

What If Creativity Were 60 Things Not One, Towards a Grammar of Design

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Abstract. This paper reports pilot study results on 3 things: a) **Creativity Models as a Possible Language of Design**---designers and others segment detailed protocols of actual design processes at points where creativity models change or conflict in the designer/process b) **Meta-Creation Improves Creativity the same way Meta-Cognition Improves Cognition**---designers exposed to more creativity models and more diverse models briefly afterwards show slight increases in creativity of design outcomes c) **Design and Creativity are at least 60 Diverse Things not One Thing**---there are at least 60 different models of creativity (gotten from 8000+ subjects in 41 nations and 63 professions via questionnaires and interviews) several of which combine in any design process. So systems published as supporting one model of creativity may or may not support 59 others models and more creativity may come from changing creativity models than from better doing existing ones.

Keywords: design syntax, design language, creativity models, design grammars, design singularities

1 Introduction—Implications for Design

Implications of the 3 above results of this study for designing and tools to support designing include: 1) If design process singularities---design: conflicts, bifurcation points, resonances, cycles, and instabilities---are where multiple creativity models collide or otherwise interact, corresponding to two or more models of creativity competing for influence in particular design steps, then helping designers see what creativity models are there or in conflict may speed up and improve design; 2) If designers become even slightly more creative when exposed to diverse and many models of creating, then systematic improvement in novelty of design might be possible; 3) if creativity is not some one abstract set of variables and one abstract process (as Amabile and other scholars insist, Amabile, 2010, 2009, 2008, 1996, 1989, 1983, Moneta et al, 2009, Fisher et al, 2008) then environments to support “it” might shut down more creativity models than they help and people investing more in existing creativity models might get

more creativity by instead investing in models of creativity now omitted and missing.

If creating/designing is not one thing, we need environments for supporting the 5, 10, 30, or more things that it is, so papers about supporting one model of it, do not at present, offer much for design practice.

2 The Origin of My Research Questions

First, the work of expert system builders in the 1980s, involved detailed protocols of in the mind operators and operands in designers during design processes. Some of the people involved (Danaher, 2000; Ericsson and Simon, 1993; Norman, 1993; Wallace and Gruber, 1989) noted that many approaches to creating rather than one or a few seemed to be found in the protocols they mapped.

Second, academics unanimously offer up single, general, highly abstract models of one process to explain all of creativity (Sternberg, 1998; Sawyer, 2002; Wallace and Gruber, 1989; Amabile, 2010; Simonton, 1999; and many others). Weak results whenever such models are actually applied suggest all such models share a fundamental failing.

Actual fully funded sincere applications of statistically validated versions of such models, that have been published, report extremely un-novel, un-innovative, un-creative results from adjusting 40+ environment variables at work to “support” one creative process from the academic involved. A leading example is Procter & Gamble's *Harvard Business Review* reported Corporate New Ventures program (Amabile and Whitney, 1997; Huston and Sakkab, 2000), the result of years of consults tweaking 42+ environment variables suggested by Harvard's Amabile. After years of work it produced a culture the leading creative result of which was copying 8 years later a very popular product already in Japan. Many would say that is not creativity at all, just delayed copying, and nearly all would agree it is a tiny increment of creativity if it is actually creative in any

way at all. This is typical of the size of creative effects from full statistically valid applications of current general single models of creativity. The tiny-ness of effects of the few validated applications of current design models suggest something fundamental is mis-construed in such models. I want here to suggest that what is mis-construed is design/creating are at least 60 things not one thing.

Third, current publishings on supports for design processes rarely include, perhaps for entirely natural reasons of space and cost-of-doing-research, two valuable types of study: articles on a dozen or more diverse technical systems to support one model of creating/designing (and data comparing their effectiveness) and articles on how a dozen diverse approaches to design are supported (with what results) by any one particular technical tool set. The model of 60 models of creativity in this paper can be seen as one step towards enabling the doing and publishing of such studies in the future.

Fourth, the split of academia itself (Simon, 1996), means that the statistically most thorough models of creativity are developed in psychology and education departments, and the statistically most thorough models of technologies to “support” “it” are developed in engineering or computer science departments. If computer scientists were as expert in social science as they are in technology matters this would not be a concern, but they are decidedly not. The result: expert technology work thrown against ad hoc or poorly researched models of what creating is, that is, poor science.

For the above reasons, it seemed one simple divergence from common research and publishing on supports for design creativity might be tried--what if designers used many approaches to being creative and what if those models at times conflicted inside design processes?

