

Rather Long Notes on the  
**“Notes on the Synthesis of Form  
by Christopher Alexander”**

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## Introduction

The following is a critique of Alexander's "Notes on the Synthesis of Form" (Alexander, 1964).

## Summary

### ***Chapter 2: Goodness of Fit***

The purpose of this chapter is to provide a "general way of stating design problems". Alexander does this by describing the design as an attempt to create a form that fits a context. Context is defined as all those things that put demands on the form. Form is defined as all those things that the designer has control over. Alexander makes the argument that the quality of a design is demonstrated by how well the form and context fit together.

Alexander presents various examples of forms, context, and fit that exist in nature and human society. Good fit in nature is related to well-adaptedness of the various parts of the environment. Examples from human society include fashion, chess, music, household appliances, architecture, and even culture itself. In each of these examples Alexander demonstrates how the concept forms, context, and fit can be used to explore why certain combinations work better than others.

Alexander acknowledges that the division between form and context is not fixed. There are multiple valid form/context boundaries that designers consider in a given design problem. The example of a kettle is used to demonstrate how there can be many different and valid form/context boundaries. At one extreme the form is the kettle and the rest of the world is the context so the designer would focus on the properties of the kettle. If the focus was on heating water then the form could include the stove or even the entire house instead of just the kettle. The role of a good designer is to be able to identify which boundaries make sense to consider when addressing a design problem.

Alexander bounds the rest of the chapter by simplifying the discussion of form/context boundaries so that only one boundary is considered thus creating a single form and single context. Within these bounds Alexander turns to how we can determine the quality of fit between a form and a context. Several examples are provided that illustrate ways of determining fit. The first method described involves testing the form against the context and observing the fit or lack of fit. Using this "trial-and-error" criticized by Alexander as being too expensive in terms of both time and resources. A second method is to describe the form and context in mathematical terms and then calculate the quality of the fit. The mathematical method is criticized by Alexander as impractical since not all forms and contexts can be described mathematically. The problem of how to determine the quality of fit when "trial-and-error" and mathematical methods are not viable frames the discussion for rest of the chapter.

Alexander identifies the problem of determining the quality of fit when "trial-and-error" and mathematical methods are not viable as the reason why design and designers are needed. If mathematical methods were available then solving design problems would be trivial. Several examples are used to demonstrate how we are able to identify good fit without having a complete or mathematical understanding of the form and context by using a "negative point of view". A "negative point of view" is used to identify what doesn't fit instead of trying to identify all the reasons why something does fit. "Departures from the norm" stick out and we use these abnormalities to judge goodness of fit. Alexander describes goodness of fit is the absence of bad fit. Alexander recommends that "we should always expect to see the process of achieving good fit between two entities as a negative process of neutralizing the incongruities, or irritants, or forces, which cause misfit".

Alexander counters the argument that “absence of certain negative qualities is no more illuminating than to say that it is the presence of certain positive qualities” by explaining how a list of positive qualities is potentially endless. Match one button to another is used to demonstrate how impractical it would be to try to compare two buttons on every possible attribute instead of simply looking for differences that stick out. Alexander points out that “we rely on a good deal of unexpressed information contained in the statement of the task, and take a great deal for granted”. For example, when trying to match buttons we wouldn’t normally consider the electrostatic charge of each button as one of the characteristics that we would compare. Alexander states that looking at “the requirements from a negative point of view, as potential misfits, there is a simple way of picking a finite set” and that this is the best approach for design. If all potential misfits are variables and are given a value of 1 (misfit occurs) or 0 (misfit does not occur) then the goal of design is to create a form where each variable has the value 0.

### ***Chapter 3: The Source of Good Fit***

In Chapter 3 Alexander presents his argument for how to “go about getting good fit”. Architecture is used as the main theme throughout this chapter, specifically a comparison between the architecture of “simpler” and “complex” civilizations.

Examples of architecturally famous house are provided to demonstrate how often design is not focused on achieving a good fit between form and context but instead “under the driving force of some comparatively simple concept”. Alexander contrasts the simple driving force approach with the piecemeal approach of developer-built houses where band-aid solutions are used to attempt to fix problems that appear due to poor design. The issue of how to design a house in modern society that has a good fit is presented as an open problem and provides evidence that we are unlikely to be able to solve more complex design problems (e.g. design of a city).

Several examples of houses from “simpler cultures” are presented as examples where better fit is achieved. Alexander describes in detail how the Mousgoum hut is an example of how a form can fit very well into its context, how the hut “is coherently related to its context” and “physically coherent”. The question of why simple cultures produce houses that are better at meeting “all the context’s demands” is partially explained by looking at the complexity that of the contexts that each culture must deal with. Despite the difference in context complexity Alexander proposes that “simple cultures do their simple job better than we do ours” and that in their success are clues as to how to deal with the complexity that other cultures face.

