects” and the related idea of “space” to be discovered from attempts to understand the world by abstracting away details of “place” due to observations of similar patterns occupying slightly different locations over time. Alternately it might be an instinctual “partial model” which is “built in” to all people.

Regardless of where the concept of “objects” comes from, most adult humans do think in terms of objects arranged within space. It is next to impossible for an adult to perceive an environment as anything other than a set of objects arranged in space.

### ***Adaptation, Learning and Prediction***

Going back to our baby in the crib; as we mentioned, our parent is going to place the ball in the crib with our infant. As the parent pulls the ball entirely off the shelf, the infant, having watched the progressive revelation, will see the curved surface of the ball she had seen past the shelf, but will now see the entire ball next to the shelf. Still connected with the shelf (next to it), the infant can focus on the particular curved surface seen before and expand the concept of “ball there” to include successively more of the surface of the ball. The infant weights certain parts of the information, the presence of a curved surface, the presence of a shelf, above the amount of the surface present. In doing so she is able to resolve the pattern to “ball there” and understand her environment. At some point the ball is completely exposed, and the infant's idea of “ball there” will match any fragment of the ball seen juxtaposed against the shelf.

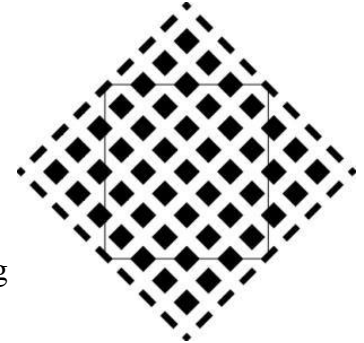
Faced with a situation that doesn't match an existing pattern, the infant has used other clues, such as the memory of the previous second's presence of the “ball there”, to weight the importance of other clues in order to expand another pattern to match the experience. She has heightened the value of the similarities to the pattern, while levelling out the differences between the patterns.

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<sup>15</sup> In philosophical circles this comes from the question of the “tabula rasa” in consciousness, the nature versus nurture debate (again). Kant argues that our object-oriented view of the world is a requirement for consciousness of the type we have, essentially that we must structure our understanding of the world according to external objects interacting in space and time. Of course, that does not preclude the possibility of a different type of consciousness that doesn't search for objects in the environment.

This has all assumed that the parent leaves the ball constantly in the visual field of the baby during the move. If we imagine a slightly more experienced baby, one who has already learned that objects present in the environment often are obscured, then re-appear, and that they can readily move from place to place with attendant changes in orientation and size, then the baby can understand that the red round, large thing that has appeared in their crib is the same object as the red ball on the shelf above their head. The particular clues of position and perspective become relegated to “location” of an object, with the more integral properties of the object will tend to be seen as more important. When trying to identify an object, the location of the object will weigh less heavily than colour, shape and the like.<sup>16</sup>

This adaptive process is constantly happening within every human mind. Faced with that which doesn't match an existing idea or experience, we attempt to understand our environment by seeking similar patterns in our experience and altering them to match the new experience. We use our learned understand of the world to decide what matching patterns or ideas best fit the new patterns. The operation occurs even at the lowest levels of our perceptual system. The famous checker-board image with the phantom grey squares demonstrates our contour-detection system's use of heightening and levelling to make the edges between items more distinct.<sup>17</sup>



To match unfamiliar patterns we heighten or level lower-level patterns.<sup>18</sup>

The impetus to resolve new perceptions is part of the perceptual mechanism's purpose, to allow us to better cope with our environment. The process of recognising underlying patterns allows us to better predict our environment with fewer and fewer patterns.

We fear the unknown, and our perceptual system attempts to minimize our fear.<sup>19</sup> When something challenges our assumptions, we naturally try to understand it. If we cannot understand it, it remains something of mystery and intrigue, or we use general categories that allow us to ignore it. Many people can readily ignore any potential challenge from a piece of art by dismissing it as “art”.

## ***Mental Models***

We tend to build “models” of our environment which allow us to better understand and deal with the environment. These models may be imprecise, tentative or conflicting, but they allow us to make predictions about what may happen. The models constitute our expectations or hypotheses about the universe, and they feed back into our perceptual system at a very low level.

It is important to understand that these models are not static models in the sense of a computer model of an environment or a scientifically rigorous model of reality. They are a dynamically changing understanding of our world which allows us to predict what it is we expect our environment to be. They are the sum of our experience in the world forming a series of expectations that we carry forward

<sup>16</sup> Consider how children are fascinated by things which change their “integral” properties, such as colour, or those which “magically” move from one location to another. Things which violate our ideas of “how objects work” capture our imagination because these patterns are so fundamental to our model of the universe.

<sup>17</sup> Heightening and leveling involves the increase of perceived contrast between dissimilar things and the decrease of contrast between similar things. Our minds use this mechanism to “feed back” higher-level assumptions into lower level perceptions in order to improve our ability to pick out patterns in our environment.

<sup>18</sup> The Gestalt discuss heightening and leveling as fundamental perceptual primitives.

<sup>19</sup> Keeping in mind that the fear of the unknown itself is likely a learned response. It is possible to argue that without pain or discomfort we would have no interest in understanding our environment.

whenever we try to cope with new environments.<sup>20</sup> Our models will include our physical, emotional and intellectual state as well as our understanding of the world around us.

We model the world to guide our predictions of the world.

The Gestalt psychologists of the late 1800s produced a number of interesting experiments that showed that our learned expectations can readily lead us to incorrectly perceive our environment. For instance, two lines of equal length, one between arrows pointed inward, the other between arrows pointed outward, will be perceived as having different lengths.

For designers, understanding this tendency allows the designer to plan an effect based upon it. Illusionists and con artists will often use their victim's expectations against them. Painters can use gestural motions to imply detail without painting it. Care must be taken, of course, as overtly playing on a user's expectations will eventually make the user mistrust the source. A village will tar and feather a con artist who comes back to the well too often.

Let us take a simple example of how the mind uses its expectations to allow it to deal with a familiar environment. Imagine for a moment that you are sitting with a friend at a table in a café on a busy street. There is a great deal of foot traffic, some vehicular traffic, other patrons at other tables, and a general din of city noise. You are, however, able to focus on your conversation. Every once in a while you will notice something of interest on the street, a particularly lovely person, a cute puppy approaching your seat, or a bicyclist riding through the crowd on the side-walk.

Consider how spectacular it is that you are able to focus on your conversation in this environment. You are not spending your entire time identifying, categorizing, and organizing the people passing by on the side-walk a mere four feet from you. Your mind's model of the environment, its expectations, include a stream of average people passing by four feet away, moving with the normal, somewhat hurried, businesslike gait of city-folk. When the percepts received match that expectation, your perceptual systems largely discard the information to allow you to focus on the conversation at hand.

When the lovely person passes by, they do not match the expectations of normalcy, so they progress farther up the perceptual system. Similarly the cute puppy that approaches your seat doesn't match the location, direction or type of percept you expected, so you notice its presence. The bicyclist matches the pattern of traffic on the street, but isn't in the expected location, so she too gets noticed, and her presence is integrated into your expectations about the environment.

That which doesn't match our expectations tends to receive our attention

Our models of our environment allow us to focus our limited attention on those things which we feel will best allow us to cope with the environment. We have assumed here that it is our friend's conversation which will seem the most likely to yield insights into our lives. Were the conversation to have stagnated, it is possible that our attention would wander to the faces of the passing pedestrians.

This ability to focus attention on particular elements of an environment which do not match our expectations substantially reduces the amount of effort required to deal with an environment. Consider the alternative, in which every moment we must constantly seek to build, from the ground up, an understanding of every human, car, bicycle, and puppy on a busy city street. Early robotics engineers attempted to use this approach and immediately ran into processing limits. Interpreting the entire world in a fraction of a second is a daunting task, whereas dealing with a few discrepancies from what you'd expected is quite reasonable.

It should not be imagined that our models of our environment are particularly formalized or well

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<sup>20</sup> We speak here of "new environments", as all environments are new, due to the changes in time and the accumulation of experience that continues even in well-known environments.

organized. We have a general idea of “how the world works”, “how people work”, “how this town works”, and a million other patterns that match the various experiences we've had. Together these collections of patterns form our expectations for how the world will work. We understand different contexts, such as “how people on TV work” which differ slightly from our general understanding; after all, people in our world are seldom able to run through hails of bullets for 2 hours without getting shot or perspiring.

We can hold multiple possible models in our head for a given situation. When we are faced with an unknown situation, we will often pull up all of the matching patterns and weigh their value. If we can't decide, we will investigate. When we can resolve a situation, we generally feel relief from stress, and when we cannot, we build up a bit of stress.

Interestingly, the strategies for investigating are likely learned responses themselves, the first time we looked around a corner and discovered something there taught us that looking around the corner can give us a better understanding of what's there. For other people, looking around the corner revealed a monster, and they would rather simply run away from the corner, avoiding the danger that may lie beyond.

There are lots of dark corners in our world-models. Philosophers, poets and artists are all designers seeking to explore those less-resolved corners, to give the user a way to resolve some of the larger questions that keep us from being content about our world-view. We are society's way of looking around the dark corners in our hearts. However, there are often those who would rather not look around the corner, who would rather not risk revealing the monsters.

## ***Associations and Identification***

Our models of our environment are not abstract intellectual structures. Our models are constantly interacting with our emotions and desires. We associate experiences with pain, pleasure, or any number of other emotions. Emotions are part of our “perceptual field” so our models of our world will tend to link in “emotional weight” for perceptions and ideas which were matched with those emotions in the past.

With experience, we build associations with perceptions.

For the designer this raises issues, as any two people may or may not have had the same experiences, and thus may not have the same associations. If design's purpose is to cause some change in perceptions of the user, and we often want to be able to predict the perceptions of the user when experiencing a design, difference of experience among the users of the design will make it more difficult to predict, and thus to design effectively.

## **“Universal” Associations**

There are patterns which we might consider “universal” associations. While it is almost always possible to imagine someone who doesn't have a particular association, there are some things which are widely shared, patterns which most people will identify with. Some candidates for “near-universal” associations would include:

- “similarity” the idea of things which share like sub-patterns and which are by implication connected in some way, dissimilarity also implies a relationship
- “closeness”, or similarity in position including position-in-time
- “relative position”, comparisons of positions such as “over”, “under”, “behind”, and “beside”,

“layered”, “obscuring”, “touching”, “almost touching”, “surrounding”

- “interaction”, relations between elements that imply that the objects are involved with each other, “penetrated”, “subtracted”, “added”, “intersected”, “pushing”, “pulling”, “compressing”, “distorting”, “engulfing”
- “proportionality” and “balance”, or differences with “measured” relationships, with many different proportional schemes proposed over the centuries
- “natural orders”, orderings of objects, such as linear progressions, fractals, geometric progressions and the like which can be easily understood by the mind
- “symmetry”, axial, radial or similar disposition of sub-patterns<sup>21</sup>
- “beat” and “rhythm”, or similarities in differences between two things, such as the duration of time between sounds, or the distances between objects
- “almost matching”, things which are almost similar, but which do not properly resolve to being the same (we will discuss this at length in *How We Perceive Depth*)
- “figure and ground”, the division of perceptual fields into perceived “objects”
- “the unknown”, things which are outside of our experience, the experience of not understanding or not knowing, often associated with the dark
- “platonic figures”, abstract shapes which most people have encountered, including crystals
- “organic forms”, vegetation, animals, structured, potentially fractally ordered, often symmetrical
- “human bodies/faces”, which are almost universally interesting to humans, along with any number of other associations, such as mothers, fathers, siblings, peer-groups<sup>22</sup>
- “near universal experiences”, birth, death, sexuality, eating, breathing, sleeping

We will see that these universal associations tend to show up in almost every school of design and could probably come up with a few thousand other associations that would be universal or almost universal in character. It is difficult to imagine how we could live, or more fundamentally, perceive our environment without many of these patterns. As such they tend to be present in every approach to design, and some approaches attempt to limit the palette to these absolutes in order to explore a “universal” or “aesthetic” design.

## The Philosophy of Universal Associations

There are associations that might be expected to exist for a large body of your expected audience; for instance, when targeting a group that consists entirely of Americans, it might be assumed that the American flag will have strong, largely positive associations. Certainly many Hollywood blockbusters will “randomly” toss American flags into their works to trigger positive emotional reactions. The fact that the majority of those not part of the target market will at best feel the use of the image is trite or pointless, with a significant subset feeling antipathy toward the image, might not matter to the designer

21 Again, the Gestalt Psychologists identified this trend. The reason for the preference may have to do with the fact that a perceptual system which can identify symmetric patterns has a much higher chance of detecting symmetrical animals, prey, predators and mates in an environment.

22 The “Curve of Beauty” described by [XXX lookup reference properly] was once thought to be a requirement for any painting, as without it the eye would not be drawn to the work. This S-shaped curve was to mimic the curve of an idealized woman's back and derriere in a loose, flowing sketch.



if the target audience is affected properly. The associations of Groups and Belonging is discussed further below.

Some schools of designer feel that “not offending” any group is more important than positive associations for a given group. Others, taking the idea even further, feel that universality and inclusiveness is more important than trying to strongly associate for any given group. The question falls into the area of “what you wish to communicate” rather than how you communicate it. Certain tasks, however, require at a design level that we restrict our use of associations to those perceptions we know to be universally shared.<sup>23</sup>

There is much debate among philosophers and psychologists about what perceptions are “instinctual” among human beings. The question of which patterns pre-exist, and which are learned over time. Do we instinctually fear a snarling dog, or do we learn that the the snarling dog is associated with pain? Do we automatically fear the unknown, or do we learn to fear it by being scared when something we do not understand surprises or hurts us?

Normally the question of instinct versus common experience does not concern the designer. If the vast majority of intended users have an association, the designer can generally ignore the question of whether the pattern is learned or instinctual when attempting to predict the user's behaviour. It becomes important primarily when we want to change the perception itself, when the perceptions we wish to engage for the user are in contrast to the a pattern which may or may not be instinctual.

The search for a universal definition of Beauty or desirability is the field of Aesthetics in Philosophy. It attempts to find some model of art or design which can be universally understood and appreciated. Similarly, the study of signs and symbols to communicate meaning and how the references of sign and symbol become significant to the individual interpreting them is the field of Semiotics. These two fields of philosophy can be enlightening to study for the designer who wishes to more deeply explore how associations form in the mind of their users.

## **Groups and Belonging**

Humans are social. We generally seek to belong to groups and often define our “selves” via roles within groups, structures such as family, community, city, state and country. Group structures allow for a simpler understanding of social orders than attempting to maintain individual relationships with all 6 billion humans in the world. The structures of our societies allow us to predict others' behaviour, to rely on patterns of interactions which are constrained and ordered by the definition and character of the society and individuals' roles within the society.

