The Tetrix – A User Friendly Variation on the Viable Systems Model

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Abstract

The Viable Systems Model (VSM) is powerful, but is not simple and 'user friendly' because in Stafford Beer's own words, "…the squiggly lines…" make it look complicated. The Tetrix is a tetrahedron based model that captures the VSM in a form that matches the typical human cognitive processing capacity.

The 'six wise men' of Rudyard Kipling; who, what, where, when, how and why; are mapped on to the Tetrix to demonstrates both its fundamental effectiveness as a model, and, also, a means to see which of these questions is being addressed by the components of the VSM.

Future work will explore implicit aspects of the VSM that can be more readily identified when using the Tetrix. Combined with the VSM's recursive nature and the Cynefin model it will be shown how emergent properties can allow a single model to be applied to everything from physics to sociology.

Keywords 1

Viable Systems Model, Tetrix, emergence

1. Introduction

In the early days of Systems Thinking and Cybernetics there was an interest in what was necessary to make a system 'self-sustaining'. The focus was on being able to design human organisations that mimic the effectiveness of natural systems. For example, living beings can grow and adapt to their environment, as well as reproduce. The search was on for the simplest model that explained what makes living things viable.

Stafford Beer proposed the Viable Systems Model (VSM), which captures the required sub-systems and their interactions, such that the overall system can absorb and adapt to variety arising from the environment. The model has six components; system 1, system 2, system 3, system 3*, system 4 and system 5. Each of these systems has a distinct and essential role to play in making a (meta)system viable. For example, system 1 is the system that "does the doing"; the part that we often focus on when we look at system dynamics; relegating the rest to the 'control system'.

Looking at a single layer of the VSM the interconnections between the six systems is manageable. However, one of the key features of the VSM is its recognition that a viable system is composed of smaller viable systems. For example, a human is a viable system, and each organ within them can be viewed as a viable system, as can each cell within each organ. To show the collection of recurring VSMs interacting resulted in "squiggly lines". In Stafford Beer's hand drawn diagrams there are many more "squiggly lines" than are typically drawn on a more sanitised version found in most illustrations of the VSM. Stafford Beer even chose not to show many of the "squiggly lines", as the figure could become an overwhelming fog of interconnections.

The VSM is powerful, but is not simple and 'user friendly' because in Stafford Beer's own words, "…the squiggly lines…" make it look complicated [1]. The temptation to make the VSM 'user

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friendly' would be to just take away the 'squiggly lines'. However, the 'squiggly lines' are the source of the power of the VSM. What is needed is a way to turn Stafford Beer's model (shown a slightly simplified form in figure 1) into something that can be built from an image in your head, or better still held in the palm of your hand.

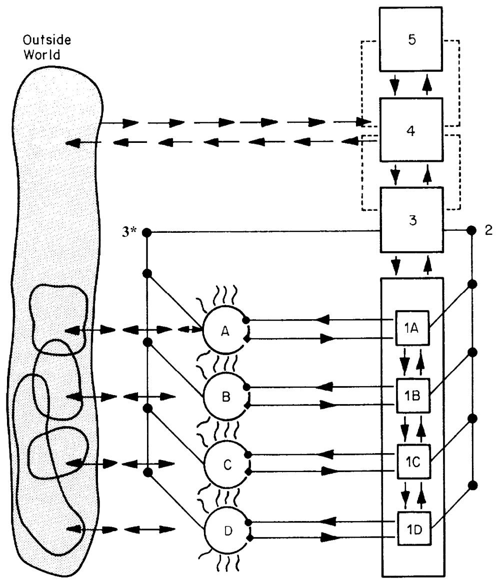

Figure 1 - A simplified version of the VSM

What is needed is some guidelines that aid the human mind to more readily assimilate the VSM and yet retain its richness and power. This paper proposes a new 'user friendly' construction of the VSM that both simplifies its understanding and, also, reveals some of the implicit characteristics. This paper is only an introduction to the model, as with VSM it cannot be compacted into a single conference paper.

2. Designing the User-Friendly Interface to the VSM

In engineering designers like rules to design, it means bridges stay up and ships float. When it comes to less concrete constructions, we can use axioms to guide us. The only guidance we have for which axioms to use are ones that have survived the test of time; usually from famed intellectuals of the past.

The first axiom is "Everything should be made as simple as possible, but not simpler", accredited to Albert Einstein. In an effort to make something more user-friendly simplicity is key. Thus, the challenge is to represent the VSM in a simpler form that does not lose its powerful 'squiggly lines'.