Alexander distinguishes between simple cultures and ones he identifies as “our own” by calling simple cultures “unselfconscious” and other cultures “selfconscious”. Unselfconscious cultures are contrasted with selfconscious in that kinship plays an important role in social structures, by the absence of urban environments, the higher level of responsibility placed on the individual, and the lack of professions such as “architecture”. This last contrast is further detailed by Alexander when he details how little attention is dedicated to design and architecture in unselfconscious cultures where there is instead “a right way to make buildings and a wrong way”. Instead of following principles and having individuals who specialize in design or architecture, design is “governed by habit”.

The method of learning in unselfconscious and selfconscious cultures are contrasted to further distinguish them from each other. In unselfconscious cultures learning occurs through an apprenticeship model which contrasts to the more formal methods of selfconscious cultures. These

methods of learning are related to the types of problems that the cultures experience. In unselfconscious cultures the same structure is built over and over whereas a wide range of structures are required in selfconscious cultures.

Alexander poses several questions regarding unselfconscious and selfconscious cultures that flow from the previous discussion of their differences. Why are unselfconscious cultures able to produce forms that fit into their context with more success than selfconscious cultures? The related question “what is it that makes a form-making process good or bad?” Two possible answers to these questions are introduced and dismissed by Alexander. The idea of the “primitive genius” is given little attention and instead Alexander focuses on dispelling the “myth of architectural Darwinism” which associates with “vague hand-waiving”.

Architectural Darwinism is defined as the gradual adaptation of forms to a context over a long period of time via a “persistent series of corrections”. Alexander’s problems with architectural Darwinism stem from its inability to explain why selfconscious cultures do not benefit from a similar process and the lack of evidence in unselfconscious cultures of such a process taking place. Having addressed both primitive genius and architectural Darwinism as inadequate answers, Alexander presents his argument that “the unselfconscious process has a structure that makes it homeostatic(self-organizing), and that it therefore consistently produces well fitting forms, even in the face of change”.

The binary description of the goodness of fit between a form and a context presented in the previous chapter is reintroduced as a way of exploring the process of form-making in unselfconscious and selfconscious cultures. Alexander uses an example of a system of one hundred lights to explain the form-making process in terms of binary fits and misfits. In this system a light that is on represents a misfit and, correspondingly, a light that is off represents a good fit. Lights can be connected to other lights. Lights have a 50-50 chance of turning themselves off in the next second. The likelihood that a light that is off will turn itself on is positively correlated to the number of lights that it is connected to that are on. Once all lights are off only an outside force can turn on a light. This system is related to the form-making process in that a given misfit (light that is on) can either be resolved (turned off) or not (kept on) over some period of time and that a given misfit (light that is on) may cause a condition of good fit (light that is off) to become a misfit (light that is on). The state of good fit is represented by the condition of all lights being off.

Using the system of one hundred lights, Alexander looks at two extremes; where there are no interconnections and where there are rich interconnections between the lights. When there are no connections it takes very little time for all the lights to go off and when there are rich interconnections it takes an extremely long time for all the lights to go off. A system of lights where there are several subsystems where there are many connections between lights in a given subsystem but few connections between subsystems is examined next. The system with several subsystems takes a reasonable time to reach a state where all the lights are off. Based on how long it takes these three systems to reach a point where all the lights are turned off, Alexander concludes “no complex adaptive system will succeed in adapting in a reasonable amount of time unless the adaptation can proceed subsystem by subsystem, each subsystem relatively independent of the others”. The analogy of how to solve a kid’s puzzle, where rolling beads must be placed into holes, is used to illustrate how the subsystem approach can be used to more efficiently solve the puzzle.

Alexander identifies the difficulty in determining the structure of a given system and proposes that by viewing how a system reacts to a change clues can be used to deduce properties of the system. If a system of one hundred lights where in all in an off state and then a single light was turned on by an external agent then how the system reacts will indicate levels of connectedness and if subsystems are in place. The level of connectedness can be deduced by the number of lights that are subsequently turned

on. Subsystems can be deduced by noting which lights get turned on. In the case where there are few connections or specific subsystems the lights will likely return relatively quickly to the state where they are all off. In the case where there are many connections and few subsystems it is likely that all the lights will get turned on and remain on for a very long time.

Alexander then relates the subsystem approach described in the system of one hundred lights and the children's puzzle to the process of form-making for a context in both unselfconscious and selfconscious cultures. The inductive argument is made that if it is determined that subsystems exist in a given process then those subsystems are responsible for the forms being produced that have a good-fit with the context. Misfits can be addressed with a small chance of causing other misfits to occur in other subsystems. Without this "active stability" a single misfit can result in other misfits popping up. Alexander concludes "the form builders in unselfconscious cultures respond to small changes in a way that allows the subsystems of the misfit system to work independently – but that because the selfconscious response to change cannot take place subsystem by subsystem its forms are arbitrary".