Which is not to say that we are always happy with our role in society, or with the structuring of our society as a whole. As we have mentioned in Rebellion and Revolution, North American society uses patterns of interaction which encourage “contained revolution”, where individual's dissatisfaction with their lot in life or with the structure of society is used to drive the overall society forward, by folding the “rebel” into the social order. In other societies, the “rebel” may attempt to replace the social order, but they generally see (or sell) themselves as being part of some greater or better model of society, convincing others to see their society as having some different definition, but seldom attempting to organise people without any reference to being part of a cohesive group.

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23 One interesting project exploring this is the “Universal Warning Sign: Yucca Mountain” competition for the design of a warning sign for the planned nuclear repository at Yucca Mountain which was intended to last for at least 10,000 years and be capable of dissuading whatever human or human-like individuals would arise during that period from excavating the buried waste. A less extreme example is airport signage which needs to allow travellers who do not necessarily speak the local language to reach their destinations. Even less extreme is the process of designing environments which must be used by those with cognitive limitations.

The associations of belonging are, as a result of their pervasiveness, powerful and commonly used. Interestingly, other than some fairly abstract groups (such as “humanity”), most groups have both an inclusive and an exclusive function. So in our example above of Hollywood motion pictures which use the American flag, those who are not part of, or not aligned with American interests will tend to have a negative reaction to the symbol.

Formally defined groups, such as religions, cities, states or countries will normally have a large number of symbols associated with them. Colours, icons, rituals, songs and stories provide a deep well of associations for designers who wish to target users who belong to a given group. Even less formally defined groups will tend to have shared experiences or ideas which the designer can use to bring up associations of belonging.

Belonging, however, is not an absolute. It is common for individuals not to self-identify with a group, that is, though some outside observer might see them as belonging, they themselves would not consider themselves to belong. Particularly with less well defined groups, it can be difficult to determine which users will identify with the group and which will not. For users the “key characteristic” of a group might be very different than that which the designer (or other users) believe defines the group. As the belonging/exclusion identification tends to be binary and inverse, a design which was intended to play on belonging may wind up alienating its targets.

One common type of group that is important to certain types of designers is that formed by design itself. Those who follow a particular style are, in effect, choosing to join a particular group which is defined by following the style. Particularly common in clothing design, “fashion” and “fad” will often cause users to strongly associate with designs which they will, in just a few months or years, reject out of hand (until they come back into fashion a few years later). This type of design-association plays strongly to the idea of being part of an “in” groups, to be part of the “cool” sub-group of a group.<sup>24</sup>

## Shading and Modifications

Of particular importance for designers seeking to understand the role of association is the combinatorial nature of association. As we have mentioned, the perceptual and cognitive processes are iterative, so that our emotions and model of our world at any given moment will affect our ongoing perception of the world. A single seemingly tiny “trigger” may completely alter the associations of the user with a given environment.

A beautiful day at the park can be coloured by a bee-sting. Where before the day seemed warm and pleasant, now it seems hot and stifling. Where before there was a gentle buzzing of bees lulling you to sleep, now you are trying to find out from where a dangerous attacker is going to attack you next. What was perfectly innocent and even calming becomes aggravating and upsetting, despite not having changed itself.

A party can be ruined for you just by seeing a jilted lover. A moving picture can be twisted because you happen to have read that the actor has abused their spouse and you find yourself constantly searching for signs of the abuse in their face and actions. We search for what we believe to be there, we look for evidence to support or contradict our model of the world. If our associations, our model, has changed we will begin to look for different clues in our environment.

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<sup>24</sup> Apple Computer Inc. is widely studied for its ability to use design associations to make consumers love its products and identify with them and with being owners of them.

## **Need**

Our last topic in our discussion of perception for designers is that of “need”. Needs can be understood as a desire, such as the avoidance of pain, or the acquisition of pleasure associated with a learned pattern of action which may produce the desired effect. For instance, the need to eat can be seen as a desire to eliminate the hunger pangs from an empty belly combined with a learned pattern that by eating food hunger pangs can be eliminated. Similarly, the “need” to own a fast car can be seen as a desire to achieve sexual release with a desirable partner combined with a learned pattern that those attracted to fast cars are desirable.<sup>25</sup> On a more abstract level, the need to understand our environment may be a desire to avoid pain or surprise coupled with a learned pattern that working to understand the environment gives us a better chance to be free of pain or surprise.

There is a great deal of research on the topic of needs. For our purposes, we will simply point out that there is a hierarchy of needs.<sup>26</sup> That is, certain needs are more urgent than others. We need air, water, food, shelter, social connections, beauty and an understanding of the underlying rules of the universe in approximately that order of urgency. While we may sacrifice a higher urgency need, such as eating, to a lower urgency need, such as universal understanding, by fasting; we generally work to fulfil our needs in roughly hierarchic order.

There is a powerful association with things which we perceive ourselves to need. We strongly desire and will expend a great deal of energy to acquire things that we feel would give us a better ability to cope with our environment.<sup>27</sup> The acquisition of a thing which we have been prevented from attaining yet which we have felt we needed will tend to produce a powerful sense of relief.<sup>28</sup>

Interestingly, if we have not been denied the thing we will not have felt a need, so will not tend to have as powerful a sense of relief. Subconscious discomfort is also one of the things which we can find ourselves being “relieved” of when we acquire some thing or idea. That is, our mind may perceive a requirement (an unresolved pattern), but we may not be aware of the source of the discomfort or unease, so that when we discover something which resolves the pattern we feel a profound sense of relief and surprise to discover that the issue concerned us.

The use of frustration, anticipation, and creation of perceived needs are extremely common tools for the Post Modern designer. The Eclectics of the late 1800s were focussed on the social and cultural needs of design, such as the need to communicate status via well-understood symbolic forms (styles, often via a simple appliqué). The Functionalist school advocated always immediately attempting to satisfy the (relatively obvious, straightforward, normally physical) needs of the user. See Modernism's Anti-ornamentation Movement. The Post Modern schools, following after Venturi have re-introduced the idea of frustrating the needs of users in order to provide a more profound or meaningful experience. We will discuss the development of these ideas at length in *Depth and Complexity*. This is often combined with a satisfaction of lower-level needs, such as the desire for beauty, so that designs will draw users in before challenging them to find some deeper need.

Advertising design, in particular, tends to focus fairly strongly on the creation of perceived needs which were not necessarily present before, by promising a solution to an existing problem (such as a

25 Such example is used to demonstrate that “needs” can be unwise or counter-productive. They are part of our perceptual system and are not guaranteed to be well thought out or logically consistent.

26 Maslow's hierarchy being the most famous formulation thereof.

27 There is also an interesting effect where tools which we are holding begin to become “part” of our arm at some level of our psychology, that is, we begin to associate the things we “own and use” as being part of us and will feel loss if they are taken away.

28 And, somewhat ironically, a subsequent let-down, as we no longer tend to have a clear path toward happiness in front of us, and having not achieved (generally speaking) a universal and unassailable happiness through acquiring our desired item.

lack of beautiful mates) via the acquisition of some product (such as a sports car). Here there is a fairly straightforward perceptual result desired within the user, and the designer must attempt to create a “learned pattern” that tells the user that by acquiring a product they will achieve a desirable end. These are commonly the satisfaction of basic desires for food, social relationships, or even transcendental knowledge. By associating the product with the satisfaction of these desires, the designer attempts to make the user do something. Most intelligent users in consumer societies are rather sceptical of the overreaching promises of advertisers, but the fact that advertising is a huge and extremely profitable industry would suggest that the design of advertising is extremely effective.

For the practising traditional designer, it is often necessary to attempt to discover the user's needs when the user themselves has little or no conscious understanding of what they desire, or where their expressed desires may be in direct conflict with their unexpressed desires. The Functionalist movement in architecture produced a large number of approaches to the process of discovering the user's preferences, from simple interviews, through Alexander's user-inclusive design processes where the designer midwived the process of the user creating their own spaces within Safe Spaces defined by the limitations of “The Pattern Language”.

Other design disciplines often have more involved and formal user-driven design processes. Human Computer Interface Design, for instance, generally relies on frequent formal user testing with formal requirement analysis driving efficiency and comprehensibility tests.<sup>29</sup> There are similar processes for Industrial Design and similar design disciplines where a readily understood set of tasks can be outlined which a design must fulfil. These disciplines often include a study of Ergonomics in order to allow the designer to use common patterns to match common requirements based on study of the physical and perceptual systems of “average” humans. These mechanisms can all be understood to live within the field of “Functionalism”, though they can easily be combined with other design approaches.

## Depth and Complexity

We have so far discussed fairly universal patterns. Objects in a field, objects persisting across time, the kind of patterns that a human tends to learn long before they learn words to describe them. With repetition we become so accustomed to given patterns that we no longer need to concentrate to identify them. Their recognition and associations become automatic and they cease to seem complex, regardless of how complex they seemed to us when learning them.

The key idea here is that patterns move from seeming foreign and complex to being familiar and simple through familiarity and practice in recognition. The effect that perceived complexity or unfamiliarity in an environment has upon us is important to the design process. All design intends to introduce into an environment a new perception, and thus every design must deal with the user's perception of its differences from what the user has perceived before.

This is not to say that all design intends to create that which is radically different from all that which has preceded it, though much of North American design in the 20<sup>th</sup> century followed exactly that ideal (see Rebellion and Revolution below). A crafts-person honing a centuries old tradition of furniture making may modify their mother's technique to such a tiny degree that the average person could not detect the change, but the crafts-person is honing the technique, and that tiny refinement is just as much a form of depth that can be perceived by a user as is a radical rethinking of what it means to be a chair. Consider the refined complexity of Samurai swords; though you might be hard pressed to detect the difference between two masters' work, you can readily detect that both masters' works are highly

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<sup>29</sup> See “Don't Make Me Think” for an practical text that describes how to handle user testing in web-site designs, for instance.

refined and complex.

We perceive an unfamiliar or unresolved pattern in our environment very differently than a well understood or familiar one. We see the unfamiliar as indicating that there is uncertainty or a lack of knowledge about our environment, and that uncertainty will generally drive us to either avoid the unknown pattern, or face it and attempt to understand it.

We cannot be relaxed and content without resolving a pattern in our environment, though our resolution may be nothing more than “something which doesn't matter” or “something I can't do anything about”.<sup>30</sup>

As we have mentioned before, society uses designers and artists to explore the greater questions of life, the unanswerable or that which should not be answered. The presentation of new patterns of experience is part of the purpose of design from a societal standpoint. These new patterns provide a way to explore the unresolvable patterns which we all collect as we live. Thus, the perception of new patterns in a designed work, in its highest expression, is a promise to reflect some universal truth.

Depth in design can be understood as a promise of a higher-level pattern which may be resolved. That is, as our minds are built of patterns on top of patterns, perceived depth is a “promise” of a higher-level pattern, a greater truth or understanding embedded in the work. The promise is part of the social contract of the professional designer. Whether or not the promise holds out, the effect of the promise on the perceptions of the user is part of our practice of design.

## ***How We Perceive Depth***

Human beings generally do not know everything about the environments they inhabit. We also frequently don't have the time or resources required to investigate our environments exhaustively. So it is common for us to be in an environment where we do not understand everything about the environment. As we have just discussed, the presence of that which we perceive, but do not understand registers as a stress, something which prevents our being content with our situation.

As the complexity of our environments grow, more and more of those environments will tend to be unknown, or poorly known. From simple examples like not knowing who is knocking at our door, through what the weather will be like tomorrow, to understanding why bad things happens to good people, there are far more unknown things to investigate than time to investigate them in a life.<sup>31</sup>

Further, though the human brain is extremely powerful, it has a fairly limited focus. We can keep approximately 7 things “in mind” at the same time<sup>32</sup>, but we have difficulty handling even two unfamiliar or learning tasks simultaneously. With practise, we can learn to handle a task with less of our attention, but that generally requires learning the patterns quite well. We are also limited in our physical capabilities; we cannot see behind us readily, nor can we normally see around most corners without shifting our position.

So, from a practical standpoint, perfect knowledge of our environment is difficult to obtain. What's

30 The “fight or flight” response is a sort of metaphoric understanding of a physiological situation where our bodies prepare us to deal with a stressor. The presence of an unknown is generally interpreted as a stressor. The dismissal of a situations as being “unimportant” has the effect of “fleeing” from that event in this classic duality.

31 Paper after paper has been written on “information overload” in the 20<sup>th</sup> Century and beyond. The amount and complexity of information to which we are being exposed is continuously expanding. From knowledge being a static “thing” of a given scope that one might learn it has become “streams” of information that one might barely manage to direct to the correct location.

32 7 is a popularly repeated number, after Miller (1956), the actual capacity of working memory varies according to what is being remembered. Cowan proposed (2001) that capacity is around 4 items. The point here is that working memory, the number of things we can keep “in mind” is very limited.

more, certain “unknowns” in our environment tend to have a far greater immediacy and impact on our ability to cope with the environment. If there's a tiger about to pounce on us and an apparently fascinating discontinuity in one of the wall's tapestries, we will normally want to focus on the more immediate situation. This judgement of priority or importance isn't an absolute, if there's no obvious way to deal with the tiger, it could be that the tapestry's discontinuity hides a secret door and we should spend our few seconds investigating that possibility.<sup>33</sup> However, regardless of which item we choose to investigate, we generally can only investigate a very small number of them simultaneously, so we must choose.

As a result, we are very good at picking out missing patterns from complex environments and prioritizing our focus on that within the environment which we perceive to be the most critical item.<sup>34</sup> Recall our example of sitting in a café with a friend. By learning the higher-level patterns of “a crowd” and “traffic”, we can largely ignore that which conforms to the patterns, while picking out more relevant items that do not conform to the patterns.

In a more natural setting, those who live in a jungle learn the patterns of sounds, smells and sights that constitute “the jungle”, and can pick out from those experiences the occasional sounds or sights of a tiger stalking them, or of a predatory snake draped over the limb of a tree. The pattern may only be something slightly off; a silence of birds as the tiger passes, a slightly-too-symmetrical vine, a set of eyes beneath a leaf caught out of the corner of one's eye. Yet it is those patterns, rather than the riot of colour, sound and light that the experienced woods-woman will pick out.<sup>35</sup>

We've used a fairly primitive example here to illustrate the next point. Whether or not an individual has lived in a natural environment, most humans fear environments that they do not understand. It is difficult to say where the fear of the unknown comes from. It may be an instinctual response, created by millions of years of hidden predators killing those who didn't fear the unknown, or it may be learned anew by every generation as each child encounters something unpleasant hidden behind a corner. Regardless of where the apprehension comes from, most human beings cannot be comfortable in the presence of an unknown.

We fear the unknown.