The second axiom is "All systems are polyhedrons", which was an assertion of Buckminster Fuller. Stating that a system can be modelled by a many-sided figure seems near oxymoronic. However, as with all axioms it is more powerful when combined with another and that is where to start. Using the first axiom, we should be looking for simplest polyhedron that explains the VSM.

The simplest polyhedron is a line, but that is unlikely to be able to hold the complexity of the VSM in any meaningful way. A line is the simplest closed system, purely A interacts B. This is the simplest closed system, and the environment is explicitly noted in the VSM.

The simplest 2-dimensional polyhedron is the triangle. This has some promise as tessellation should cover any shape. It is the simple closed system 2-dimensional line with a third point for the environment. Figures 2 to 4 show how the VSM can be tessellated and reduced to a single triangle.

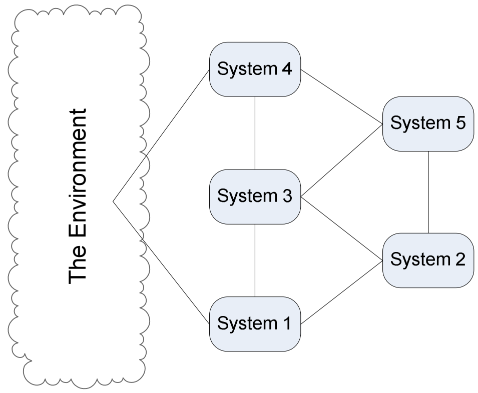

Figure 2 - A tessellated simplified VSM

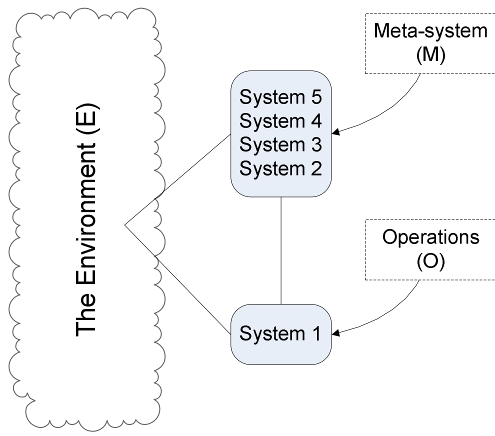

Figure 3 - A reduced VSM tessellated

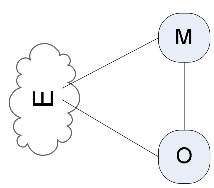

Figure 4 - The VSM as a triangle

This would suggest that the triangle is a promising candidate as a user-interface for the VSM. Indeed, a strong case could be made that this represents the 'ideal VSM' in a stable environment. However, the power of the VSM is that it represents the real world, which is unstable and where a viable system must adapt to the changes in the environment; the process referred to as heterostasis. To engage with heterostasis we need another 'system' that represents all the potential states a VSM could become. We could, again, create a multitude of 'potential systems'; however, it is easier to represent them as a single collective supra-system. This adds a fourth element (P), which creates a simple acronym for remembering the component systems: POEM.

How can we maintain the simplicity of the triangle, yet capture the potential for change as well as the core three aspects of the VSM? Not only do we have a fourth component, but it must be connected to all the other components. For this we need to leave the strictures of paper and look in 3-dimensions. The simplest 3-dimensional polyhedron is the tetrahedron; the solution to the old riddle of how to make 4 triangles with 6 matches. Within the strictures of 2-dimensional media the Tetrix can be show in the figure below (figure 5).

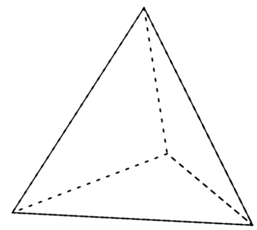

Figure 5 - A tetrahedron as a foundation for the VSM

3. A User-friendliness Test

Having established the model a litmus test should be applied to confirm that it is "user-friendly". A blunt test for this is whether or not the model is within the easy information processing space identified by George A. Miller; or the magical number 7 (±2) [2]. To meet Miller's criterion the model should have between 5 and 9 parts.

This model consists of 4 vertices and 6 edges, a total of 10 parts. That indicates that the model is too complex. Perhaps if we reconsider it as 4 faces plus the total system it would have 5 parts; indicative of it being readily processed by the human mind. In addition, each face has 3 vertices and 3 edges; a total of 7 including the face.

