FEAR & GREED – A Political Archetype

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Abstract: *A novel archetype, abstracted from published work and supported by anecdotal analogies is proposed. Its novelty is evidenced by a comparison with the 'Relative Control' archetype from Wolstenholme's classification. The significant difference is the inclusion of the whole structure within the system boundary. The effect is to create a 'political' archetype: a structure representing the struggle between two opposed policies.*

Introduction

Archetypes (and their precursors, generic structures) have been of interest to system dynamicists for many years, gaining notoriety from their wide use in The Fifth Discipline [Senge, 1990] and being treated more formally in Wolstenholme's classification [Wolstenholme, 2003]. Archetypes "were introduced as a formal and free-standing way of classifying structures responsible for generic patterns of behaviour over time" [Wolstenholme, op.cit.]. The varied uses of archetypes in modelling and in thinking about systems are well developed in papers such as [Lane & Smart, 1996], an article devoted to 'generic structure', whose argument can be applied equally well to archetypes and in [Wolstenholme, 2004].

This paper draws on "The Cycling of a Decision Threshold: A System Dynamics Model of the Taylor Russell Diagram" by E. Weaver and G. Richardson presented in a poster session at the 2001 SDS Atlanta Conference and on "Threshold Setting and the Cycling of a Decision Threshold" by the same authors presented as a parallel session paper at the SDS Palermo Conference [Weaver & Richardson, 2002] to develop an archetype, FEAR & GREED, that is a distinctive variation of the Relative control archetype proposed in [Wolstenholme,2003]. The reader is encouraged to read the papers by Weaver & Richardson, in particular [Weaver & Richardson, 2002] for a masterful presentation of the social theoretical basis of the archetype (which is only summarized in the present paper) and to appreciate the possible breadth of its application in many dynamic contexts.

The contributions of this paper are to make the structure of the archetype explicit, to relate the archetype to previous work on archetypes as such, to present the reasons for considering it as a new archetype to be added to Wolstenholme's classification and to describe several contexts, not explicitly mentioned by Weaver & Richardson in their publications, that could use this archetype to aid in developing or explaining models of specific issues.

Origins of the "FEAR & GREED" Archetype

The seminal idea of the "FEAR & GREED" Archetype was presented in [Weaver & Richardson, 2001] which considered the case of university admissions decisions based on threshold values for SAT scores. Such a threshold value could change over time under pressure from constituencies 'concerned with maintaining academic standards' (seeking to exclude those with low potential for success but high scores) versus those 'concerned with unfair disadvantage' (seeking to accept those with high potential but low scores). The objective of the paper was to 'elucidate the essential structure required to reproduce the moving threshold' with special emphasis on the 'cycling' or oscillation of the threshold in response to the opposing pressures described above.

Further clarification of the archetypal structure as well as confirmation of the usefulness of such an archetype was provided by [Weaver & Richardson, 2002]. In that paper, adroit use of prior work in social theory [Brunswik, 1956; Hammond, 1996] was applied to a specific situation: the use of a threshold of evidence to support a judgment of 'reasonable suspicion' by a police force to decide whether to search, or not, an individual encountered during a routine patrol. The authors clearly presented the opposing pressures exerted by constituencies sensitive to civil liberties (seeking to raise the threshold in order to reduce the number of innocent people searched) versus those more sensitive to security issues (seeking to lower the threshold in order to reduce the number of guilty people overlooked). They developed a basic model of the variation over time of the threshold and the basic model was extended to three subsequent models that included three different delay mechanisms, each of which generated the 'cycling' behaviour mentioned in the title.

The core of the argument for the basic structure rests on four characteristics derived from prior work [Brunswik, 1956; Hammond, 1996] cited by Weaver & Richardson:

- An ***event of interest*** that is not directly knowable
- An ***indicator*** that is used as a proxy for the event of interest
- The ***statistical uncertainty*** of the link between the indicator and the event of interest
- A ***value-based threshold*** (rather than a fact-based threshold) of the indicator is used to make a dichotomous decision (accept/reject, guilty/innocent)

From results reported in these papers, it became clear that the essential structure described there – two feedback loops acting to control the threshold value of an indicator with delays in either or both of the loops –was a compact representation of the dynamics at play in other situations. Thus the structure was a candidate for consideration as an archetype: the essential structure would be an example of Lane & Smart's ***canonical situation models*** [Lane & Smart, 1996]-a model that summarizes the essential features of a dynamic structure found in various situations. To confirm the candidate as an archetype, it produces a limited range of typical behaviours namely damped oscillations that are also characteristic of the 'canonical situations'. As will be seen below, the "FEAR & GREED" archetype resembles previously defined archetypes while presenting some distinctive features that justify its description as a 'political' archetype.