Combined with an imperfect knowledge of our environment, our fear of the unknown prompts us to take some action to reduce our fear. Commonly learned actions are investigation, intimidation, and avoidance. Individuals can have very different responses to the same unknown environment.

These strategies are refined by the individual according to experience. For instance, if an unknown sound is that of laughter from members of the opposite sex, many individuals will have learned to investigate such an unknown by walking into the unknown situation. The number of individuals who will investigate the sound of gunshots similarly is probably lower and dropping all the time.

The examples so far have been mostly crude, life-or-death situations. For designers the more interesting aspect of our relationship to the unknown is in the more subtle, longer-term “off” patterns

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33 An interesting example of non-obvious prioritisation is that players of “platformer games” on computers may very well see the appropriate response to a huge and deadly enemy as ignoring the enemy and jumping up and down to see if some tool can be found in the environment to kill the enemy in the next life. Similarly, ideologically motivated individuals may see discovering some greater truth to be used by later generations as sufficiently important to risk, or even end their own lives.

34 Illusionists often use this capacity to deceive our perceptual systems by distracting us with a seemingly very important detail while changing another apparently less important detail.

35 Recall from the previous chapter, however, that our heightened interest in tigers will affect our perceptual system. The result of this is often that after detecting a pattern that makes us think there may be a tiger, we will tend to see tigers everywhere we look.

that humans detect and fear. Society has formed many explanations for the unknown, from religious mythologies through particle physics. Seeing a problem with our current understanding of how the world works, we investigate or create, to try to find a better model that can eliminate the dark corners.

We attempt to understand complex patterns to better predict our environment.

While we fear the unknown, we do not, without some sort of mental pathology, believe that we understand the totality of our world. This has the effect of meaning that while we fear the unknown, we are dissatisfied with our currently knowledge of the world. We tend to perceive this dissatisfaction as “boredom”, and we will seek out new and interesting patterns when we find that our understanding of our environment has become stale or ceased to resolve itself. This may be a simple learned response. Since we do not generally believe we fully understand our environment, we cannot be sure that we are able to predict our environment, and thus we cannot be sure that we can cope with that environment.

Fear of the unknown drives us to seek out the unknown.<sup>36</sup>

As we move away from needing to devote all of our resources to base survival, we begin to dedicate resources to more complex, less readily understood problems. We dedicate more time to play, to arts and design, to science and exploration, mechanisms which allow us to explore the dark corners that exist in our world.

On a societal level, strategies for dealing with the unknown can have a cumulative effect. Those who investigate the unknown and communicate their findings with their society can reduce the total “unknown” space in the world. A systemic organization of this knowledge can let members of the society prosper due to their ability to predict the effect of their actions beyond what simple experience would have taught.

Science and culture allow us to cope with successively more complex environments.

During the late renaissance period in Europe, it was believed that human beings were coming close to understanding everything there was to know about the world. Projects such as “The Encyclopaedia” were started with the intention of collecting all knowledge. A human was considered complete only if they understood all of the arts and sciences. Humans saw themselves as living in a bright age when all could be known, all could be mastered, and there was no limit on growth and potential. There would be no dark corners left to hide demons.

Since then, humans have continued to learn. Sceptical philosophers such as Hume have seriously called into question whether we can really know anything about our world. Scientists have discovered that the underlying patterns of the world, far from being the simple equations of Newton, are so alien to our understanding that few if any humans can have even a loose intuitive grasp of their operation. Fields of knowledge have multiplied so that, far from any individual being able to master all of human knowledge, it would be nearly impossible even to keep up with the day-to-day production of knowledge. There is far more information than our brief life-spans will encompass. We have mastered the majority of our environments to such an extent that we are the demons waiting in the shadows to consume our society. Most of our unknown situations are now man-made, either physical or social, and most of our fear of the unknown is directed at other humans and societies.

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36 There is an interesting question here from a neurological standpoint, namely what causes this dissatisfaction to appear in our neural make-up. It could very well be that differing levels of a single chemical or gene may control individual's level of boredom/thrill-seeking behaviour. That is, the feedback of dissatisfaction for a given environment may be linked to the feedback strength learned or inherited regarding how much to weight the violation of a high-level pattern in re-examining lower-level patterns. See <http://blog.vrplumber.com/index.php/?archives/2209-Is-Boredom-Instinctual.html> for an exploration of this topic.

Science and culture have created successively more complex environments.

The same mechanisms that allow us to live in a forest are now being brought to bear in allowing us to cope with these new realities. We can learn the patterns of a city as readily as those of a jungle. We pick out that which doesn't match our model of our environment and focus our attention on it, allowing us to learn and grow. We investigate that which doesn't make sense. We prioritise our investigations according to what seems most important and unresolved.

### ***Refined and Abundant Depth***

For the purposes of designers, there are two major types of complexity that need to be considered. In abundant depth, a great deal of detail exists, but it often conforms to well-known patterns, creating a sort of “textural” paper which fills in another pattern. Baroque architecture, patterned wallpaper, lace, Corinthian capitals, tie-dye shirts, or a tile mosaic are all good examples of abundant depth. They are complex physical patterns, but can be understood at a glance.

Abundant depth, while overwhelming, and preventing the mind from apprehending all of its details, can be understood readily because the mind can match the overall pattern. Our previous example of sitting in a café demonstrates this type of depth as well. The street-scape is complex, ever-changing, and overwhelming until one learns the overarching patterns. Once that occurs, the complexity of the street-scape reduces to a filler for the idea of “busy street”.

Refined depth, by contrast, tends not to be overwhelming in its operation, instead a phenomena largely conforms to a known pattern, with only a slight tweaking suggesting something unknown exists. The plaza of the Salk Institute, a Samurai sword, the Parthenon of Athens, Venturi's '50s diner, or the smile of the Mona Lisa are good examples of refined depth. In each case, the phenomena is not particularly complex seeming, they are an empty courtyard, a big knife, a columned temple, a '50s diner, and a portrait of a lady. But in each case there is something not-quite normal about the phenomena, something which causes the mind to reject it as a simple match for the pattern and search for some other explanation (or reject the pattern as uninteresting/foreign/unimportant).

In refined depth the mind can apprehend the pattern easily, but is left feeling that something is missing, hidden, unclear or unseen, something which is controlling the environment. This feeling that something is almost-understood is a commonly used tool for designers. In fact the use of the “hidden” or “unseen” mover in art has been so commonly used that many users have become jaded regarding the largely arbitrary actions by artists and will tend to discount art which uses simplistic methods of constructing refined-seeming depth.

An interesting example of the effect of the hidden or unseen mover in design is ritualistic behaviour. Here a largely arbitrary-seeming system of actions are performed which are based on a liturgical framework. The liturgy becomes the hidden actor which controls the actions of the participants. For outsiders, the result seems largely arbitrary, but they can see large numbers of people making similar or interlocking actions, the ritual will seem foreign, often scary and fascinating. For insiders, the ritual is comforting and familiar, based as it is on their shared liturgy. They can “see” the hidden actor which is made manifest through their actions.

Being someone who “knows the secret” is attractive to the individual, for the same reason that we investigate the unknown patterns in our environment in the first place. When something is not merely unknown, but actively hidden, the desire to understand by outsiders is normally greater. Secret societies, handshakes and decoder rings all hold a fascination for most users.<sup>37</sup> Of course, as with any

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37 Belonging to a group is a form of association, as discussed in Groups and Belonging above.



pattern, repeated disappointment will tend to dull interest. Discovering that most secret societies are just social clubs, and that decoder rings are mostly rotor ciphers will tend to make individuals discount the potential of any value arising from belonging to similar groups.<sup>38</sup>

Designers often focus primarily on one of either abundant or refined depth. You will often see discussions of “textural richness” of one designer versus the “sparse elegance” of another. Movements such as the early architectural Functionalists went so far as to ban abundant physical depth (“ornament is crime”) where the Arts and Crafts movement had embraced it.

### ***Physical and Intellectual Depth***

We have outlined above how the perception of abundant and refined forms of depth affect the user. In doing so, we were somewhat too harsh in our treatment of abundant depth in describing it as textural, for while abundant depth may be textural, it might just as easily be a cascading, ever-changing pattern that can be explored for years. Abundant depth as we normally see it, and as in the examples described above, is perceived as an appliqué upon the surface of some other thing<sup>39</sup> because without doing so we would be unable to deal with the environment, but that does not imply that the depth itself is without meaning or patterns of its own.

It is obviously easy to create an environment which is physically “complex”. Throw as many things as possible into a room and you will have a physically complex environment. In design, it is quite easy to produce a similar effect by applying mechanistic processes to an environment and simply judging the result based on compositional criteria.

We can wallpaper every surface with gold-leaf filigree and toss in a riot of broken parti-coloured statuary. We will create an environment that has a physical depth, and humans exploring the environment may find patterns in the environment because they want and need there to be patterns. Humans will find within their environment patterns that allow them to understand the environment, but an unstructured or poorly-structured environment may very well be understood as merely unstructured; effectively meaningless.

By comparison, the work of Baroque or Rococo architects,<sup>40</sup> while often a “riot” of sensual stimulation, could hardly be thought of as lacking structure or order. Similarly, the fanciful work of Antonio Gaudi is often complex physically, but there is an underlying order continually hinted at by the structures and forms chosen.

Similarly, we readily see a difference between a pictorial stained-glass window and a randomised collection of shards of coloured glass. Though to be fair, were the shards of coloured glass bound into something that looked like a window we might very well start picking out patterns within them.

The connection that arises between physical depth (refined or abundant) and intellectual depth is one of perceived intentionality. Users over time are exposed to many complex environments, and they will prioritise their exploration of an environment according to whether there is likely to be a “payout” in terms of understanding of the universe. When there is a “trace of a hand” in an environment that suggests there may have been meaning trapped within, it is often far more attractive to explore the environment than if there is no such trace, but this does not mean no meaning will be found in its absence.

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38 Consider, for instance, the largely successful castration of the Klu Klux Klan by exposing their secret rituals through the Superman radio-shows (XXX source was Freakonomics, verify validity)

39 Keeping in mind that this is a metaphor for “filling in a pattern”, that the “surface” might be three dimensional, temporal or ideological

40 See, for example: <http://www.wga.hu/art/c/christia/ottobeur.jpg>

We recognise arbitrariness, hints, missing pieces, hidden actors, unclear situations, difficult, different or frustrating situations in design as embodying depth of some form. The difference from what we expect produces a physical depth that may or may not be successfully converted to intellectual depth or meaning. Users may perceive the depth as meaningless noise, or a potential solution to the problems that have plagued them their entire life. Overuse of a particular signifier for physical depth without any particularly valuable intellectual depth, such as performing arbitrary geometric operations, may reduce the user's perception of meaning in subsequent works which use that signifier.

If a user is constantly disappointed in the ability of design to provide insight into the greater meaning of life, she will tend to discount the ability of later designs to provide insight.

Physical depth describes complexity in the things that we perceive, while intellectual depth describes the complexity of ideas and thoughts that the work triggers. The two are related, and interact via our associations and experiences, but there is no one-to-one relationship between them.

### ***Consistency and Subtlety in Depth***

Perhaps the most obvious indicator of intellectual depth in a design is consistent expression of an emotional or intellectual principle throughout all levels of the design. A design which applies a particular principle to the design and organisation of the overall plan, while applying an apparently entirely different and unrelated principle to the detailing or disposition of sub-elements will tend to violate the user's assumption that the design has an underlying meaning.

To put it in the same terms as we have discussed to this point, the user's perception of the higher-level patterns which govern the operation of a design is that which controls the perception of depth in the design. If the pattern of patterns is incoherent, the design will not appear to have depth. By contrast, a design in which all elements of the design appear to be tied together will tend to be more readily perceived as having significant "meaning".

Traditionally the approach to creating a consistent design in architecture is to use detailing and motif; that is, applying the design principles of the whole to each detail level in the design as a considered design process. It is common for an architect to design a parti sketch that has an overarching idea. From this initial movement, the choice of room layouts will flow, the ideas used to decide the parti will inform the shape and disposition of the rooms. The same ideas will be used in choosing materials, disposition of columns, choice of bathroom fixtures, and eventually doorknobs.<sup>41</sup>

Keep in mind, however, that "coherent" here does not imply that the design must have only a single idea or movement. As we have pointed out, the role of the professional designer is to deal with complex and potentially irresolvable issues, to deal with such issues a certain amount of depth and complexity is often required. Too simple or obvious an application of an idea is often discarded as having no insight to provide.

The perception of an order of some form is the key issue in the perception of intellectual depth within a design. Orders that imply conflict or dissonance in an ordered or structured way are more likely to be perceived as meaningful than those which have a total consistency (for more on this, see the next section).

To be more concrete, consider the design of a house by an architect; imagine that our architect makes a first movement based on the (typically modernist) idea of bringing the "outside" of the house "inside"

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<sup>41</sup> Though you may have heard that Architects are cheap labour, all of that time in making every decision at every level of the design winds up making such buildings rather expensive compared to one that makes only a first movement and then just randomly chooses the rest of the details.

by way of large plate glass windows which are visually penetrated by a pool.<sup>42</sup> Our architect wants to produce a feeling of openness and lightness, an extension of spaces into one another, a layered almost-in almost-out feel. The design is bright, open, and without internal barriers as much as possible.

Having made this first movement, the architect is informed that the client would like a “traditional mud room” through which all users must pass in order to deal with the practical problems of working and playing outdoors, namely mud, rain-clothes and the like. The architect dutifully adds a closed off space that separates the “clean” interior from the “dirty” outdoors, while leaving the bulk of the connection with the house in the layered half-in, half-out form. Unhappy with the need to include the mud room, the architect tries to hide it's existence, but cannot really do so as it is in the middle of an open concept space with little or no place to hide it. It winds up pulled off to the side so as not to block of view.

What is the effect of this space on the user? The space seems to be predicated on the idea of openness and blurring the line between the inside and the outside. It seems to be about living in a closer relation with nature. But then there is, hidden, but not hidden well enough to not affect the user's perception is a room which mutely (i.e. without a clear statement) rejects the underlying idea of the rest of the house. Rather than being able to walk through the insubstantial glass wall into the surrounding nature, the user is forced to walk around the glass barrier and into a dark and disconnected room in order to reach that which seems merely a breath away.

The imagined design has not actually examined the ideas behind the mud room to realise that they are at odds with the idea of the house, there is no dialogue (relationship) between the two elements. The design does not hint at how to deal with the challenge the “mud room pattern” deals with in the context of the merged indoor-outdoor living space. As a result, the mud room appears out of place, but not so out of place as to be in meaningful dialogue with the design as a whole.

There are any number of ways one could imagine solving such a problem, from dissolving the mud room into a progression of elegant and functional cleansing stages spread out over ten feet or so in which the border between outside and inside becomes a procession of sorts, through flights of fancy such as a glass-walled room violating the pure lines of the plate glass windows with mud-spatter-patterned walls and an intimidating array of cleaning apparatus.