- a) what were those many models of creating
- b) did designers who used some of them out-design those using others of them
- c) did early career designers use some of them and evolve, during their career, to use of others
- d) did environments that support one or a few such models hinder other such models (were the models in negative trade-off relations to other models).

These were the sort of questions that arise when one doubts that all designers in all design fields create useful novelty the same way using the same approach (steps) to creating. If creating is many diverse process roads, then no one environment would support “it” because there is a “they” there not an “it”.

3 A Tiny Thought Experiment

Here is what one wonders if one considers it actually possible that there are plural diverse models of creating inside design not one overall general abstract one:

Question 1, Supports that Hinder: If creating were more than one thing, environment factors that supported one version of it might shut down or reduce other versions of it. How much of this was actually going on and hurting creativity of persons, works, and economies?

Question 2, Consulting that Hinders: Therefore, might consultants and professors promoting environment changes to “up” creativity thereby be shutting down more creating than they upped? How many and what exact negative trade-off relations existed between the known models of creating?

Question 3, Academics Assume Unity: Do we treat constructs like “creativity”, “design”, “educatedness” as one thing, in part, due to skipping steps in the scientific method, in particular, due to not building comprehensive categorical models of a phenomenon before building causal models of it (and this comes from how academia is structured, and academics are trained, Herbert Simon's exponential fragmentation of knowledge and its corresponding professions, into tinier and tinier fragments of what is there, real, and to be solved/handled by us all)?

Question 4, Design's Relation to Creating: Formally, what is the relation between creating and design? Is it better to talk of many design approaches within any one creativity model or vice, versa, it is better to talk of many creativity models within any one design approach?

Question 5, Elemental moves of Design: If design is various, and if we want scientifically to categorize that variety in ways that reveal rather than obfuscate, ultimate causal operators and moves within design approaches, what elemental moves, operators, “words” are best to thusly break design down into, and would breaking it into creativity models outperform other things we might break it down into?

Question 6, Meta-Creating & Meta-Designing: Research in cognitive psych has found that people who do more and better quality meta-cognition outperform in many domains of mental performance people who do less and poorer quality meta-cognition. Is there an analogy for creating and design--do people who meta-create—that is, who monitor how they create (what model they use) and change it mid-creation-process out-create those who use one approach un-self-consciously?

4 First Results: A Model of 60 Models of Creativity

8000+ people nominated as superb in each of 63 professions comprising 41 nationalities were given interviews and questionnaires over a 5 year period about their bases of excellence. Many were superb by virtue of being more creative than others in their chosen profession. Questions from total quality work process modeling and artificial intelligence within-the-mind protocol analysis were asked about creativity. Careful categorization (both representational and relational naming of categories on multiple levels, and all pairs of suggested creation steps ordered as pairs--What step comes before this one? What step comes after it?) of tens of thousands of such answers produced the model of 60 models of creativity, 10 sets of 6 each, given below. Research about these 60 models exposed designers to the table given below, used as a research instrument. A book providing 20 variables for each of the 60 models is available at www.youpublish.com/richard-tabor-greene Are You Creative? 60 Models by Richard Tabor Greene. NOTE research on meta-creating meta-designing cannot be done without a model of the variety and number of approaches to creating and/or designing. We have to know nearly all the approaches to creating that are used in order to spot which ones a particular designer uses, knows, does not know, and how introducing him/her to others improves or decrements his/her work. Categorical models used to proceed causal ones in science but in recent decades journals lost interest in them and short sighted causal models operating on tiny fragments of fields have proliferated, perhaps to pad publishing numbers of faculty. If we build good comprehensive detailed categorical models of ways to create, it allows us to create environments to support many approaches not a few, and to measure how many models of creating a creator uses versus how many he or she knows that he or she uses, and to parse designer protocols by which creativity models are used or in conflict.

CATALOG	Recommendations
	Traits
	Question Finding
	Darwinian Systems
	Combined Thought Types
	Garbage Can

BLEND	Culture Mixing
	Discipline Combines
	Tuning
	Paradox Doorway
	Scale Blend
SOCIAL	Idea Marketing
	Community of Ideas
	System Model
	Social Computation
	Social Movement
GROUP	Sapce Sharing
	Participatory Design
	Mass Solving
	Process Deployment
	Optimize Ideal Flow
EVOLVING-KNOWING	Meta-Cognition
	Social Connectionism
	Demystification
	Dialectics
	Compilation Cycle
EXPERIMENT	Relocating Idea Ecosystems
	Idea Waves
	Fractal Recurrence
	Simple Programs
	Solution Culture
EXPERIMENT	Policy by Experiments
	Creation Events
	Fractal Model Expansion
	Social Automata
	Create by Balancing