# Criteria

## **1. Theoretical Concepts Should Be Universal**

Theoretical concepts that are presented should not be tied to a specific context in time and space but should instead be applicable in any context. If theoretical claims are dependent on a specific context then they lose their generalizability and end up just describing only a subset of contexts. Identifying universal theoretical concepts is important because they provide tools for predicting or explaining something in a future context. The value of a universal theoretical claim is that it can be combined with other universal claims in a logical context to create new theoretical claims (e.g. If A implies B and B implies C then we can conclude A implies C).

## **2. Theoretical Concepts Should Be Well Defined**

If a theoretical concept is not well defined then there is a good likelihood that the concept will be applied incorrectly or in a context for which it was not intended. For example, Darwin's Theory of Evolution involved the survival of the fittest and the notion that a species survival is dependent on the weaker members being culled from the population. Application of Darwin's theoretical concepts in a context outside of its original intention by Nazi Germany resulted in genocide. This is an extreme example of the danger of taking a theory outside of the realm for which it was originally intended. This does not mean that a theory should be tied only to a specific context but that a theory should be clear on when it is applicable and how to apply it.

## **3. Evidence Should Be Provided To Support Claims**

Without evidence, we end up trying to identify truth via questionable methods like "tenacity, authority, and agreeableness to reason" (Frick, 2004). Tenacity, which involves believing something because you have heard it many times, can lead to the acceptance of false claims. People also commonly accept claims based on the authority of those the claims come from. These claims may or may not be based on observable evidence and could be false. Something can be agreeable to reason without being true. Recent discoveries in Quantum Physics (e.g. light acts like both a wave and a particle) defy common sense but can be tested using empirical experiments.

## **4. The Findings Should Be Replicable**

If findings can be consistently replicated then it is unlikely that the findings are due to random chance. Random chance can produce outcomes that at the surface look like evidence of some underlying pattern but through statistical methods the role of chance can be accounted for in an experiment. In a single experiment, the hypothesis is often accepted or rejected based on its ability to explain or predict something that is unlikely to be due to random chance. If the experiment was repeated twenty times then hypothesis should hold for 19 of the experiments. If the findings are replicable then it is unlikely that the findings were due to random chance or some other explanation.

## **5. No Plausible Alternative Explanations**

If there is a plausible alternative explanation then one is less likely to accept a claim. The design of an experiment can go a long way in limiting the number of possible plausible alternative explanations through controlling variables or random assignment to groups. In arguments of a more logical nature, plausible alternative explanations can be dealt with by first identifying the alternative explanation and then making a convincing argument about why it is not plausible.

## **6. *Rationally Related to First Principles***

Evidence cannot be used to backup moralistic arguments since what exists right now does not provide justification for what should be. This is the “naturalistic fallacy” that would condone world hunger since there is so much evidence to suggest that it exists. First principles must be used instead. These first principles form the foundations for religions, constitutions of nations, and individual ethics.

Agreeing upon a set of first principles that can be used to differentiate the “good” from “bad” is not easily done. A better approach is to clearly identify the first principle (e.g. torture is bad) and then make the argument about what is worthwhile based on how it relates to the first principles that have been identified (e.g. observation by a third party reduces the likelihood of torture so observation by a third party is good).

## Application of Criteria

### ***Application of “1. Theoretical Concepts Should Be Universal”***

[Type 4 claim] “... I should like to recommend that we should always expect to see the process of achieving good fit between two entities as a negative process of neutralizing the incongruities, or irritants, or forces, which cause misfit.” While I think that Alexander’s claim has some merit I think that the use of the word “always” is makes the claim too overreaching. Some forms (e.g. spacecraft) must be designed in an environment where the extent of the “incongruities” or “irritants” cannot be completely known until after the design is complete. In this case, an argument can be made that the theoretical view of how to achieve good fit proposed by Alexander is not universal. If the design of a form is considered include multiple iterations of the form then Alexander’s claim has more merit.

### ***Application of “2. Theoretical Concepts Should Be Well Defined”***

[Type 2 claim] “The rightness of the form depends, in each one of these cases, on the degree to which it fits the rest of the ensemble”. Alexander has provided several examples of different cases where form and the rest of the ensemble meet. The examples are varied enough to suggest generalizability and I’m not able to identify an example where the claim would not be true. Alexander is specific in each of the examples about what the context is and what the ensemble is so the claim is a theoretical concept that is defined fairly well.

### ***Application of “3. Evidence Should Be Provided To Support Claims”***

Alexander starts off chapter 2 with the claim “The ultimate object of design is form.” This could be considered either a type 2 claim or a type 6 claim depending on if you think that Alexander is making a judgment on what ought to be or just a more theoretical statement about design. I think that the claim is type 2 Like most of Alexander’s claims, the supporting evidence comes from primarily logical arguments and presentation of examples. The claim is certainly universal and well defined since it can be applied to any design situation and doesn’t leave any points of ambiguity. Based on the argument that Alexander makes I am inclined to believe his claim about form being the ultimate object of design even though he doesn’t provide detailed evidence to support the claim.