The key idea here is that the ideas of the design are resolved, or at least addressed, by the design, rather than merely being hidden in a corner. Rather than a nice, but impractical statement about transparency between inside and outside, the refinement of the design brings an impression of completeness, of having something important to “say” about the nature of life as seen from such a first movement.

Consistency by itself will tend to suggest a certain amount of intellectual depth, but let's consider our last two “solutions” to the problem of our mud-room problem. Both solutions are consistent; one reinterprets a traditional pattern in light of the “new” pattern, the other highlights the conflict between the two ideologies drawing them as a conflict. The two pieces reflect the consistency of their design and might pass muster in a design studio or in the rarefied atmosphere of “high” design, where users are willing to deal with that which is “difficult”.

However, the first solution, in which the “statement” of the two conflicting requirements is more subtly made, will tend to be perceived as having a greater total depth in the design by most users. Here the “statement” of the design is made using complex and non-obvious patterns. Rather than hitting the user over the head with the presence of two competing ideologies, the design attempts to discover the underlying features of the two ideologies or patterns and tries to create an “interference pattern” that shows their intersection. Rather than being a philosophical treatise, the design is an exploration of ideas surrounding inside and outside in relation to inhabited space and cleanliness.

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42 A typical house by Richard Neutra, or anything following the Barcelona Pavilion, for example.

Consistency and subtlety in a design can be thought of loosely as a hierarchy of organising principles which provide depth at all levels of a design such that the user can discover “meaning” by drilling down ever further without coming to “mute” elements within the overall fabric.

### ***Depth and Frustration***

Faced with many modern architectural designs, people are struck by their seeming lack of concern for the user. Many designers produce designs that can seem sadistically focused on frustrating the user. The underlying “movements” of these designs are often so hideously complex and abstract that they appear to have no particular relationship to the life of any normal person. Things seem to happen for no reason whatsoever, and trying to investigate the underlying order merely leads to meaning-free textual analysis or similarly empty-feeling “truths”.

This state of affairs can be traced fairly directly to Venturi's seminal work “Complexity and Contradiction in Architecture” from the 1960's. Venturi identified and catalogued the existence of what we are here calling “physical depth” in adjudged great works of architecture from history. He argued at length and convincingly that it was the presence of this depth in architecture that made it great; that the physical depth was what cued the mind to the presence of “intellectual depth”.

Reacting to the Functionalist movement, which demanded an ordered, up-front and logical explanation for all elements within a design on the grounds of utility for the user, Venturi blessed the idea of frustrating the user's needs in order to accomplish a higher goal. What precisely this higher goal would be was somewhat unclear. Perhaps “greatness” would be the most obvious formulation of Venturi's thesis, though we will try to explain here in more detail what precisely Venturi was identifying.

As we have noted, the role of artists and designers in society is often to call attention to the more subtle and complex aspects of life which are seldom addressed by the individual. Venturi's implicit critique of the modernist (Functionalist) movement was that it appeared to have abdicated this responsibility and was focusing instead on the mechanical details of providing shelter, becoming, in a sense, engineering. Venturi's extensive cataloguing of major artistic works of the past looked for the presence of the complex and contradictory, and found it. He did not particularly address why the complexity was there, and what particular human need it had served. Through our understanding of the nature of human cognition, we can see that the complex and contradictory patterns Venturi identified were likely useful to allow the mind to search for patterns which might better allow it to understand and cope with its world.

The complex works of art which were being identified allowed the viewer's mind to find patterns within them which in some way shed light on the nature of the universe. The creators of the ancient works were often using extremely complex generative schemes. For example, the master painters of the renaissance used long and careful study of human nature, lighting and technique. In every painting they would attempt to capture the nature of the subject in subtle and complex ways; their paintings reflected a deep and carefully constructed understanding of certain aspects of the world and carried with them the world-views of the painter.

The master architects were similarly careful, considered and aware. They studied widely, brought in ideas from as many areas as possible, and produced designs which were contradictory, complex, and yet coherent in a very strong sense; part of something larger than themselves. Each design explored a set of ideas which were being constructed with the idea that “Truth” might be understood, that light might be shed on the nature of the universe by contemplation of the patterns the universe presents.

The effect of Venturi's work was to point out the presence of features within certain great designs which frustrated the user's expectations, which conflicted with one another, or which were complex

enough to trigger interest on the part of the user. He then drew a causal link between the physical complexity and contradiction within the design and the greatness of the design. This linking ignored the presence of intellectual depth or “meaning” in the designs, or perhaps simply associated intellectual depth and greatness.

Within “Complexity and Contradiction”, frustrating the user's expectations, attempting to force them to address the issues within a piece of art (physical depth), is put forward as the mark of greatness in design. Venturi gave the designer explicit license to frustrate the user, but the consequence has not been a flowering of works loved by all people.

When every work of art is “off” and “wrong”, and most, if not all, of them are off or wrong because of trivial, crude, or pointlessly complex ideological foundations which seem disconnected from the user's life, the user loses their impetus to explore and inhabit the works. If the payout for figuring out the ideas within a work of art is so trivial in comparison to the work required to figure them out, then users will stop trying to appreciate works of art entirely. The intellectual depth involved in the pieces is often so remote or trivial that the “sausage factory” analogy kicks in; you may actually like the final produce, but you don't care to find out how it was made.

Venturi's approach is rooted in the popular philosophy of the 20<sup>th</sup> century, in which it is pointless or fruitless to try to understand the world in a greater sense, as all meaning is contingent and self-or-culturally-referential.<sup>43</sup> Within such a philosophical framework, it is just as likely that a Coke can will allow the user to discover the meanings of the universe as it applies to them as the Venus d'Milo. Venturi advocates for physical depth as the end in itself, the mark of greatness as a simple physical reality without reference to any ideology or meaning.

This is not to say that Venturi didn't inspire intellectual rigour in the creation of physical depth. It would be hard to argue that the Deridaesque analysis of texts in which post-modern architects have occasionally engaged does not require thought. Certainly it requires a rather complex mind to process the dozens of largely arbitrary tricks and rules used to process a set of texts or events, but in the end there is no necessary approach to a wider understanding of the world. By intellectual depth we refer to meaning and understanding in the wider sense, access to the greater unresolved patterns of life, wisdom and insight as distinct from mere thought. Patterns which allow one to better cope with one's life.

Venturi's blessing of frustration meant that designers felt a release from mechanistically satisfying the needs of their users. Instead, they could frustrate the user's need in order to “force” the user to appreciate whatever concept the designer wished to promulgate. Unfortunately, the rather abstract and largely unapproachable or trivial generative ideas the designers were attempting to force the user to understand wound up leaving most users dissatisfied. Spending days pulling apart obscurely written texts which sought at every turn to seem more important than they were, only to discover that the underlying message was trivial, might be an interesting game for certain people, but those people are not the average person.

The result of these increasingly abstract generative influences, combined with a free hand to frustrate expectations and utility has produced a widespread disaffection with post-modern architecture. Even those willing to devote significant time to understanding the works often discover the underlying patterns to be nothing more than philosophical chop-logic applied to irrelevant ideas. Rather than discovering the secrets of the universe, the user is faced with an impenetrable thicket of jargon and arbitrary choices leading to nothing of any great moment.

Modern designs are judged as a result largely on their aesthetic attraction<sup>44</sup>, as few if any users are

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43 As we have noted, this philosophy owes much to the writings of Hume and similar sceptical philosophers.

44 That is to say; by their low-level “limbic” appeal, beauty, richness, symmetry, the type of aesthetic typically explored by

willing to investigate the “meaning” behind a design.<sup>45</sup> Frustrated in their day-to-day operations, they don't find a meaningful reason for the frustration, and the whole exercise begins to look sadistic and pointless.

Before we are accused of being too horribly biased toward the post-modern architectural movements, we'll address some of the positive effects of the movement. Freedom from mechanistic interpretations of functionalism was valuable in preventing the reduction of architectural design to mere engineering. The effect of having extremely complex and inaccessible generative movements has, by and large, returned many designers and users to making judgements about architecture based on lower-level impressions and visceral appeal.

To some extent this has refocused architects on questions of “aesthetics”, or items of universal appeal and “beauty”.<sup>46</sup> This focus on “universals” has, somewhat ironically, “saved” architecture for the common user, as it has begun to “speak to them” again. Biomorph architecture, contextualism and the like are all appealing at an aesthetic and social level, so they appeal to the average user. When combined with extremely involved generative and organizing principles, they can be simultaneously interesting to those who have steeped themselves in the lore of post-modern architecture.

Those individuals who have “followed” post-modern architecture have become capable of “understanding” and appreciating extremely complex designs; appreciation of complex or chaotic environments has created a niche for designers interested in working for these arbiters of taste.<sup>47</sup>

## ***Depth and Familiarity***

We earlier touched on the idea that familiarity with a particular pattern allows a user to more readily understand similar patterns. The learning process is one of discovering patterns and training the mind to better recognise the patterns when they reoccur. This process is applicable to recognising and interpreting complexity and depth within an environment. That is, with time and exposure to a particular type of complexity a user becomes better able to recognise and interpret similar complexity.

Now, consider the role of artistic exploration we have posited within a society; exploration of the more complex and difficult unresolved patterns facing the society and its members. What effect does an increase in familiarity and ease of access have in the attractiveness of a given design? As a user becomes more familiar with a particular pattern, and with the ideas which that pattern engenders, they are less likely to see the pattern as continuing to be “meaningful”. As the user's mind grasps more of the implications and ideas behind a given pattern, the amount of new insight a particular piece gives will tend to reduce.

In modern society, we have a significant split between those who spend a great deal of time working with complex pieces of art and the general populace. The amount of time that the average citizen spends appreciating “high” works of art could be measured in minutes per year, while designers, artists and art-lovers may spend hours per day immersed in the symbolism and ideas embodied in works of design.

The effect of these vastly different levels of experience is that two major streams of designed work

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those who study philosophical “aesthetics” as a study of that which is universally appealing.

45 Which of course increases the perception that there can be no meaning found in design, amplifying the tendency to discount the possibility of such meaning.

46 For the average user, Frank Ghery's works, for instance, are largely a matter of organic forms and composition, both low-level “aesthetic” tools. Similarly most post-modern architects spend a great deal of time on questions of beauty, texture and lighting, all of which can be appreciated without any knowledge of underlying patterns.

47 Consider the compositional “industrial” music scene, where eerily beautiful chaotic compositions are created by composing fragments of sounds from industrial music.

have arisen, “high” art catering primarily to those who are deeply immersed in complexities and higher-order patterns, and “low” art catering primarily to those aspects of the individual which are more or less instinctual or universal.

Crozier points out that individuals within any community will tend to have a given threshold of learned complexity with which they can easily deal. That which is considerably more complex than their threshold will tend to seem daunting or impenetrable.<sup>48</sup> That which is just slightly more complex than that which is familiar will tend to be seen as a surmountable challenge, and in surmounting the challenge the individual will tend to move their threshold for complexity higher. That which is less complex, however, will be seen as trivial, boring or uninteresting.

Thus appreciation of designed works would seem to be an educational process, motivated by the individual's belief that greater appreciation of designed works will open new understandings of the universe. That motivation is sapped each time users attempt to appreciate a complex work only to find trivialities. Why shouldn't one wallow in the simple and overt when it at least presents “truth” about our lower natures. If all designers can teach users of the world's complexities is that they know nothing about them and aren't even willing to admit the possibility of understanding, why bother playing these often sadistic-seeming games.

That is, the user learns that exploring extremely complex works of art will often not help at all in understanding the universe. The complexity itself is associated with the disappointment at the waste of effort, and in the future complexity is seen as a contra-indication of likely benefit and value. The pattern of that particular type of complexity has been “learned” and it is no longer mystifying or difficult to understand, it is simply discarded as meaningless or useless.

The same basic operation occurs when a work is satisfying, and the user does experience some meaning or association with a work, familiarity with a type of physical depth will tend to make it easier and easier for the user to apprehend the complexity of the pattern. Having never seen a building with a dropped keystone in an arch, a user might ponder the meaning of the feature for hours. When they have seen thousands of such keystones it requires no great effort to understand them. Rather than having to work and ponder for minutes or hours, the patterns snap into focus in seconds as the result of the learned “meaning” of the pattern. The challenge of the work diminishes, and consequently, the perceived value of the reward also diminishes. The user starts to look for the subtle distinctions between the keystones, or to look to radically different approaches to keystones, becoming dissatisfied with the simple fact of “dropping” as a design movement.

Since exposure to and appreciation of complex forms of depth eventually makes users less interested in less complex forms but many people never take the first step of finding meaning in any art “High art” takes off into realms of frustration or abstraction that are of little interest to the average person on the street, while “low art” caters to the broadest possible swath of the society, often merely playing on base instincts and assumptions.<sup>49</sup>

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48 We have posited in the past that the mechanism of perceiving depth is related to the iterative attempts to resolve patterns within the system; spending more time trying to figure something out where we do not reach a conclusion as to the final underlying pattern tends to create the impression that the pattern is deep. When we are under greater stress, our perception of depth will tend to increase, as we can dedicate less time to figuring out a given pattern. This supposition would only hold true for patterns which are not completely learned, of course, as such patterns are generally apprehended within fractions of a second.

49 Consider, for contrast, Shakespeare's plays and network television in the later 20<sup>th</sup> and early 21<sup>st</sup> centuries. Shakespeare wrote his plays to appeal to both those who were interested in the bawdy and vulgar and those looking to understand the subtle nuances of the human condition. Your average network television show, by contrast, has abandoned the search for subtle nuances in favour of the skimpiest costumes, simplest sight gags and most obvious laugh tracks it can find. Meanwhile PBS, the CBC and similar socially motivated organisations produce “high” fare which is almost aggressively uninteresting to the bulk of the populace.

From a social standpoint, the effect of this split in the arts has caused a significant crisis in artistic communities. The general populace tends toward an apathy or antipathy toward modern artistic works. Consider how little the average person appreciates the works of post-modern architecture. Consider that most people find modern painting and sculpture pointless. Consider how little experimental music is appreciated compared to the vast bulk of mass-produced popular tunes.

Is the appropriate response to this situation to target individual works at users of a particular complexity threshold? The result of such targeting, particularly in public works tends to be dissatisfaction among those who are not part of the target group. Even in the private sphere, community groups can become quite upset about an “avant garde” house spoiling the unified appearance of a suburb.

Much gets written in architectural circles about how to bridge the gap between high and low art. Alexander and others have advocated for community-designed architecture. Functionalists argued for a return to the basics of firmness and commodity, letting the artistic truths fall out from the process of solving problems. Aestheticists such as Van der Laan look to rediscover “beauty” in some universally pleasant form which all people can love based on perceptual operations. Traditionalists argue for a return to craftsmanship and iterative centuries-long design processes in which novelty is resisted.

