THE POWER OF FRAMING, AMBIGUITY, AND FUNCTION ANALYSIS IN PROBLEM SOLVING

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Abstract

Having been a practitioner of Function Analysis for 30 years, it is a technique that remains elusive, challenging, and confounding yet utterly fascinating and inspiring. I have witnessed the power of this abstract way of thinking first hand on countless occasions. Further, having taught Function Analysis for nearly 30 years, I am constantly challenged by students about the examples I provide, which in turn, opens my eyes to alternative possibilities that had not occurred to me. I find myself questioning my own thinking. This is both scary (recognizing the possibility that I could be wrong) while empowering (by stimulating my creative thinking). Why is this so?

This paper seeks to broadly explore the concepts of framing and ambiguity, consider their relevance to problem solving within the context of Function Analysis, and offer a hypothesis that could theoretically be tested.

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Introduction

Creative problem solving lies at the heart of the Value Methodology (VM). The VM Job Plan provides a structured sequence of steps designed to leverage both divergent and convergent thinking. From the first phase, where the problem(s) is defined, through the last phase, where the solution is implemented, the VM Job Plan draws upon both types of thinking while shifting the dominance of the two as the participants move through the process (Stewart, 2017).

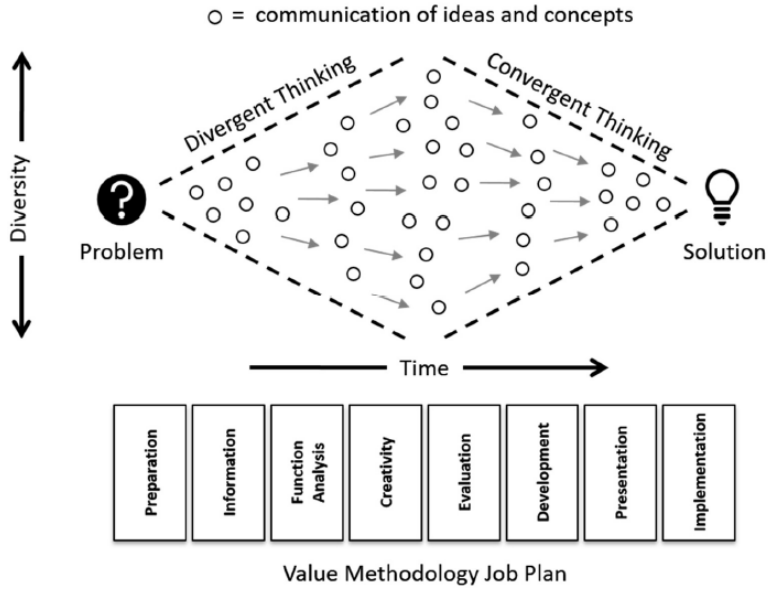

Figure 1 – Relationship of thinking patterns relative to the VM Job Plan

Generally, speaking, our formal education tends to emphasize convergent thinking, often at the expense of divergent thinking. The evidence for this is quite striking. In one study, it was determined that the vast majority of children, approximately 98%, test at the "genius" level for imagination and creativity. When the same group of individuals were tested again as adults only a mere 2% achieved the "genius" level. The conclusion from this study is that our education system essentially atrophies our innate capacity for creativity and innovative thinking (Land & Jarman, 1998) due to its focus on convergent (critical) over divergent (creative) thinking skills.

Based on this research, people need help improving their divergent thinking capabilities. Tools such as Function Analysis, Team Brainstorming, and other creative techniques employed during the VM process are designed to do this. This paper will focus on the technique of Function Analysis and explore some of the related concepts that make it work.

Framing

In the social sciences, framing comprises of a set of concepts and theoretical perspectives on how individuals, groups, and societies organize, perceive, and communicate about reality. Problem framing is the process of describing and interpreting a problem to arrive at a problem statement. It is considered an important step in problem solving as slight changes in framing may lead to a vastly different problem-solving process and resulting solutions.

The word "hammer," or witnessing someone use a hammer to drive a nail, are examples of real world observations. The sentence "Invent a better mousetrap." could be used as a problem statement. This phrasing forces us to think about the object and current operations.

Within the context of Function Analysis, framing is the process whereby we transform the problem statement from the perspective of the directly observable world to that of the ontological (i.e., the examination of what is meant by the word 'thing' and all it entails).

A function is a two-word phrase that states what something does. Functions are ideally phrased using an active verb and a measurable noun. Care must be taken not to be too object-oriented in defining nouns. For example, in considering the basic function of a hammer, the phrase "drive nail," while a verb and a noun, describes an action, which is object based. The noun "nail" causes one to visualize an actual nail, which is overly specific and narrows the scope of the problem.