[Type 2 claim] “...we should not really expect to be able to give a unitary description of the context for complex cases: if we could do so, there would be no problems of design.” Again logic is used to support this claim and I am inclined to believe it. The logic that if there exists a unitary description then there does not exist a design problem is equivalent to saying that if there is a design problem then there is no unitary description. This claim was an “ah-ha” moment for me about the nature of design.

[Type 4 claim] “While it is true that an individual problem can often be solved adequately without regard for the fundamental physical order it implies, we cannot solve a whole net of such problems so casually, and get away with it.” In this claim Alexander is stating what he thinks won’t work. While he does provide the example of a developer built house more evidence would be helpful to provide additional support.

### ***Application of “4. The Findings Should Be Replicable”***

[Type 6 claim] “... the houses of simpler civilizations than our own are in some sense better than our own houses.” This claim is supported by the citing of sample houses from both simpler and our civilizations and the claim is worded such that the existence of a contradictory case would not invalidate the claim. Since the writing of Alexander’s work many houses have been constructed (e.g. “Mc Mansions”) that have also been criticized as being inferior to houses of simpler civilizations. It seems that Alexander’s claim is replicable.

### ***Application of “5. No Plausible Alternative Explanations”***

In talking about non-selfconscious cultures Alexander states the following [Type 2 claim] “With no variety of experience, people have no chance to see their own actions as alternatives to other possibilities, and instead of becoming selfconscious, they simply repeat the patters of tradition, because these are the only ones they can imagine. In a word, actions are governed by habit.” While Alexander does provide a reference to back up this claim it does seem like an over generalization. Evidence could have been provided that shows that there are relatively few differences in the huts. Interviews of those who build huts could be cited to support this claim.

[Type 2 claim] “No complex adaptive system will succeed in adapting in a reasonable amount of time unless the adaptation can proceed subsystem by subsystem, each subsystem relatively independent of the others.” If there is one example that does not support this claim then the claim should be disregarded or modified in strength but I’m not able to identify any such example. One possibility may come from the controversial ideas of “Intelligent Design”. Intelligent Design proposes that there exist some irreducibly complex biological systems whose creation cannot be explained by the theory of evolution. While I don’t believe that the ideas behind Intelligent Design have merit they do provide examples of complex systems that don’t seem to have subsystems that adapt independently.

### ***Application of “6. Rationally Related to First Principles”***

[Type 4 claim] “...this way in which the good designer keeps an eye on the possible changes at every point of the ensemble is part of his job”. Alexander is making a claim about a step that designers should take as part of the design process. I have interpreted this not as being a judgment of what should be but instead as a description of what works in design. This claim is made to balance out an earlier statement that Alexander makes that warns the reader of trying to change the constraints of a problem to make their life easier instead of dealing with the problem in front of them.

[Type 6 claim] “We ought always really to design with a number of nested, overlapped form-context boundaries in mind.” This claim is making a statement of what design should be. Alexander doesn’t directly relate this claim to first principles. One can infer that Alexander thinks that keeping “overlapped form-context boundaries in mind” will lead to better design and that better design can have good outcomes for society. An argument can be made that better design will save money or time. Better design may allow people to do something more easily or better but what that something is makes all the difference. What is more debatable is if a better designed weapon or junk food is a good thing. Alexander does not address this question.

# Conclusion

## **Strengths**

Alexander presents a convincing argument. In Chapter 2 his claim that form must fit context is well supported and can provide valuable guidance to the world of design about what design ought to be. His discussion of the necessary complexity of design problems and his proposal of an approach to dealing with the complexity is well formed and backed up by examples. While some of his claims might overwhelm the novice designer (e.g. that many different form context boundaries should be considered), these claims do paint a picture of what design is and what it ought to be.

## **Weaknesses**

Alexander's discussion of design in chapter 3 relates design to system's theory concepts. While his examples do shed light on how a subsystem approach to design, the informal nature of the argument lacks the preciseness and rigor that of other system's theory papers (Rowe, 1987). I was left with questions on how to apply Alexander's ideas to a real world scenario. Is Alexander proposing that a quick prototype be created and then modified subsystem by subsystem or was he proposing that the design itself be tackled via subsystems? No doubt these questions are addressed in one of Alexander's other works but it would have been helpful to at least have the questions identified.

## References

- Alexander, C. (1964). *Notes on the synthesis of form*. Cambridge,: Harvard University Press.  
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Rowe, P. G. (1987). *Design thinking*. Cambridge, Mass.: MIT Press.