Some designers attempt to layer ideas within their designs such that all users can discover meaning with the work depending on which level of the work appeals to their capacities.<sup>50</sup> Layering generative and organizing impulses and their incorporation into the work such that they appeal to everyone. Other designers see “low art” as the proper and correct form of art, with socialist/egalitarian impulses declaring that the effete aesthetics are a form of oppression, while Disney, Advertising or Pop Rock represent the true path for art that serves the people.

One way or another, designers are being forced to deal with the problem of an increasingly dissatisfied and unimpressed general populace while still trying to cater to those highly educated customers and peers who have “come along for the ride” into the higher realms of abstraction.

### ***(Anti-depth) Movements for Simplicity in Design***

There are problematic moral issues surrounding the class split in design. Elitism in the sphere of design tends to produce feelings of alienation among those who are not privy to the social and cultural group from which the design issues. Increasing complexity, and generators for depth based on social and cultural ideals can readily produce a backlash toward simplicity and transparency in design.

For example, at the end of the 19<sup>th</sup> century, the Eclectic movement in architecture reached its apex. “Style” as a primary determinant in design had been largely accepted by the population. Buildings were made “Gothic” or “Classical” or “Romanesque” to match social requirements of status and position with little concern for the functional requirements of the design.<sup>51</sup> Most of the effort in a design was spent on the ornamental programme, often “ignoring” the functional requirements of the users (as distinct from the owners) of the building. Buildings were primarily designed to communicate social status, and the primary focus of the design was on providing the appropriate appearance to passers-by.

The results of the eclectic movements were in many ways spectacular. Important rooms within a

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Note that this contrast is somewhat overstated for emphasis, programmes such as “The Simpsons” are obviously attempting to appeal to both the “high” and “low” markets, and do well doing so.

50 Consider, for instance, the appeal of the early “Simpsons” cartoon shows, where references to literature, politics and the like were liberally interspersed with sight gags, physical humour and slapstick comedy.

51 For an exploration of the history of ornamentation as part of the functional program of buildings, see Krufft, 1994.



building might be left without windows, or with inadequate windows, due to the desire to produce a particular façade layout. Designs might fail to provide the spaces required to accomplish the tasks required of them. However, the buildings were often quite pleasant to look at, and they “fit” people's expectations of a building (from the outside).<sup>52</sup>

For many architects and users, this situation represented a moral failing in architectural practise. Designs were being produced which were unable to accomplish the basic functions for which they were designed. The argument for the worth of design seemed, to many designers, to have been cheapened to mere fashion and fads. Design began to be seen as a wasteful and capricious nicety applied atop a building's fundamentally uninteresting form. From a perceptual standpoint, the purity of “form” had been marred by social requirements acting as an appliqué on top of the structure of a building. The dissonance implied that there was a “lie” in the design.

Architects began casting around for a better approach to design, and came upon the ancient authority of Vitruvius. In his “Ten Books of Architecture” Vitruvius laid out a set of four principles which were to govern the nature of a building, firmness, utility, commodity and delight. A building must do what it is supposed to do, that is, provide facilities to accomplish the program intended of it. It must be structurally strong and survive weather and the like (and it must follow the classical orders).

The architect and theorist Marc-Antoine Laugier issued a call to return to previous ideas of architecture. Most famously he put forward the idea of the primitive hut, given to man by the requirements of nature, as the perfect ideal to which all architecture should aspire. At approximately the same time, Ruskin put forward his famous sentiments surrounding the search for the ideal in architectural form; “a noble building never has any extraneous or superfluous ornaments; that all its parts are necessary to its loveliness, and that no single atom of them could be removed without harm to its life.”<sup>53</sup>

Both Ruskin and Laugier were calling for a reduction primarily in the physical complexity of designed works, rather than reducing the complexity of the underlying ideas which drove the design. They advocated for a return to a previous mode of design (classicism) which was physically simpler than the Baroque, Rococo or Gothic styles, but they did not particularly challenge the class-based ideology of the eclectic movement. The quest for perfection was seen as a fix to the aesthetic program, rather than a social movement attempting to liberate architecture from the grip of the upper classes.

### ***Modernism's Anti-ornamentation Movement***

In contrast to Laugier and Ruskin, who were attempting to reduce the complexity of the aesthetic programme in order to better serve the needs of the upper class clientèle, the Modernist Movement explicitly advocated the elimination of ornamental programmes as part of a philosophical movement to create architecture for the “people”.

Adolf Loos, in particular, with his essay “Ornament and Crime” equated the use of ornament (physical complexity) with violations of the social contract, effectively abuse of power (waste) by those who should be serving the needs of the people. Similarly, ornament was equated with hiding or obscuring the programme or structure of a building, allowing for shoddy construction, poor expression of purpose, and general deception. Ornament was associated with “lies” about a structure, the ideal was to express structure as simply and straightforwardly as possible.

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52 The writer Ayn Rand uses this situation to some effect in her novel “The Fountainhead”, where her hero/anti-hero plays the role of a modernist architect in a world full of eclectics. The novel is worth reading, though a vehicle for questionable philosophical polemic.

53 Laugier, “An Essay on Architecture”

Within this framework, architecture adopted the machine as the ideal and the metaphor, with the home being a “machine for living”<sup>54</sup> which was to be efficient and effective, designed to serve the needs of the common man. It would provide American-style efficiency with designs as trim and efficient as a sailing ship.

Loos and his followers envisioned a movement where all people would be able to afford mass-produced works with deep meaning and intellectually complex design because of the ability to take a simple, plain design and reproduce the design using technological means. The simple modern stackable chair in formed plastic and steel is an obvious example of this design approach. It contrasts with the earlier Arts and Crafts Movement<sup>55</sup> in which ornamental details were often mass produced to reduce cost and provide access. There mass-produced (repeated) complexity such as wallpapers or pressed-steel ornaments created physical complexity without much intellectual complexity.

This is not to say that Loos and his followers rejected all physical complexity. The use of programmatic concerns to generate complexity was rigorously explored, and culminated in the Hi Tech movement.<sup>56</sup> However, the number of ideologically “valid” sources for intellectual complexity were rather significantly narrowed within the early Modernist movement (as followed Loos).

Of course, the bulk of the follow-on designers who trailed behind the modernist movement seemed to see the reduction of ornament as largely a cost-cutting effort that allowed them to mass-produce ultimately uninteresting designs. Rather than reproducing designs with great intellectual complexity, they tended to produce harsh, ill-conceived designs with none of the humanistic “softening” of previous generation's decorative programme.<sup>57</sup>

Interestingly, along with Functionalism came a style, the CIAM “International Style”, which was every bit as arbitrary as the styles against which the Functionalists were rebelling.<sup>58</sup> The irony seems to have been lost on the Functionalists, however. It became possible to “paint” “Modernism” onto a building, just as one might paint Classicist or Romanesque styles onto a building.

### ***Suggestive Art, Gestural Design, and Abstract Art***

Ignoring the question of whether the Modernist programme worked as implemented by the tenement developers of the world, it is interesting to look at the effect that reducing the physical complexity in a design has on the user's perception of the design.

The works of the modernists and post modernists are often described metaphorically. Users might describe the same building as a ship, plane, cliff or cave.<sup>59</sup> This is because the forms are not obviously intended to represent anything but they tend to suggest possible associations; by being simple but not platonic, with nebulous relationships to other things.

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54 Corbusier

55 Of which “The Red House” by William Morris is a good example.

56 With the most obvious and successful example of that movement being the Centre Pompidou in Paris. Interestingly, the Hi Tech and Brutalist “styles” are quite expensive to produce as styles, as they expose what would normally be hidden and thus require considerably more effort to make structural or service members presentable. Compared to simply “papering over” with some ornamental material they can represent a considerable cost.

57 Consider the difference between Corbusier's “Habitation” projects and the soulless infinite copies of it which are the average modern apartment building. While Habitation may not have succeeded in producing communities in all cases, it at least attempted to have people interact with one another. Most apartment dwellers in modern western countries have never met any of the people who live in their building.

58 See Corbusier's Villa Savoye for an example of this style.

59 For example; Corbusier's Ronchamps, and later in the same vein, Pelli's Pacific Design Center (“The Blue Whale”) or the Sydney Opera House.

We have discussed the perceptual effect responsible for this effect earlier. Faced with a pattern which is unfamiliar, the perceptual system will attempt to resolve the pattern to something with which it has experience. The discovery of similarities in this way is normally satisfying for the user, as it makes them feel that they are discovering a deeper, hidden pattern that joins seemingly unrelated elements in their environment.

Observing this effect, artists, and particularly painters in the later Nineteenth and early half of the Twentieth Century experimented with gestural or impressionistic painting. Paintings were not random or entirely compositional, but left enough room for the human perceptual system to play with resolving them.<sup>60</sup> User's emotional attachment to the paintings might have nothing to do with the emotional attachments of the designer. Instead of relying on the user to have the same associations with the content as the artist, the user's associations would arise from their own experiences and the openness of the design allowed those associations to bind to the work.

It's possible to think of the movement toward abstract art as merely the most extreme end of explorations into suggestive geometry and reduction of depth in designs.<sup>61</sup> The key difference between the two "types" is that while suggestive design tends to leave out physical depth from an otherwise well understood pattern, allowing the user to fill in the missing detail via their associations with the pattern, abstract design is often formal in character, in the sense that there is no necessarily well understood pattern from which to begin.

Abstract art is often explicitly compositional in its construction. Though some artists may have particularly convoluted generative programmes with produce their work, the work is so abstracted from the generational programme that the user is not likely to feel that they could discover the original generating influence, which tends to reduce the user's expectation to that of merely a safe aesthetic composition.

Design which is explicitly formal, that is, which operates purely on the formal level with only geometric patterns available to be discovered, tends not to produce strong associations. It is seen as a mental puzzle, a game, an obviously safe piece that, while it may produce some implications in combination with something else, normally our own history of associations, is essentially a mute object. We will discuss this further in our discussions of *The Inexact (the Multivalent) in Play*.

## ***Generative and Ordering Patterns***

As we have discussed, a "generative programme" is often a source of perceived "depth" within a design. Users perceive the traces of the ideas which the designer was playing with during the design process and begin to search for meaning within the design. The particular ideas may be obviously displayed or extremely subtle and hidden.

Whether or not the user's perception of the depth matches with the designers, the user searches for meaning and will generally find some means by which they can bring the design within their model of the universe.<sup>62</sup>

"Generative patterns" create depth within a design.

The types of generative pattern vary widely, from simple physical realities, such as the shape of a lot, or its frontage, through entirely abstract and disconnected ideas of a philosophical nature. The

60 Munch's "The Scream", Monet's "Impression: Sunrise", almost any work by Salvadore Dali or van Gogh; "Impressionism", "Expressionism" and "Surrealism"

61 Mondrian would serve as an obvious producer of "abstract" art as we discuss it here, while Mondrian's Impressionist paintings would serve as examples of "suggestive" art.

62 Though as we have noticed, the means of doing so may be simply to dismiss the work as irrelevant.

Functionalists after Loos advocated the use of a particular generative pattern, namely a formal analysis of the (physical) needs of the user. The Eclectics of the Late 19<sup>th</sup> Century advocated the use of social status and communication of role as the primary source of detail and refinement in design. Other designers advocate the use of “site” as a primary source of detail. Others argue for the primacy of the parti sketch, or the role of proportion and compositional harmony.

There is a huge body of literature which discusses various types of generative patterns, discussing at length their merits and utility with reference to one another.<sup>63</sup> Most of these arguments come down an attempt to address to the same basic problem of design gridlock, and alleviating that gridlock by providing something against which to react.

When a designer sits down to create, they are faced with a “blank sheet”. There are an infinite series of possible solutions that could be proposed for any given problem, and indeed there are often an infinite series of possible problem statements that can be produced for a given situation. Any possible movement may be a path to a final magnificent destination, or to abject failure. From the beginning of the project the designer cannot know whether a given path will lead to one outcome or the other. Committing to any given first step too early may result in not following a step a second later that would have been a better solution.

The same problem plays out throughout the design process writ small. At each corner, at each decision, it is hard to make a decision without some ground on which to stand. Faced with an essentially arbitrary choice, the mind wants to find some way to predict which choice will produce a more appropriate outcome, but the extreme complexity of design makes it difficult to choose which approach is more likely to be productive.

Faced with an infinite series of possible choices, none of which is immediately and obviously superior, the mind will spend a great deal of time searching for some indication of how to proceed. As each exploration is attempted, the mind is anxious that it may have missed the correct other path, and will tend to take any reversal as an indication of a misstep.

What a generative pattern does is to allow the mind to quickly make a given decision based on a high-level idea which can be applied to the current decision, and which will appear throughout the design. Because every decision will reflect the nature of the generative pattern, the design will tend to become a reflection on the nature of that pattern. Users will perceive within the design the echoes of the pattern, and will tend to see the result as depth. That coherence of idea forms a possible source of “consistency” which gives the designer some comfort that what they will produce will be somewhat satisfying.

The generative pattern produces complexity and details, normally in combination with other patterns. Its initial application produces an environment against which the mind can begin to process. As noted above, the human mind is not good at concentrating on large numbers of things simultaneously, so having an initial environment we can critique allows us to far more quickly progress within a design.

We can think of this in terms of our understanding of the mind. Our perceptual systems are very good at picking out patterns which do not match our expectations. When we are facing a blank page, everything is not matching our expectations and desires for the design. To move from the blank page

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<sup>63</sup> Many designers advocate sketching, quick explorations of a given idea, never pausing long enough on a single solution to get attached to it, exploring the whole of the problem space in parti sketches. When finished the exploration, choose the most interesting of the partis and start sketching around it.

Others will use a huge body of experience, choosing a substantially similar starting point, rather than re-imagining the project as a new thing. Others will use randomness, the layout of the site and the zoning restrictions, or some detail of the client's life. We will see an enormous body of generative patterns proposed as we explore the various schools of design theory.

to a fully realized plan is generally beyond our capabilities without significant mental discipline. When we already have some initial “movement” present, our minds can tell us what about the movement is not appropriate and what is, and we can change the movement, refine it, and move forward.

We are far faster at making decisions when changing a few things here and there, morphing and updating an already-present idea to better match what we are looking for. While we can work with a blank canvas, it is generally faster to work with some existing proposal and see what doesn't match our idea of what we want for the situation. The generative pattern allows us to begin thinking of a design in concrete terms, which allows us to more easily employ our world-model's ability to notice unresolved situations.

The obverse of “generative patterns” are “ordering patterns”. These are our ideas and understandings of what must happen to make the design suit our needs, or what ideas any new material must fit within. They are the patterns with which we examine the details generated by a given generative pattern to decide what needs to change. In our understanding of our mental processes, ordering patterns are the model into which new information, the generative pattern, must be integrated.