Making An Archetype

Social systems are fields of civilized battle for opposing policies. They are political systems in the most fundamental sense of the word. The "FEAR & GREED" Archetype contains the essential features of a political archetype: the opposing political pressures that arise to control a decision threshold that touches deeply held values. There is much evidence of these pressures: in the multitude of election campaigns for everything from the proverbial town dog-catcher to the more august posts of president or prime minister, in the even more numerous efforts by polling firms to determine the moods, the intentions and the intensity of interest of a population about everything from deodorant purchases to national constitutions, and in the incessant drumbeat of conflicting editorial and private opinion on subjects of public interest. These pressures are represented in Figure 1 as the first step in constructing the archetype.

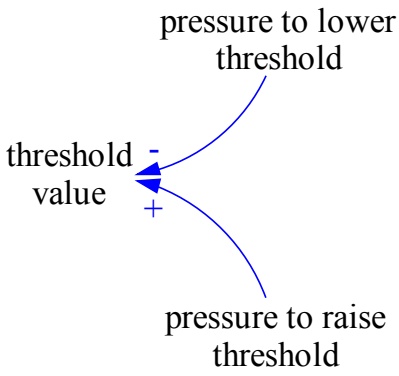


Figure 1: Causal diagram of opposing pressures on the decision threshold

The political nature of the archetype is represented by the distinct, opposing pressures to move the threshold in directions preferred by distinct groups holding opposed views of the desired value of the threshold.

Figure 2 displays several examples of thresholds and the opposing pressures that affect them. With no attempt to be exhaustive in providing evidence, this paper asserts that there is much anecdotal evidence that political systems (in the broadest sense) operate in such a way as to determine currently acceptable (value-based) decision thresholds, and this in an environment formed by ignorance, error and uncertainty, that is, the first three characteristics mentioned above. This assertion is simply a re-statement of Hammond's insights [op. cit.].

Domain	Loan approval	University admissions	Policing
Event of interest	Scheduled repayment	Successful alumni/ae	Guilty verdict
Indicator (threshold)	Credit-worthiness score	SAT scores	Number of suspicious behaviors
Pressure to lower threshold	Make more loans (greed)	Admit more students/ More opportunity	Arrest more suspects/ Get tough on crime
Pressure to raise threshold	Make better loans/ Fewer losses (fear)	Admit better students/ Keep standards high	Arrest fewer suspects/ Support civil liberties

Figure 2 Examples of thresholds and the opposing pressures that affect them

To complete the causal loop diagram of the archetype, we must specify the causal determinants of these opposing pressures driven by the current value of the threshold. In social systems, these determinants are not as clear as they are in physical systems that 'cycle' or oscillate. The (current value of the) threshold is used to make decisions and the results of these uses of the threshold affect perceptions and thus affect reactions to the (current value of the) threshold, i.e. affect the pressures

to change the threshold. These opposed perceptions were at the heart of the public security case presented in [Weaver & Richardson, 2002].

In many cases, such as those sketched in Figure 2, it seems evident that the opposing groups are animated, perhaps even defined by their perceptions of the 'errors' that arise from using the (current value of the) threshold. These 'errors' are due entirely to the 'irreducible uncertainty' inherent in these political situations.