Conversely, "deliver force" more accurately states what the hammer does when it "drives nails." If one focuses on the statement, "deliver force" one can envision multiple possibilities that have nothing to do with nails. Further, by asking the question "why does a hammer deliver force?" it leads to a further, broader, reframing of the situation. For example, a hammer delivers force, in one sense, to "connect materials." In another sense, the claw of a hammer "separates materials." By focusing on the problem at this further level of abstraction leads to alternative solutions that transcend the original, object-based frame of reference involving hammers and nails. The use of function statements changes the problem context, called framing, and creates ambiguity through its use of word structures.

Object	Activity	Function	Ideas / Solutions
"Hammer"	"Drive Nail"	"Deliver Force"	Darth Vader, Explosion, Ball

Figure 2 – Comparison of objects, activities, functions and ideas

In the example above, reframing the context of the object "hammer" as a function "Deliver Force" yields ideas and solutions that we would likely not have considered had we focused exclusively on the object. Obviously, many of these ideas will appear "useless" at face value, but they are not useless in the sense that they provide a vehicle for our minds to associate different concepts in unexpected ways that may indeed lead us to a breakthrough.

In the book Stimulating Innovation in Products and Services (Kaufman & Woodhead, 2006), have an excellent discussion on defining problem statements they refer to as the "Fuzzy Problem Technique." The authors walk the reader through a series of questions that center on the concept of problem framing using function logic. The questions provide a natural progression that ultimately refocus the problem statement using different levels of abstraction. Q: If we want to design a better mousetrap, why do we want to trap mice? A: To eliminate mice. Q: Why do we want to eliminate mice? A: To prevent disease. Using this technique, we have made the problem progressively fuzzier and have identified three problem solving frames: "Trap Animals;" "Eliminate Animals;" and "Prevent Disease." Note that by shifting the noun 'mice' to 'animals,' we have further altered the frame of the problem statement. One could take it a step further and replace 'animals' with 'creatures' or 'entities' and make the problem even fuzzier. Fuzziness will get us more ideas, which is the goal of creative thinking, because it broadens the net we are casting if we think of fish as ideas. We can begin to see how framing and ambiguity (fuzziness) are inter-related in Function Analysis.

Function Analysis requires us to reframe the object as a statement of purpose or intent. It is not the hammer we are interested in, but what the hammer does and, perhaps, why it does it. This change in framing problems is essential in changing the way we in which we think about possible solutions.

Ambiguity

Ambiguity is alternatively defined as: 1) doubtfulness or uncertainty of meaning or intention: to speak with ambiguity; an ambiguity of manner. 2) an unclear, indefinite, or equivocal word, expression, meaning, etc.: a contract free of ambiguities; the ambiguities of modern poetry. It is interesting to note that this concept has many applications beyond language and is a meaningful construct in the fields of the visual arts, music, computer science, computational linguistics and mathematics. This paper will focus on the concept of ambiguity relative to language.

Clearly, functions, as defined above, reframe objects and activities as what they do rather then what they are. This transformation results in ambiguity, partly because it forces use to articulate function statements concisely and excludes the use of qualifying words such as adjectives; partly because words have different meanings; and partly because objects and activities can have multiple functions. But most of all, Function Analysis creates ambiguity because it reframes context.

In one recent article, the multivariate meaning of words was explored. Did you know that the word 'run' has the most potential meanings in the English language? The verb form of 'run' has 645 differ usage cases (Specktor, 2017).

Context is everything. Think about it: When you run a fever, for example, those three letters have a very different meaning than when you run a bath to treat it, or when your bathwater subsequently runs over and drenches your cotton bath runner, forcing you to run out to the store and buy a new one. There, you run up a bill of $85 because besides a rug and some cold medicine, you also need some thread to fix the run in your stockings and some tissue for your runny nose and a carton of milk because you've run through your supply at home.

Interestingly, the 'run' has not always been the word with the most meanings. When the Oxford English Dictionary's first edition came out in 1928 (after 70 years of editorial research), the longest entry belonged to the word 'set.' Even today, 'set' has some 200 meanings, beginning with 'put, lay, or stand (something) in a specified place or position,' and continuing on for about 32 pages.

The point is that words can have a variety of meanings depending on context relative to use, location, and time. It is interesting to note that in Computational Linguistics, which is the field of science that utilizes computational methods to process natural language (e.g., Siri, Alexa, etc.), ambiguity is generally regarded as problematic.

Think of it – how do you write code that allows a machine to interpret the meaning of the word 'run' if there are 645 potential usage cases? This phenomenon is referred to as word-sense disambiguation. It focuses on identifying the recognition patterns that help the computer algorithm determine which meaning is the right one. So, from our current technological standpoint, ambiguity has been regarded as a major challenge.