Patterns will tend to shift between generative and ordering roles during the design process. Our minds take a pattern which is “new” to an environment and work it's implications through the environment until the pattern is no longer “sticking out”, and we start using it as a normative piece, requiring other ideas to fit into the pattern formed by our previously exotic element. Over many projects, we will tend to adopt ideas and patterns which have worked well before and begin to consider them a requirement for inclusion within further designs.

As a result, while generative “movements” often allow us to move forward more rapidly in the design process, they can also trap us in a poor decision or a sub-optimal habit. Once we incorporate a “movement” into our model of a design, it can be quite difficult for us to give it up, even if the movement is obviously inappropriate to someone looking from outside. Because our model of the design is all predicated on that initial movement, we do not readily see it as not belonging. Our mind will focus on all the little details of how the current solution doesn't seem to match what we wanted from the design, without being able to see the elephant in the room.

That is, normally the design process is iterative, changing what was previously discovered by adding new ideas, whether generative or ordering, and working through the ramifications of those new ideas within the environment we are creating. The process of attempting to unify and organize the ideas can be thought of as the societal job of the designer. Highlighting the connections which make the whole set of ideas involved in a piece comprehensible and understandable is a large part of why society wants designers and artists to work. The iterative nature of the process means that the designer is constantly working and reworking the ideas involved in order to make them fit into each other. We are constantly working to find a model of the environment which meets all of the criteria they have identified as being important.

An interesting experiment to attempt in your studio is to select a particular assignment, make a quick parti sketch, follow the project to completion quickly, without worrying about whether you have an optimal solution, but getting to a substantially finished state. Some schools even suggest making the project explicitly bad, that is, a caricature of what you might want to do, with the knowledge that this version of the project will never be presented to anyone. Then set aside your initial solution and recreate the project from scratch with an explicitly different parti sketch.

The second design will generally be far more interesting and “deep”, as you have addressed the secondary issues while working through the details with the first parti, without worrying about whether the parti is a good idea. When you choose your second parti, you have already resolved the bulk of the

secondary issues in your mind as a model of the problem and so the parti becomes the only part of the project you need to fit into your now quite refined model of the problem. The secondary effects of reducing stress (after all, you already have a 90% complete version of the project if your wild second parti should fail) can have some interesting effects too.<sup>64</sup> We'll discuss these approaches again in *Safe Spaces for Design*.

We discussed briefly the problem of not being able to see the “elephant in the room” of an obviously wrong first step in a design. The same problem occurs for any generator or orderer, that is, any idea, within a design. The problem being that in our minds, the model of a project includes our first steps (and our second, and our third) such that while we may have achieved a perfect realization of our model of the design, what we have created is not particularly interesting to other people.

In most design studios, we address this issue with the use of peer or client critique. We ask someone who was not involved in the design process, and thus who has no pre-conceived agreement about our choice for the design, to review the design with the same type of information as we started from. Where we cannot see a design gone “off the rails” due to the inclusion of an irrelevant or uninteresting detail, a fresh mind, without our initial assumptions can readily detect the problem.

This is not, of course, the only role of critique, but the ability of a critical external eye to pick out the problems in choice of generative and ordering pattern is key. It is far more likely that a “second set of eyes” can pick out the problems that you have learned to ignore.

### ***Calculus, Computers and Super-Organisation***

Recent movements in Post Modernism have moved toward successively more complex designs where individual elements of the design are often unique, modified by complex generative schemes which are encoded in computer software. For instance, the organisation of seats in a theatre will be controlled by models of lines-of-sight in such a way that the spacing between any two given seats or rows may be modified by a seemingly “random” value, but the result of the modifications is a perceivable pattern.

The result of the complex generative and limiting languages is an “organic” feel to designs, an expression of “fractal” complexity which can be understood at a glance, but which contains deep “detailing” which can be explored for a considerable period.

Lynn discusses the idea that “calculus” is an enabler to this level of detailing<sup>65</sup>, though it might be argued that “computers” would be a more general understanding of the enabler. That is, the ability to use an automated tool to provide detailing via formally specified organising mechanisms is what allows us to develop this type of “deep detail” in buildings. In the past this “fractal detailing” required that a junior architect be assigned to design each sub-detail, computers simply make the process faster and cheaper.

Our perceptual systems can pick out the fact of overarching order in complex environments, and once the order has been established, we are particularly interested when the totality of an environment continues to adhere to that order, but plays with it in such a way that all aspects of the environment become reflections on the nature of the overarching order combined with some other idea. Throughout history we have used this appreciation of depth in architecture, but now we have far cheaper tools than paying sous-architects to detail the buildings manually.

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64 This is not a novel observation. Computer scientists facing the design of very large systems often advocating creating a “throw away” implementation to allow you to explore the problem space before making your “real” implementation.

65 Greg Lynn, TED talk “How Calculus is Changing Architecture”, 2005

## ***Iterative Design***

We discussed within our discussion of Generative and Ordering Patterns the idea that patterns will tend to shift from being generative to ordering over the process of a given design. The design process, much as the perceptual process it attempts to influence, is an iterative one. We do not normally jump directly to a given final solution, we work an idea over many times, feeding more and more supporting ideas into the environment we are composing, testing the ideas against one another and searching for a model which best reflects all of the ideas involved.

At times, we may bring in other people in order to have their fresh ideas on what needs to be done, what has been done wrong, and what could be done better. These critics allow us to avoid having our designs become stale, and allow us to explore new ideas that we had not considered. Because these interventions are generally more involved than our own explorations, we tend to have these cycles of critique less frequently than those which deal solely with our own ideas. However, the basic mechanism of the critique is to introduce new ideas into the environment of the design, ideas which can be integrated and used as generative or ordering patterns as we move forward in the design. This is the same mechanism as we see when working alone, we introduce new ideas and attempt to resolve our understanding of the environment in light of the implications of the new ideas.

Disciplines which have more formal techniques will often conduct “user testing” in order to test their designs. Here users experience the environment and are asked to reflect upon their reactions to it (or simply to accomplish some set of tasks). Experience with this type of testing will tend to make a designer far less sure about their user's mental models and perceptions. Understanding that users often have dramatically different understandings of the environment you create than you do is part of becoming a professional designer. Formal testing will often reveal that your clients don't even begin to see your carefully constructed generating and organising patterns, and instead have strong associations with some detail you chose at random as a place-holder.

While a critique or user testing is generally quite a formal way of introducing new ideas into a design environment, our day-to-day designs are not normally quite so formal. We will introduce new ideas as half formed feelings, quick sketches, experiments and pushes in a given direction, often without really understanding the direction we are taking the design. We will often use patterns discovered seemingly at random which happen to tweak some interesting idea or shape.

The design process, much like the cognitive process in general, is highly feedback driven and self referential. It is not a crystalline set of cycles which repeat like clockwork, constantly adding new ideas until a perfect design is realized. It is far messier and ambiguous. Our generative patterns are often half-formed and unvocalised, we often could not begin to describe what it is about a given element that makes us reject it. We are constantly using patterns which are not explicitly understood to be part of a design as part of our design process. Our understanding of our cultural, social and physical environment is constantly creeping into what we design, and as it does so, its assumptions will tend to creep into our design. Far from being a problem, this social and intellectual complexity is often that which makes designs more interesting and approachable to users.

We will often have conflicting, unresolved and ambiguous situations within our design environments. The conflicts, problems and ambiguities are what tend to trigger our perceptual mechanism to want to change the environment so that the model of the environment is at least somewhat closer to resolution. Of course, much of the time there simply is no resolution available to us. Designers can attempt to resolve an issue, or they may recognise the issue as beyond their ability to understand and try instead to point the way for others to consider the problem, taking the user as far as they can without claiming to have discovered the end-point.

The process of working through conflicts and ambiguities, of working them through a design, making them available to the user so that they can begin to address the larger issues in their lives is all part of Play in Design. Playing with ideas over time, letting them reflect on each other and work through each other will tend to produce designs which appear to be deep and “meaningful” to users. The exposure of ambiguous and difficult issues as worked through your design allows your users to perceive the problem as a pattern within the environments you create.

However, it is also possible to play too much with a design, to include too many ideas, to over-work the integration to such a point that the result is “muddy” and “tired”. Depth and iteration, as with most things in the world of design, can be over-done. Sometimes what is needed is a simple contrast, a simple narrative, a simplification that glosses over the complexities and implications and provides a straightforward idea that covers the bulk of the problem and hides any issues beneath that bulk. Inviting the user to play often requires that the environment reduce the ideas involved down to a reasonable set of approximations that allows the user to pick them up and run with them within a few minutes.

## Play in Design

It would be quite reasonable for a society to produce solely that which the members of the society needed from a physical standpoint, expending only the amount of energy required to produce the minimum required effect. It would be reasonable for there to be a single type of chair for a given purpose, a single colour of blouse for every woman, a single design of car for a given task, and a single type of house for a given climate. We could go about our lives meeting solely the minimal physical needs of our bodies, but we most emphatically do not.

Human beings are playful creatures. If we are to understand human design and intention we must understand the process of play. The professional designer is in some sense paid to retain the plasticity and playfulness of the childlike mind, to be able to play with ideas and forms in ways that most adults have long forgotten, but for which they long.

Professional designers normally have to work at being playful, at moving from being sober and serious to being able to explore the space of ideas around a project. Having achieved playfulness (delight), of course, the professional designer then also needs to guide their playfulness to solve the problems of design, that is, to guide the perceptions of the user in some way. The professional designer needs to be able to pass into a playful mode and then back again while carrying the insights of each mode into the other.

Some designers also discuss the process of play as the process of allowing one's subconscious or one's “intuition” to take over and work from the gut on a project.<sup>66</sup> By releasing tension and concern about a project, a designer is able to explore ideas “laterally”, that is, to avoid reductive thinking and explore the problem space more expansively, discovering ideas which are not already understood. As much of design is a process of choosing among otherwise equal-seeming approaches, the ability to move beyond a “stable” solution to find other possible solutions allows the mind to avoid gridlocking in a design. The process of play allows one to avoid “local minima” in solutions.

Critiques (crits) in design schools work within the “controlled” mode of design, that is, they allow more experienced individuals to suggest other areas for exploration, or to correct “incorrect” design solutions. It should be understood that part of a critique is intended to shut down certain areas of exploration, and thus might be considered the antithesis of playfulness. The mind tends to over-compensate for critical feedback, preferring to “play it safe” in the future if an excessively harsh critique

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66 David Carson, TED Talk “Design Discovery and Humour”, 2003



from a trusted source is received.

Even the requirement that all things be “original” (as discussed in Rebellion and Revolution, below) can be a form of “editing” or restriction to the individual's willingness to explore things which are too “close” to other designs. It is difficult for adults who have been constantly corrected to easily drop into free play. We become afraid of the disapproval of our peers and cease to be able to release the “safe” solutions and attempt to find lower-probability solutions. The “tiger” of disapproval distracts us from exploring the “tapestry”.

Professional designers are able to “switch” from expansive thought into modes where we can begin to reduce and expand a model which has been found in the exploring (playful) periods. We need models which are well-enough defined and explored to provide some insight to the user. If we cannot explore an idea sufficiently, instead only flitting from idea to idea, we might be able to provide an initial movement, but we won't really help our users understand their world. Professional designers have to achieve their “practical” tasks as well.

Within the perceptual system, play seems to be a mechanism to allow one to explore the alternate models or approaches which would otherwise be suppressed by our current model of the world. Playfulness allows us to discount potentially negative outcomes so that we can try approaches which would otherwise be immediately rejected as being “silly”, as we understand the “Safe Space” of play to avoid the negative effects.

You can consider play to be a way of finding “interesting mistakes”, that is, ideas which would not normally be explored because it would obviously be easier to choose an existing “correct” solution. Fortuitous accidents, mistaken understandings, shadows that suggested something out of the corner of the eye, all of these are part of the process of playing, of letting your mind explore alternatives to the obvious.

We have discussed the question of depth at some length, and the exploration of questions of intellectual depth has been further discussed as one of the primary goals of society in the process of designing works. As a species we are curious, constantly searching for deeper meanings, constantly toying with new ideas, new possible explanations to the great and small problems that face us in our lives, new approaches to doing the same thing, new ideas about what any given pattern really is. Our mental models of the world are constantly being revised, communicated, miscommunicated, critiqued and tested. Play and playfulness are a large part of these mental processes, and since these processes are the focus of design's social role, play is a large part of design.

Play requires enough freedom to allow for exploration. If a situation is critical to our survival and every ounce of effort must be expended to meet the minimum requirements of survival it is unlikely that we will want to play with that system. Until we can risk failure without guaranteeing catastrophe we are unlikely to see a situation as being “playful”.

Taking our example of the tiger and the tapestry, unless we have sufficient room and time to tease out the meaning of the tapestry by playing with possible meanings, the tiger is likely to be our primary focus. However, if we see no other solution to the tiger problem, we may turn to the puzzle of the tapestry; there is nothing else we can do to ensure our survival in the near term, so we can explore the puzzle (though we may be too terrified to do well). Playing is a survival trait that allows human individuals and societies to find new solutions to problems.

This is not to say that all forms of play must be safe. Skydiving or bungee jumping are not “safe”, and may imperil one's survival. However, these are forms of play that arise only after base safety is established, and they offer a promise of some greater understanding of human nature and capacity. The design of such activities allows the individual to explore mortality and fear in an environment that is

reasonably safe, but still holds the potential for catastrophic failure that allows the exploration.

Play is often a social phenomena. As a society we create games with shared rules to allow us to play with each other. We create theatre, ritual and stories to communicate our ideas. We set up puzzles and problems for other people to solve. Our educational system is based on setting up challenges in a constrained environment to allow students to grow as they surmount the challenges. As groups we use designed play in some of our most fundamental ordering and structuring systems.

Consider for a moment the economic systems which govern the “world economy”, and how those systems are studied. The “guiding hand” of Adam Smith works only if all members of a society follow a fairly rigidly constrained set of guidelines; the rules of the game. If everyone in a society follows the “rules” of an economic model, then it is largely possible to predict the outcome of a particular situation. Economists can apply the mathematical approaches of “game theory” to the situation. The key operation being to reduce the complexity of the rules and motives of the individual down to an abstract model of the world; one of the most common operations in setting up a form of play. However, when the game does not accurately model the real world, the predictions which arise can be inappropriate.<sup>67</sup>

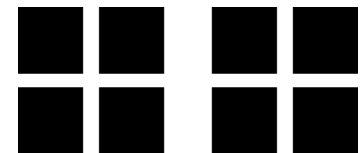
Anything as fundamental to our mental processes, and the process of design in particular, is going to be complex and multi-faceted. When we speak of play we are speaking of everything from theatre and ritual through children's school-yard games to designers at drafting boards testing out half a dozen different positions for a column before settling on a satisfying one.