SYSTEM	Non-Linear Systems
	Darwinian
	System Effects
	Surprise
	Adjacent Beyond
	Population Automaton
PURITY	Subcreations
	Productivity
	Performance
	Influence
	Investing
	Info Design
SELF	Courage
	Anxiety Channel
	Extended Self Development
	Interest Ecstasy
	Career Invent
	Performance Creativity
MIND	Insight
	Cognitive Operator Extremes
	Making Sense
	Percept Invent
	Experience Realization
	Substrate Update

Fig. 1. 60 Models of Creativity from 8000+ people in 41 nations and 63 professions

5 Discussion of the Model of 60 Models of Creativity

A book presenting 20+ variables for defining each of the 60 models was written (Greene, 2007). Used with creators and designers in this research, it is successful in making both creators and designers more “meta-” in the meta-creating and meta-designing sense analog of meta-cognition.

The table form of the model, above, with a third column containing 4 key variables for each of the 60 models (that has been omitted here), is the PRIMARY tool used in this research, with the prose summaries of each model covering the four primary variables in each of the 60 models. Very nearly all the research and practice imponderables of creativity research, whether creation is group or individual, whether it is conscious or unconscious, whether it improves with time or stays unimproved, whether it is domain dependent or independent, whether it is a judgment of creators or their historic audiences, whether humans only do it or the universe does it nicely without humans, whether design is an inspiration or solving process, and others, can be generated and better understood by merely, in sequence, moving from the catalog, through the group/social, then knowledge, system, to the interior mind and self models.

No existing publication or system to support design or creativity covers an appreciable fraction of the 60 models presented in this paper.

This is worrying and an example of the cost of academia and professions trained by academia, assuming that creativity or design are one thing, in some basic process or causal path, sense (Kaufmann, 2008, 2003, 1995, 1993). Our academia manias for reduction, aping physics, dis-serve us when they induce us to skip categorical model building, for comprehensive coverage of a phenomenon before moving to causal models to explain “it”. When we casually explain an “it” that is not unitary and indeed is quite diverse, we fool ourselves and delay technical and knowledge progress.

6 Pilot Study of 12 Designers—Creativity Models as Their Language of Design

As 150 designers in 63 different kinds of design work were contacted for initial research probes, 12 designers agreed to help me try out research approaches for various research questions that started this paper.

The first thing we all wanted to test was: *What lay behind the discontinuities, the ill-defined points*

(analog of functions in the calculus where certain rare points have more than one slope or rates of change otherwise mathematically ill-defined as, for example, fractal “monster” functions a la Mandelbrot) in otherwise rote, routine, “smooth” design approaches and processes? The research literature is so male and rational (and techno-centered and American in many ways) there is a drive in academic publishing to minimize and marginalize, almost omitting, irrational points in design protocols where designers are genuinely lost, ambiguous, confused, spinning wheels in rather ineffective repetition, or leaping between extremely different alternatives (Casti and Karlkvist, 2003; Whitelaw, 2004; Silvia, 2006; Birkhauser, 2005).

An example from actual designer protocols is probably needed here:

“you know... this reminds me of something...all that Santa Fe stuff...I could do somethingemergent here...by leaving this unconstrained and seeing how it grows to fill out other dimensions constraints the design flows into....Hey...there is another total approach here.....wait a sec....instead of going Santa Fe, what if I gave the user a choice here...tune the design performance up or down, left or right....something like that....damn.....how do I decide Santa Fe or user choice? What should determine that....there is that research about too much choice irritating consumers....did anyone publish how much choice is too much or when in a user protocol choice irritates?.....I don't begin to know this...I don't know anyone who does...no, wait a sec.....X at Rochester probably has stuff on this...hand me that phone...the red thing...yea...just a minute while I ring X up....” (Greene, 2009)

This is a design discontinuity moment, where a single step of design action took much more time (in seconds) than all the steps before and after it, where real ambiguity was expressed by the designer and where multiple ways to go got considered. Basically here, in this protocol example, the designer came upon a place where he could go “Santa Fe” by not designing but leaving the aspect un-decided, letting side-effects of other constraint-meeting fill it, decide it, or where he could go user-choice, designing a way for users to choose from a list of alternatives. This is typical of design process singularity points. Creativity via emergence versus creativity via user determined design attributes (2 different models of creativity).