Whilst this has not conclusively shown that the model is 'user-friendly' it is more digestible than a typical diagram of the Viable Systems Model that has a dozen vertices plus all of the various interconnections. It is that explosion of possibility in the VSM that overwhelms people's information processing abilities, which the Tetrix provides by creating layers for the mind to create a hierarchy for the whole VSM model. This layering, also, reveals types of recursion not conspicuous in the original, however, this will be reviewed in more detail in future work.

4. A User-effectiveness Test

Returning to the axioms the model must be tested to ensure it is not "too simple". The purpose of a model is to provide the user with ability to predict the behaviour of whatever system is being modelled. From a linguistic perspective a model must ask and answer questions. The most common set of questions was made famous by either Shigeo Shingo or Rudyard Kipling and are known as 5W1H or:

1. Who,
2. What,
3. Where,
4. When,
5. Why, and
6. How.

Looking at these in a slightly different order each part of the Tetrix can be associated with one of the questions. "When" covers the entire Tetrix; time encapsulating the entire system. The VSM is not noted for identifying time dependent criteria, however, we can use it for testing a system state and how it viable it is, or was, over time.

"Why" is the purpose of the system and is embedded in the vertex that represents the 'meta-system' that includes systems S3, S4 and S5. Notionally, it is found in S5, however, S3 and S4 must implement and interpret the purpose of the system. The purpose of the system is either defined by the modeller and thus the vertex becomes the anchor for examining the rest of Tetrix.

"Where" is one of the other vertices. This represents the context, or environment, of the system. This creates an open system, without which we could return to the triangular model that would represent a closed system. The entire environment is represented here and this one implicit area of recursion that Stafford Beer did not explore in any depth. In part, this is likely to be due to his recognition that the environment is composed of other (viable) systems. This paper does not explore this further, but it shall be the subject to future publications.

A third vertex represents "How" things are, were or can be done. This is the vertex that was introduced to show the potential of the system, most notably of S1. This is implicit in the original VSM and represents some of the interactions between S3 and S1, but most significantly between S4 and S1. This paper does not examine this in greater detail; however, this will be the subject of future publications.

The final vertex represents "Who" and the edge connecting it to "How" combines with the two vertices to represent the agency of S1. This 'edge' encapsulates the current and all other states of the system. This is the area that tools such as Failure Modes and Effect Analysis can be applied. This is another hidden feature of the VSM that will be explored further in the future.

The "Where" vertex is connected to the "Who" vertex by an edge that represents "What" is being done. This edge, and to an extent the face including the 'How' vertex, represents the process that involves the transformation of inputs and exchange/outputs with the environment. We could capture this in an IDEF0 diagram, but would need to recognise that some of the signal and noise would be coming from the meta-system, or the 'Why' vertex.

Whilst there are more questions that can be asked, at least 6 more, this demonstrates that the model provides a framework that creates a simpler way of conceptualising the VSM and that maps the key questions asked when constructing models. The mapping of the questions, also, provides an introduction to the power of the VSM that is not immediately apparent in Stafford Beer's original VSM.

5. Future Work

Stafford Beer published a multitude of books and papers on the VSM; and future work on the Tetrix will go on to show how all of this work is encapsulated in the Tetrix. In addition, future work will show many implicit features of the VSM that are often not discussed because of the apparent complexity of the VSM disguises them.

Other future work will combine the principle of recursion and the power of the Cynefin model to create a cohesive framework that links physics to biology to psychology to sociology. This will show how each new level, or field of study, is created by the emergence of a new meta-system and new models to examine the behaviour of these new meta-systems. However, it will clearly show how these models are composed of the models from the layers below, but with emergent behaviour. In addition, it will provide a rationale for applying models across levels; for example, applying physics models to sociology.

As it is based on the VSM future work on the Tetrix will be extensive. This work will involve exploring how to explain the VSM in a User-friendly way to new people, as well as delving into some of the implicit features of the VSM that seasoned practitioners may not have seen. The ultimate goal will be to make the VSM a first choice tool when creating new models.

6. Acknowledgements

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7. References

[1] Beer, S., 2000. The Heart of Enterprise. Chichester, Sussex: John Wiley & Sons, p.546.

[2] GA Miller - Magic Number 7 (The Magical Number Seven, Plus or Minus Two Some Limits on Our Capacity for Processing Information); Psychological Review Vol. 101, No. 2, 343-352