## ***The Ampersand***

In *The Study of Perception for Designers* we introduced a perceptual model loosely on the Gestalt psychologists of the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. The “gestalt” described an idea which was that the totality of a perceptual field could be more than the mere components of the perceptual field. That is, we construct from a visual field a whole which is greater than the sum of the parts.

The Gestalt Psychologists performed and described a number of effects which demonstrated the existence of this “greater whole”, many of which demonstrated that what we perceive is not necessarily the world-as-it-is, but rather the world-as-we-expect-it-to-be. Our perceptual mechanisms are constantly predicting what we will see and priming our perceptual system to see what we expect to see.

The “Ampersand” here describes not the gestalt (the totality of perception), but the “extra piece” which is not part of the perceptual field, but is instead the totality minus the components. We can see this in the classic Gestalt figure to the right. This figure appears to our perceptual system as two groups of 4 squares, rather than as a simple set of 8 squares.<sup>68</sup> The “gestalt” of the total is the combined image, while the “ampersand” is the difference between what obviously is, and what we perceive to be, the grouping itself, rather than the grouped figure.<sup>69</sup>



- <sup>67</sup> Critical economic theory is beyond the scope of this text, but consider the question of “externalities” in economics. These are elements which do not have an assigned cost for the actor (e.g. environmental degradation or consumption of a shared resource for which no cost is levied), and the “perfect economic entity” will tend to maximize the usage of externalities as the externalities produce economic value with no assigned cost. If you are interested, explore “the tragedy of the commons”.
- <sup>68</sup> The logic of why the figure appears as such is due to a number of perceptual mechanisms (described by the Gestalt psychologists) which are seen throughout the perceptual process. In this case the operative mechanisms are, proximity, continuity, and closure, which together cause us to perceive the grouping as a pair of related figures rather than a single figure or 8 figures.
- <sup>69</sup> Van der Laan's studies of proportion were largely driven by the exploration of the limits at which such grouping occurs. He used the mathematical proportions derived by experiments in grouping and perceived relations to produce a system of proportions which attempted to create “resolved” relationships within spaces.

The “Ampersand” is the “hidden but emergent” aspects of a design, the parts of the design which are “generated in the user's mind” rather than being explicitly encoded in the media of the work.

As we have discussed, our perceptual systems are constantly seeking to understand our environment. We are constantly looking for new meaning in the world. Playing with the “Ampersand” is about trying to provide a moment of “wonder” at the discovery of new knowledge in the environment. It is about making a person aware of the assumptions and ideas that they have brought into a design.

The various types of Ampersand play try to guide the user to explore and discover new things about their environment. They bind elements in such a way that the user is expected to uncover some “other thing” which is the focus of the work. That “other thing” may not actually be known to the designer, as it will often be a reflection of the user's preconceptions, but the play of the Ampersand brings out the ideas for discussion and reflection.

The Ampersand is the creation of environments which exist in a “multivalent” state, in the sense of sub-atomic particles, that is in states where the environment may be interpreted in a potentially large number of different ways, such that the totality of the environment constitutes a “single thing” which is greater than the mere collection of possibilities. As we have discussed above, Play allows us to explore possibilities, the creation of multivalent environments brings the user into a state where they are open to more than just a single solution. Presented with multiple solutions, the mind begins searching for other patterns, for patterns within the patterns. Venturi's presentation of the value of complex environments was discussed extensively in *Depth and Complexity*.

The discovery of an Ampersand (emergent meaning) in any environment is a powerful motivator. Our perceptual systems are constantly searching for meaning. Play which promises to guide us to find some new understanding of the universe is an extremely attractive promise. When we fight to discover something and discover a hidden “truth”, we are satisfied and happy. We might reject the same truth were it stated clearly and explicitly, but when we have “parsed the dialectic” for ourself we feel an ownership for the resulting ideas.

### ***The Missing Element***

We have briefly touched on “missing element” games in *How We Perceive Depth*. Human beings are constantly searching for underlying orders and patterns that govern their environment. Games and designs which play to that search are powerfully attractive precisely because the search for the hidden is so deeply ingrained in us.

The “missing element” doesn't necessarily need to be a complex understanding of the nature of the universe. Many missing element puzzles actually work with very simple physical “missing pieces”; they play on the psychological effect of discovery and detection, the joy in figuring out a complex problem, the wonder of a hidden element being revealed, the happiness of solving a problem oneself. That said, that very exploration of joy can be understood as part of our greater search for meaning in the universe.

The nature of the missing element in a missing element game is often far less complex than the type of patterns we have discussed as indicative of “intellectual depth”. In particular, there is often a simple deterministic solution to formalised games. Jigsaw puzzles, for instance, have a single solution to the problem of what piece will fit into any given hole. Riddles or mystery novels generally have a single solution, though they might have half a dozen almost-fitting solutions and we derive joy from discovering which solution is the “real” one.

Design that uses such deterministic missing elements is often seen as overt or propagandistic. After all,

if a design can be understood as the simple expression of a single movement it is hardly likely to be seen as providing the secrets of the universe. We have mentioned before the projects endlessly churned out in studios of architecture schools which are basically a single “hidden movement”. To be concrete, a platonic sphere cut out of the centre of a building, while it may be aesthetically pleasing and appeal to users on a limbic level, is unlikely to, by itself, convince the user that the design is going to provide insight into the nature of the universe.

Modern humans' lives are complex, their moral systems are constantly shifting in the shadow of Kant and Hume. To make sense of such a world they need a system of understanding which can embrace the chaotic nature of the universe. Art and design which puts forward simplistic approaches to solving problems will tend to be rejected as not being able to shed light on the world. We desperately want there to be a simple, neat, solution that means that we will be happy and prosperous, but history and experience tells us such solutions generally fail.<sup>70</sup>

Missing element puzzles are not all deterministic in nature. While it is possible to create a missing element puzzle simply by removing something from an environment to leave a hole, this is only the most basic approach to constructing such a puzzle. As elements become more abstract, it is possible to see them more as modifiers of other objects, not things in and of themselves.

Consider our project to cut a sphere out of the centre of a cubic building. It produces a straightforward physical impression of something being missing. It requires no particularly complex thought to recognise the missing element's nature. Imagine the same project where, instead of removing a sphere, we take our first movement to be “an empty nest”.

We now create a reasonably standard home, but in choosing the details of each room, we weave in the idea of a couple whose children have left the home. We might use the circle cut-out as a decorative motif in some out of the way locations. We create “nesting spaces”, we have no overtly obvious mention of the empty nest, but the missing element permeates the entire design.

If we were now to introduce a second related hidden movement into the design, such as the customer's new-found freedom in having an “empty nest” that allows them to entertain and socialise far more. We can play with images of opening outward, of moving into new spaces, of breaking down the walls of the nest in certain areas, while retaining them in others. The missing elements can play off each other, modifying the physical project as their interactions are worked out. If the game is played through, the effects should be subtle enough that while users can see that something has shifted the design in an ordered and structured way, they cannot work out precisely what the ideas were without significant effort.

Which is not to say that it should be possible at all for the user to figure out with any certainty what the missing element in a design was from the point of view of the designer. The determinacy of the missing piece will vary according to the type of game being played. Sometimes you wish to lead the user to a particular solution, sometimes you want to lead them in a general direction, sometimes you just want to move them and let them find whatever meaning they can when faced with something structured-but-hidden.

Missing element play will vary with the type of interactions between the missing element and the surrounding context. Some puzzles will have a very straightforward relationship creating a “hard edged” silhouette which uniquely defines the shape of the (normally determinate) missing thing.

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<sup>70</sup> When “shopping” for religions, many people look for the religion which has just enough absurdity to make it seem likely that the absurdities in their lives can be explained. We don't want a religion that has all the answers, but one that has enough answers to make sense most of the time and enough “mystery” to let us deal with the seemingly irrational world in which we live.

Others may have the user sort through some number of different possible solutions looking for the one which fits most precisely, such as in “whodunnit” games. Still others may only specify a small set of requirements which allows for any number of “correct” solutions, but asks the user to find a “satisfying” one, such as in “the riddle game”<sup>71</sup>. The complexity of the “clues” in missing element play is often just as important a consideration as the type of solution being sought. The types of mental manipulation required in each type of game is slightly different, and satisfying (or frustrating) to the user in different ways.

## ***The Arbitrary***

Much as children on a playground will play by adding an arbitrary condition to a well-established game, much of the whimsical and magical in design comes from combinations of readily understood schemas and orders with arbitrary elements. In introducing a new arbitrary element into a design, the designer often leaves the impression of a greater purpose. Even if no greater purpose is perceived<sup>72</sup>, the interactions of the arbitrary element with the established and known order tends to produce a new understanding of both the arbitrary element and the established order.

Consider “A Connecticut Yankee in King Arthur's Court” by Mark Twain. Here an arbitrary element is introduced which rewrites the structure of the medieval court. The element sheds light both on the nature of the court and on the nature of a Connecticut Yankee. The combination of the two produces a whole (the story) which is greater than would be produced by an essay on the nature of a Connecticut Yankee and another on the nature of King Arthur's Court.

Similarly consider the design of Tolkien's “The Hobbit”. Here the arbitrary inclusion of a homebody Hobbit turns a rather straightforward adventure story into an exploration of what it means to be a hero. The arbitrary, seemingly whimsical inclusion is that which gives the story its meaning and resonance, far beyond that of an adventure story populated by competent, hard-headed adventurers.

Lastly, consider the character of Arthur Dent in the “Hitchhiker's Guide to the Galaxy” series. Here it might be argued that the entire universe is merely a collection of arbitrary decisions bound together by a loose set of rules that might be summed up by “Once you turn on an infinite improbability drive you should expect the infinitely improbable”. We can view the story either as a continuous set of arbitrary intrusions into Arthur's life, or the arbitrary introduction of one rather staid and straightforward Arthur Dent into the comparative uniformity of an insane universe.

In effect, the “arbitrary” introduction acts as a missing puzzle piece where “motivation” or “meaning” is the implied missing element. Why was that particular element combined with the others? What was the designer trying to show by combining the two together. What does the combination of all of the elements imply is missing. In effect, what is the Ampersand which is introduced by the juxtaposition.

Similarly, there are many designs which use the arbitrary to generate complexity and depth. Consider, for instance, painters who use paint-splatter techniques to produce a complex textural depth within their work, or those who incorporate into their work “found” materials or environments. Faced with the arbitrary elements, the user searches for their meaning, even if the designer explicitly states that they were chosen arbitrarily.<sup>73</sup> If an arbitrary generative rule, such as “there must be exactly three windows

71 As seen in *The Hobbit* by J.R.R. Tolkien, where the riddle solution must be satisfying to the questioner and the answerer to be considered a valid riddle. In the book, Bilbo asks a hard-edged question (“what do I have in my pocket”), rather than a true riddle, and this violates the implied contract of the game.

72 Such as when the user doesn't trust that the designer has any particular insight into the ideas being explored, which can happen when the arbitrary is used too much.

73 Of course, it's debatable, given the nature of the subconscious whether any decision made by a human can be truly arbitrary.

in each room, one above eye level, two below” is followed, the user will, faced with the environment, look for meaning in it.

In the obverse, arbitrary rules and constraints can be used to filter a given phenomena, producing complexity by arbitrarily ordering or structuring an environment. This is seen in designs where, for instance, “every column or wall must be centred on a 2m grid at 30 degrees to the lot frontage”, the arbitrary rule working its way through the entire design, by altering every choice that is made to make sure that the result of the choice fits with the arbitrary rule.

In the design process itself, arbitrariness is often used to break choice gridlock or eliminate possibilities from consideration. Consider the practise of starting a design with an arbitrary gesture on a piece of paper, building out from that gesture to produce a sketch of what is desired. By the end of the design process the initial arbitrary gesture is often long since forgotten or hidden in the plans, but the element served as the kernel from which the design grew, either by extension, contrast, or rejection.

The arbitrary, like most tools in design, can be overused. Keep in mind that the power of the arbitrary, as with any Ampersand, is that the user is searching for meaning. Too many obviously arbitrary and unrelated decisions will tend to produce a design which the user simply rejects as having no particular likelihood of producing meaning. The combination of the arbitrary with the ordered and structured, however, tends to imply an underlying meaning that interests the user.<sup>74</sup>

## **Rebellion and Revolution**

While arbitrary play introduces an element which simply doesn't belong or contrasts some other element, the play of rebellion and revolution involve setting up a strong order against which another order is pit. We set up revolutionary play in many contexts. In North America in particular, many of our myths are based around the idea of revolution against the established order, of finding a new order that will solve the problems perceived in the old order.<sup>75</sup> This effect is so pronounced that we actually use the perception of “rebellion” to sell many products.<sup>76</sup>

As with arbitrary play, revolutionary play sets up a conversation between the two elements. Unlike arbitrary play, however, in revolutionary play the elements are necessarily in conflict, with reactions in both directions. The “world” isn't merely reacting to or trying to absorb something benign and foreign, it is reacting to something trying to tear it apart. This active engagement between the ideas allows for more overt exploration of the ideas than simple arbitrary introduction would allow.

Revolutionary play tends to produce fairly straightforward designs. There is a conflict, the conflict is resolved, by victory for one side or compromise between the sides. In some cases the battle is left undecided, hanging in the realm of the possible or the future. Occasionally a design will attempt to set up a rebellion, but fails to set up the oppressor sufficiently to make a convincing conflict. Other times a design may wind up making every member rebel, that is, omitting the oppressor entirely so that the oppressor becomes an unknown or unseen thing.

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74 For a fun exploration of what happens with overuse of the arbitrary and lack of “order” in art, see Ursus Wehril's TED talk: “Tidying up Art” at TED 2006

75 Interestingly, North America may be one of the most stable societies because of this particular set of mythologies which tend to channel “revolution” into economic mechanisms which serve to enhance the capitalistic structure of society. It would be interesting to study whether the prevalence of this type of play has to do with the structure of early tribal societies, where a single alpha would rule and all other members of the society were subjugated.

76 Consider for instance Apple Computer's “Think Different” advertising campaign, which implied that revolutionaries would use Apple Computers.

## ***The Inexact (the Multivalent)***

What is the attraction of a silhouette, cartoon or comic? Why is a sketch on a napkin more evocative than a fully drafted plan? Why are we affected by metaphors more strongly than by concrete descriptions of a phenomena? Why does something that is "just off" disturb us? Why do we see loose and fast music as being particularly energetic and powerful?