This also nicely covers much of what makes designing hard work—points where the “slope” of design work can go in either of several directions, without adequate reason to choose any one over the

others—points of design imponderability. The points often get solved via quite general quite abstract re-framing of major parts of the design project—who the customers really are, what they really require, which assumed materials and approaches are being vitiated by trends in technology or competitors, and so on. In short, designers switch creativity models or choose among conflicting ones at these design singularity points.

The pilot study categorized these, from raw protocols taken from each of the 12 designers handling one of their own typical design challenges and them all handling generic challenges outside their field of design expertise, devised by me (to expose them to models of creating in their design approaches along with ones not in them), as follows:

DESIGN SINGULARITY TYPES:

a. design bifurcations---Rene Thom's catastrophe theory and Santa Fe Institute non-linear system dynamics, points in state space where a process switches from one attractor to another (note: no actual attracting is going on so the term mis-leads us). This is the butterfly effect working itself out in ordinary design processes.

b. design resonances---these are larger scale non-linear effects unleashed in markets and museums, in design communities and publication circles when one design turns out to be a tipping point for other designs and designers, somehow magically changing the context, standards, and directions of following design work. It is the larger social scale of a above: same dynamics, larger scale of operation.

c. design cycles---these are instability points in designing, designers, design teams, design spaces, where alternatives denied re-appear, repeatedly, so cycles of departure and return recur, maddeningly. The designer, the design, are unable to choose among alternatives, but continually revisit them or the denied alternative re-appears within the dominant “winner” design as a re-contexted embedment. This is often a spiral form of repeated visiting of the same approach, briefly, but from gradually more abstract or remote frameworks applied to it or derived from it.

d. design conflicts---these, within one designer person or among members of design teams, are where non-linearities of social trust, information flow, and relating intersect and influence, for good or ill, design processes and purposes.

The METHOD of this pilot study was simple indeed:

a) Each of the 12 designers did two designs, one in their field and typical of that and of them, and another

in a field foreign to them that was also done by the other 11 designers and also outside their fields. This produced a total of 24 designs done.

b. Graduate students not aware of any aspect of the research and not themselves studying design or trained in it, evaluated each protocol for where each of the four types of singularity appeared.

c. Each designer reviewed all 24 protocols and identified where each of the four types of singularity appeared.

d. Graduate students, the same mentioned above, examined the segments of protocol *between* singularities, and named what models of creativity were operant (which variables of the operant model appeared, where and how) there.

e. All the 12 designers repeated d without knowing what the grad students had identified for each segment.

f. Graduate students then did “d” above for each singularity, that is, they identified at each singularity in each protocol, what creativity models were operant there, using variables of the models considered to decide on presence (presences of the variables of a model indicated presence of the model, that is, for example, when a designer considers, tries, or rejects an alternative he or she changes the value of some variable or other).

RESULTS:

1. 98% of the singularities were where more than two models of creativity were interacting/involved
2. 81% of the singularities were where more than three models of creativity were interacting/involved
3. 94% of the segments between design process singularities were dominated entirely by one model of creativity
4. 6% of segments were dominated by two models (only 3 segments overall out of thousands were dominated by 3 or more models)
5. the more intractable the singularity, the more difficulty reported by the designer experiencing it, the more *distant* the models of creativity involved were on the 60 model table presented earlier in this paper.
6. the more time and resource expended on handling a point of design process singularity, the more models of creativity were involved in it and the more distant from each other on the table of 60 they were.

The sample is too small for generalizable conclusions, but this pilot study suggests that creativity models might be highly useful on a formal theory basis, for articulating design approaches and the

evolution of their elements within one design process protocol and across lifeworks of designers and genres. Are creativity models useful *practically* as a possible way to improve design?

7 Pilot Study of Design/Designer Improvement via Meta-Creation

The pilot study was extended to handle this last question of practical improvement of design and designers. Meta-cognition improves cognitive outcomes (test scores etc.), so meta-creation might (might) improve creating (meta-designing improve designing)(Flavell, 1979, 1976; Shekerjian, 1990). The data collecting process involved above, steps a through f exposed my 12 designers to creativity models and how they appeared in design process segments and singularities. That means each of the 12 designers left that research a lot more conscious of their own processes of design, of the processes of others, of the creativity models in general (my model of 60 of them) and of which of those models appeared in their own design segments and singularities and in the segments and singularities of the other 11 designers involved. Six months after experiencing thusly the above research, each designer and two colleague designers who worked with each (and were not at all aware of or involved in the research) were given one page brief questionnaires on the quality of originality and design creativity present in the designer's last months of work. Fortunately these same questions had been answered in the initial research that chose which designers I would work with for this research, so we had before and after data for the same questions.