Let us consider an example of ambiguity in the formation of a function statement as one would apply in Function Analysis. Let us assume that we are considering the function of a concrete slab foundation for a building. One of the functions of this might be to "Distribute Load." The number of meanings of the verb "Distribute" include:

1. to give or deliver (something) to people
2. to deliver (something) to a store or business
3. to divide (something) among the members of a group

The number of meanings of the noun "Load" include:

1. something lifted up and carried: burden
2. the quantity of material put into a device at one time He washed a load of clothes.
3. a large number or amount They collected loads of candy on Halloween.
4. a mass or weight supported by something
5. something that causes worry or sadness That's a load off my mind.
6. a charge for a firearm
7. an amount added (as to the price of a security or the net premium in insurance) to represent selling expense and profit to the distributor — compare
8. to put a load in or on rabbits were loaded with…pyruvate by intravenous injections—Experiment Station Record
9. to weight (as a test or experimental situation) with factors influencing validity or outcome
10. to change by adding an adulterant or drug

Mathematically, there are a total of 30 (3 x 30) possible meanings or associations of the function "Distribute Load."

Next, let us consider a possible function of a switch, "Break Connection." The number of meanings for the verb "Break" include:

1. Weaken
2. Diminish
3. Injure
4. Fall
5. Domesticate
6. Change
7. Turn
8. Damage
9. Change Integrity
10. Divide
11. Check
12. Develop
13. Break Off
14. Interrupt
15. Deaden
16. Break Down
17. Change Voice
18. Go
19. Lick
20. Destroy
21. Diphthongize
22. Disrupt
23. Pause
24. Tell
25. Get Out
26. Outstrip
27. Penetrate
28. Become Punctured
29. Detach
30. Crumble
31. Bust
32. Disunite
33. Shoot
34. Modify
35. Exchange
36. Express Feelings
37. Give Way
38. Founder
39. Appear
40. Scatter
41. Take Flight
42. Get Away
43. Change Direction
44. Impoverish
45. Designate
46. Split
47. Invalidate
48. Break Away
49. Ruin
50. Disrespect
51. Trespass
52. Come About
53. Emerge
54. Violate
55. Quit
56. Give Up Habit
57. Vary
58. Finish

The number of meanings for the noun "Connection" include:

1. the act of linking together *connection of the pipes*
2. the fact or condition of having a link : relationship *There's no connection between the two incidents.*
3. a thing that links *hose connections a telephone connection*
4. a person having a relationship with another by kinship, friendship, or common interest *He was able to get tickets through his connections.*
5. a social, professional, or commercial relationship
6. the act or the means of continuing a journey by transferring (as to another train)

There are total of 348 (6 x 58) possible meanings or associations for the function "Break Connection."

Based on observations in my personal practice of the technique of Function Analysis, I have witnessed a great deal of discomfort when it comes to the ambiguity of function statements. I suspect that this is largely because we are conditioned to find the "correct answer" and we often struggle with ambiguity because it may lead us to the "wrong answer." The pragmatist within us is also concerned that we may indeed waste time; that our "creativity" may be too broad; and that the results will likely generate ideas that are ultimately useless.

Conclusion

Function Analysis is a powerful tool in helping people overcome, or at least reduce, this preference for convergent thinking by changing the context of problems by leveraging the concepts of framing and ambiguity. This is the belief of the author and it is not supported by scientific evidence. What is needed is data to either support or reject this supposition. I would like to offer a challenge to our friends in academia to consider the following questions:

- Does framing problems using the Function Analysis approach improve divergent thinking?
- Do ambiguous problem statements aid in creativity?

Hypothesis

The technique of Function Analysis uses function statements, composed of a verb and a noun, which describe what things do rather than what they are. This technique changes the context of problems and leverages the principle of ambiguity. This in turn leads to a greater potential for innovative solutions than traditional, object-based thinking.

Possible Tests for this Hypothesis

A relatively simple test could be designed that asks people to identify as many solutions as possible within a pre-determined period of time using the following framing techniques:

1. Object-based framing
2. Activity-based framing
3. Function-based framing
    a. Basic level
    b. Higher-order levels of abstraction
4. Some combination of these – for example, if you start with:
    a. "Let's try to improve this hammer. How can we do this?" – Object-based
    b. "Let's try to come up with a better way to drive nails." – Activity-based
    c. "Let's try to come up with ways to deliver force." – Function-based (basic)
    d. "Let's try to come up with ways to connect materials." – Function-based (higher-order)

Outcomes could be potentially measured in the following ways:

- Quantity of ideas generated per approach (easy)
- Utility of ideas generated per approach (harder)

The author would be very interested in engaging with anyone interested in developing a formal test of this hypothesis.

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