Part of playing is ignoring differences or details long enough to create a coherent idea or story. The looseness of this type of play allows us to sift and sort through our perceptions and feelings to find the underlying patterns which govern our experience. We play with ideas, looking for things that remind us of them, trying to see within our environment rules and orderings which allow us to better understand, and thus cope with it. Our perceptual systems are constantly attempting to find patterns, and to make those patterns fit, they have to play fast and loose with our perception of the environment, as we discussed in Suggestive Art, Gestural Design, and Abstract Art.

We are fascinated by the parti-sketch (the abstraction or inexact representation) as a map which contains the core idea of a phenomena. We see within the parti a glimmer of a greater truth, the pure force of an idea realised because it is rough and ready. The parti sketch holds the first movement, from which all others are mere elaborations. When we play this game we are playing a game of seeds, seeking to understand how the crude sketch is expressed in the world. The parti holds an energy and force which conveys an impression of speed and power. We are excited by the process of becoming, of defining what will be.

When we play with metaphors, we are pointing out the similarities (and the differences) between the subjects. There is, perhaps, no easier way to give an impression of depth and meaning to a design than to base it on metaphor. We cannot help but appreciate a properly drawn metaphor, a binding of things between which we did not previously see any connection. The metaphor is a Gestalt which allows us to contemplate relations between components.

It often seems that precision of thought is the antithesis of creativity. The stereotypical artist is sloppy, disordered, almost random in their operation. Creativity is, perhaps, related to that very imprecision. When the mind seeks to grab one concept, a dozen similar ideas are returned. The ability to see a pattern might very well be a function of an inability to distinguish between them when accessing our memory.

Reduction to the essence of a problem is a powerful tool. Cartoons, for instance, are a form of design where abstraction and imprecision is used extensively to make it easier to communicate ideas. Each character, a parti sketch of a human, is shown interacting with other parti sketches. The patterns that arise expose fundamental patterns of human interaction. Often this allows us to see the humour in life, but they can just as readily be used to educate or to sway opinion. We see within the cartoon a reflection of patterns we see in our lives, and the abstracted and imprecise nature of the patterns allows us to consider it without getting tied up in the details.

From another angle, looseness in design is that which allows for interpretation. Venturi touches on this in 'Complexity and Contradiction' where looseness in a work of design or art is what allows for true art to occur. He spends considerable time discussing how the collision of different ordering principles (such as in Mannerist architecture), or a slight (often minimal) contradiction between elements is what allows for greatness to emerge. Venturi was arguing against the Modernist school; a school of theory that assumed everything could (and should) be resolved and explicitly expressed in a design; that there should be as little looseness in a design as possible.

Interestingly, the Modernist school, by attempting to eliminate metaphoric and stylistic thought from design practice, produces some sublimely imprecise designs in the sense of designs that are not overtly

telling a particular story, but which hint at half-discovered patterns and ideas.<sup>77</sup> By relying on simple geometries, Modernist architecture tends to evoke metaphoric comparisons with any number of objects. The simple forms serve as parti sketches in and of themselves, a sketch onto which the viewer can project any number of metaphors.

Imprecision is a powerful tool for the designer. It is what opens up our designs to allow them to transcend mere communication of an idea. It provides the space for interpretation and internalisation which allows the user to find their own meaning within the work.

## **Universe Modelling**

As a form of play, Universe Modelling can be thought of as allowing the user or the designer to try out an understanding of the world. One of the most commonly seen forms of Universe Modelling is in speculative fiction (such as Science Fiction), where a common approach is to make a single “insertion” into a world which is otherwise exactly as we would understand it. For instance a story might start with “what if everyone could see anyone else all the time” and then tell a story of life in that world.

Other universes might make a simple environment that allows the user to explore a simplified model of war on a chequered board with small figurines. Others might attempt to model biological or social processes. In each case, this form of play is allowing the user to explore an alternate environment in order to attempt to discover some understanding of their own environment.

The “abstraction” of the modelled universe allows the user to think about the elements modelled with more reserve than they normally would be able to apply due to personal associations. By providing an environment which does not precisely match the real world, the designer can strip away “distracting” details while focussing attention on relevant patterns. “Universe modelling” is part of the perceptual process, it is part of what we do in order to predict and thereby cope with our environment. The use of Universe Modelling in Play is a powerful tool to help us direct the user's understanding in a particular direction. We are, in effect, providing a mental model in designed form.

Universe Modelling allows the user to explore alternate ideas of themselves or their world. Therapy sessions have used “virtual worlds” to allow users to explore their fears and overcome them. By playing games with what is otherwise an insurmountable problem, the user is able to find alternate understandings, alternate models of their world.

## **Safe Spaces**

Closely related to the idea of Universe Creation, “Safe Spaces” are part of the process of playing which creates an environment in which the user can easily make mistakes of judgement without consequences. Safe Spaces allow the user (or designer) to test out new ideas and approaches to dealing with their environment without risking real-world failures.

A Safe Space allows the user to explore a problem in ways that would be difficult or impossible if the implications of their actions were more weighty. As we discussed in How We Perceive Depth, if we are confronted with an immediately dangerous situation (a tiger), we are unlikely to begin exploring the subtle details of our environment (a tapestry). The delineation of a Safe Space allows the user to relax their guard and explore possibilities.

Consider the childhood games of “tea party”, “dress up” or “house”, where children will adopt different identities and attempt to role-play those identities with each other. The children will explore

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<sup>77</sup> See Corbusier's Ronchamps or “The Blue Whale”



interactions among themselves to which they would otherwise not have access (yet). They model the behaviour of the system and attempt to predict how others would interact to their actions. The children explore the Safe Space and learn from it the social rules which govern the interactions they are mimicing.

The Safe Space encourages experimentation and risk-taking. Making a mistake in this environment is of minimal (or no) consequence, the other children laugh, and the child learns. This type of play informs the child's model of the real world, though they are (generally) aware that there is a difference between playing a role and actually experiencing it. They build up the model via tests in the Safe Space which have minimal risk and can test the largely-complete model outside the Safe Space.

Environments which encourage a user to formally explore alternate identities, such as these, are less common among designs for adults. Normally designers will encourage adult users to empathize with others, speak for one another, or reflect back what they hear from another, but true role-playing is seen in some rare circumstances.<sup>78</sup>

Advertising will occasionally ask a user to take on the role of another, with techniques where the user is asked “how they would feel” or “how they would react”. The question creates a Safe Space, an abstract hypothetical situation, in which the user can pretend to take on another user's role and explore their model of the universe from that viewpoint. It is not, however, necessary that the user's conclusions in the Safe Space will necessarily be integrated into their wider world-view.

It is quite possible for a mind to partition the models created in the Safe Space with the idea that the ideas are only valid within the constraints of the space. If the criteria for setting up a Safe Space are such that they make the Safe Space seem entirely unconnected to the user's life, then the user may not attempt to integrate the ideas into their wider understanding of their world. The Safe Space becomes merely a “Game”, something which doesn't necessarily imply anything about the wider world.

## Generative/Limiting Spaces

Creating a Safe Space generally involves the establishment of some set of rules which limit the behaviour of the participants. These might be social rules, physical limitations, or any sort of barrier which prevents the users from being hurt or the results of the environment from becoming “unsafe”. To set up limiting environments, designers communicate to their users the limitations and rules of the environment, either implicitly or explicitly. Childhood games of “make believe” generally use implicit rules, but the participants often make up new rules *ad-hoc*, declaring some particular behaviour to be “no fair”. There is a social contract between the designer of a Safe Space and the participants that the space is, indeed, safe.

The imposition of such limits is also one of the most powerful freeing aspects of a “Safe Space”. Often the limits reduce the possible actions to a much smaller set of choices than an unlimited space would provide. With a smaller set of possible “moves” available to them, the user can make decisions more quickly, pushing them through the experience “faster” than they would through an unrestricted environment. Similarly, often the rules will provide an initial set of assumptions that make it easier to see what to do; a defined goal in a game being an obvious example. Provided with these initial “generators” (see our discussion on Generative and Ordering Patterns), the user can often use simple deductive logic rather than exploratory search to decide on their next move.

Certain Safe Spaces work by providing a limited set of components which the user can combine as they like to achieve their own goals. These limitations allow the mind to explore the problem-space more

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<sup>78</sup> Certain types of therapy, for instance, (e.g. Pyschodrama) where participants take on each other's roles and then interact with each other.

efficiently, as they limit the numbers of degrees of freedom available, but avoid defining a particular desirable ends-state.

Consider, for instance, the “Lego” modelling toy. The mechanics of the toy limit the user's interactions, there is a small set of possible “blocks”. These blocks have a limited set of interactions available between them due to their connection mechanisms. New blocks might be purchased, but while playing there is only a certain set of blocks available. The toys provide “sets” which have pre-defined end-goals, but for the most part users are unconstrained by any externally provided goal, and many children will play by randomly connecting some piece to some other and continuing to add and remove until something is “found” in their work.

North American High School art classes often use a form of limiting Safe Space. The teacher designs some particular piece that is composed of a set of aesthetically appealing elements, then the students in the class are tasked with producing “one of” the pieces. The students can excel in the class by exploring the ideas in the piece, but the average student will produce something “appealing” by virtue of the underlying design.<sup>79</sup> The teacher effectively enters into a social contract that the pieces created by following the instructions will at least “not be horrible”, so that the students can explore as much as they want within the constraints of the lesson. Ignoring whether promising just to “not be horrible” is a desirable form of contract, it is a contract between the teacher and student, and for the most part it is upheld.

Violating the contract of a Safe Space is also seen in design. There is an implicit contract in the space of “social and political polls”, where industry and academia is expected to adhere to strict standards of impartiality to prevent biasing results of polls. As such, the poll tends to be seen as a “Safe Space” where the user can consider ideas and answer questions honestly. The practice of “push polling” violates the implicit contract in order to attempt to influence user's opinions. Here the poll's questions, which restrict the possible movements within the environment, attempt to force the user to accept a set of ideas by planning the questions to “trap” the user into accepting the underlying assumptions/ideas.

For instance, the question: “Which of the following would you like to see: A 200% tax increase or our candidate in office” attempts to get the user to accept the assumption that the “other side” will increase taxes by 200%, and that to avoid such an increase the user should vote for “our candidate”. The implied contract that polls are fair and balanced (a safe space) is violated in order to guide the user toward a particular idea. Of course, real push-polls tend to be far more subtle than this example, as overt attempts to manipulate the user tend to cause a negative reaction.

## Safe Spaces for Design

The work of the designer themselves often requires filtering through a large problem space where almost all decisions impact on every other decision. Faced with such complex problems the mind will often “freeze”, as the degrees of freedom are too many to find a single solution which is unambiguously and predictably good. Many techniques developed to aid designers attempt to create safe spaces in which the designer can explore a problem without fear of failure.

Techniques such as parti-sketches, brain-storming, planning to throw away the first draft, etceteras all work by reducing the designer's risk in exploring any given direction. Able to explore a given direction cheaply, the mind can then critique the result to see whether there were problems, or explore another directly similarly cheaply.

Proportional Systems can be seen as a type of Limiting Space which defines a set of restrictions which

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<sup>79</sup> The author happens to despise this method of art instruction, but it is an interesting example of the issue at hand.

have an implicit contract of restricting a design to conform to some definition of aesthetic relationships. The “safe relations” and potentially, as with the Plastic Number, “safe shapes” with which the user may work both limit the degrees of freedom and promise to eliminate glaring mis-steps.

Christopher Alexander's “The Pattern Language” is another example of a generative/limiting safe space for designers. Alexander analysed and abstracted common patterns in a large number of “successful” designs and created from them a limiting/generative language which “should” encourage the creation of appealing towns/buildings. Individual designers<sup>80</sup> could play with the design by fitting together the various patterns, and the results “should” be reasonable, though a professional designer was also involved to prevent disastrous mistakes.

### ***Storytelling: Mystery, Discovery, Triumph, Frustration***

The process of playing is often a cyclic one, where challenges and mysteries are explored one after another. The user explores some idea, discovers some truth, and is then presented with another challenge. The cyclic nature of the play echoes the cyclic nature of perception, where ideas formed in one cycle influence the ideas formed in the next. Our minds release endorphins and experience satisfaction when we solve a problem or resolve a situation. The triumph of a minor goal accomplished allows us to relax after the tension of expectation. We feel exhilarated and push forward into the next challenge.<sup>81</sup>

Designers can use linearity or constraints to bring users through progressively more complex problems. We can challenge the user in stages, rather than dumping a large number of simultaneous problems to be resolved. We can reveal designs over time and space so that the user can experience and appreciate the individual challenges without feeling overwhelmed by the depth and complexity of a design.

We discussed the idea of cycles at some length in Iterative Design.

Design is often thought of in terms of storytelling, of a process of laying out ideas for the user which allow them to understand some concept or pattern. This is a cyclic form of play which has its own complex structures and assumptions. Most literate humans have read a large number of stories, watched them on television and motion pictures, and generally absorbed the various patterns of character, plot and setting. Thus it is possible in storytelling play to use shortcuts and simplifications in providing cyclic experiences which lead the user through some set of defined experiences.

Storytelling traditionally is an entirely “linear” design form. While cyclic play in a game, for instance, might be highly branched and “open” in design, stories are particular paths which provide a more constrained exploration, which allows for better prediction of the user's response to the individual environments presented. Books, symphonies, plays and motion pictures are all obvious forms of storytelling play. They allow us to explore alternate worlds, or alternate understandings of our own world, by following along with the designer's structured narrative of environments.

In other forms of design, storytelling play tends to be more subtle. Architects, for instance, may design a “moment” of passage from the street through to the front door of a home, forcing the user to follow a particular path, physically stopping them at certain points, requiring certain movements, etceteras. A chef will often attempt to blend palates across a sequence dishes in order to provide a procession of

<sup>80</sup> In Alexander's model, these were actually residents/users whenever possible.

<sup>81</sup> Games such as the Massively Multiplayer Online Role Playing Game (MMORPG) *World of Warcraft* seem to use this effect extensively, creating an “addictive” effect where game-players are constantly feeling a rush of adrenaline at achieving a minor goal, often the acquisition of small token. This effect counters the “grind” of the game, which is mechanical and straightforward in forms of play, leading to a situation where people are both addicted to and contemptuous of the same game.

experiences.

A jazz jam, by contrast, might be considered less of a story, and more of a cyclic experience, with the players returning to a theme and based on a rhythm, but not necessarily planning from one cycle of play to the next. Storytelling play structures multiple cycles into a single environment with a planned set of transitions which are themselves part of the environment of the play.

Play based on ritual and theatre is a particular form of Storytelling which formalizes and abstracts the relationship of the user with the designed work. It draws on religious associations of the user, along with various effects such as hidden actors (liturgy) and tightly controlled designed experiences.

## Further

We may be extending the current document to cover more material, as was covered in the original thesis. However, feedback on the current state of the document is most welcome. Please send comments to the author, Mike Fletcher via [mcfletch@vrplumber.com](mailto:mcfletch@vrplumber.com)

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