RESULTS:

1. All 12 designers rated (using a dozen diverse scales) their recent design work as better than work earlier had been rated, before they knew of this research.
2. All 24 colleagues rated (using a dozen diverse scales) their recent design work as better except one (we have no data on why for this exception).
3. In brief phone interviews with each designer, more creativity models were mentioned (via factors in each model), without request or prompting, than before this research began, for 10 of the 12 (when an identical set of questions had been asked of prospective participants in this study).

Again the sample size prohibits generalization, but allows us to suggest that meta-creation *probably does* positively improve originality and worth of designs in designers made more aware of what creativity models they use and how they use them (but by how much?).

8 Conclusions, Per Research Question

Question 1, Supports that Hinder: If creating were more than one thing, environment factors that supported one version of it might shut down or reduce other versions of it. How much of this was actually going on and hurting creativity of persons, works, and economies?

This study did not examine directly how “supports” for one creativity model reduce or hinder work of another, but, the singularities of design protocols, examined in this study, involved more than one model of creativity, overall, while the protocol segments between singularities, involved only one model overall. This suggests that the imponderables of design processes stem from creativity model conflicts in the designer or his/her process. So “supporting” a design process with such singularities in it, necessitates “supporting” the imponderables at such design process points of singularity—one has to “support” two or more mutually incompatible models of creating and a designer's choosing among them or applying other mental operations to them (fusing, subsuming, blending, shuffling, sequencing and so on). This means formal “supports” for meta-creating activities.

Question 2, Consulting that Hinders: Therefore, might consultants and professors promoting environment changes to “up” creativity thereby be shutting down more creating than they upped? How many and what exact negative trade-off relations existed between the known models of creating?

This study suggests that any environment that “supports” one or a few models of creating thereby ignores or perhaps randomly hinders far more other models, unconscious or never encountered by particular designers. This study certainly suggests that models of creating that happen to *not* be “supported” by some software or technical system, and that *do* appear in design process singularities in conflict, are biased against and the re-framing work at singularity process points is reduced or eliminated by them—hurting overall design in ways further research should specify.

Question 3, Academics Assume Unity: Do we treat constructs like “creativity”, “design”, “educatedness” as one thing, in part,

due to skipping steps in the scientific method, in particular, due to not building comprehensive categorical models of a phenomenon before building causal models of it (and this comes from how academia is structured, and academics are trained, Herbert Simon's exponential fragmentation of knowledge and its corresponding professions, into tinier and tinier fragments of what is there, real, and to be solved/handled by us all)?

Design protocols from these designers showed the more experienced and expert designers having more rote executions of process segments, but also they spent more time pondering design singularities and played around with more alternative design approaches then, than less experienced and expert designers. The more expert ones also completely revised design context, purpose, and approach in radical ways, at times, that were missing from protocols of less expert designers. All these, though rather indirectly, suggest a wider deeper repertoire of design approaches, to switch to or replace current approaches with, making the idea of “designing” as one process, somewhat worthless and unrepresentative of actual designing they did. .

Question 4, Design's Relation to Creating: Formally, what is the relation between creating and design? Is it better to talk of many design approaches within any one creativity model or vice, versa, it is better to talk of many creativity models within any one design approach?

The design process protocols developed in the pilot study reported here, showed clear unmistakable evidence in terms of factors from particular creativity models and not from others. Within design process protocols operate a number of sometimes conflicting creativity models, it appears.

Question 5, Elemental moves of Design: If design is various, and if we want scientifically to categorize that variety in ways that reveal rather than obfuscate, ultimate causal operators and moves within design approaches, what elemental moves, operators, “words” are best to thusly break design down into, and would breaking it into creativity models outperform other things we might break it down into?

In this study, by breaking down design process protocols, both segments and singularities, into creativity models, insight into the causes of singularities and the causes of their difficulty were obtained.

Question 6, Meta-Creating & Meta-Designing: Research in cognitive psych has

found that people who do more and better quality meta-cognition outperform in many domains of mental performance people who do less and poorer quality meta-cognition. Is there an analogy for creating and design---do people who meta-create—that is, who monitor how they create (what model they use) and change it mid-creation-process out-create those who use one approach un-self-consciously?

Suggestive but not statistically valid and reliable results from this study indicate that meta-creating improves design outcomes by an as-yet-to-be-determined amount. This should be explored in serious later research studies. That subsequent work should include coverage of which particular “good outcomes” of any particular type-of/genre-of design specific combinations of creativity models enable or enhance, getting us a mapping from creativity models (and their combinations) to desired design outcomes.

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