Thus, to complete the two feedback loops that encompass the threshold-setting dynamics, we need to use the first three characteristics underlying the basic structure to represent the 'irreducible uncertainty' present in political decision-making when applying (the current value of) the threshold. The following points will clarify the meaning of these characteristics:

-An event of interest is an observable outcome of interest that is unknowable at the time that the threshold-decision is applied. For example: the successful completion of a degree several years after an admission decision is made, the successful (and ultimately correct) conviction of an individual who was searched (and arrested) months or years earlier, the bankruptcy of an individual who, years earlier, was refused a loan…

-An indicator is the resultant assessment of currently available evidence that is presumed to be relevant to the event. For example: SAT scores combined perhaps with recommendations and other evidence of academic potential; the demeanour of an individual when questioned by a police officer perhaps combined with the observed actions of the individual before being stopped; the evaluation of the net assets of an individual perhaps combined with an assessment of credit rating, employment history, etc.

-The statistical uncertainty surrounding the event (the outcome of interest) is a consequence of ignorance (the decision-maker cannot predict the future) and error (the indicator does not predict the outcome perfectly even if the outcome were close in time to the decision).

The statistical uncertainty of the link between the event of interest and the indicator means that there will be two types of errors committed

- False positives: accept, go, guilty,… when the correct decision would be reject, no go, innocent,…
- False negatives: reject, no go, innocent,… when the correct decision would be accept, go, guilty,…

Hammond represents the outcomes of judgments or decisions as a Taylor-Russell diagram in a two-dimensional space of indicator values and true event values [Hammond, 1996]. Figure 3 represents these characteristics for a hypothetical example of the loan approval case. The horizontal axis represents possible values of the indicator, credit-worthiness scores; the vertical axis represents possible values for the event, success in repayment of loans (amounts delayed or in default). A minimum value of the indicator for credit-worthiness is the current threshold value, represented by a vertical line; a minimum value of the success in repayment is the current criterion value for the event, represented by a horizontal line. The 'cloud' of points represents the population of potential customers (debtors). Note that the cloud may be derived from historical data with the assumption that the population of potential customers has the same distribution of characteristics as the data used.

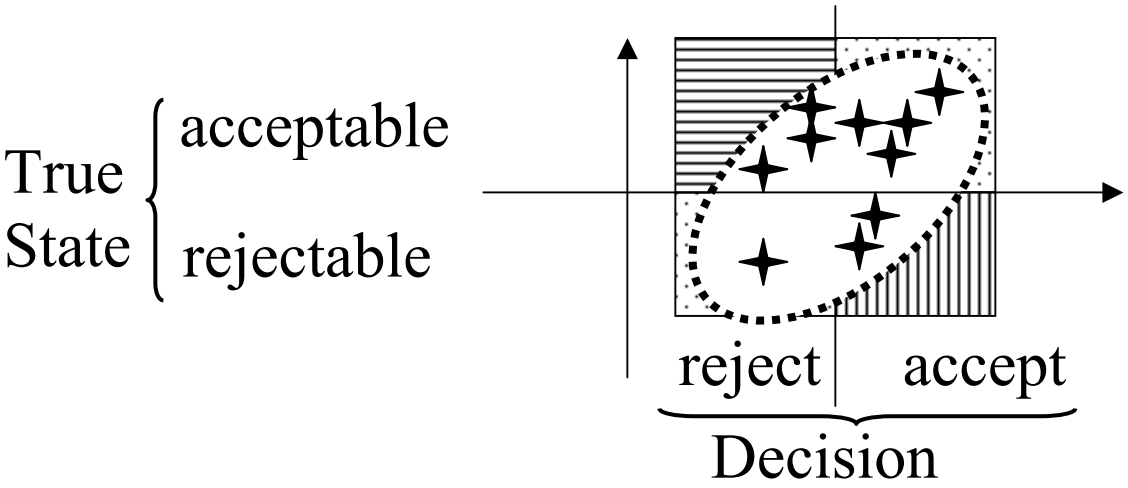


Figure 3: Taylor Russell diagram of a hypothetical loan approval case

In Figure 3, the upper-right and lower-left quadrants represent correct decisions, respectively: loans granted to successful customers-those who repay their loans on time, and loans refused to unsuccessful customers –those who become less credit-worthy or bankrupt.

The lower-right and upper-left quadrants represent incorrect decisions (errors): loans made to ultimately unsuccessful customers (false positives) and rejection of ultimately successful customers-those who improve their credit rating (false negatives). The well-known concepts of Type I and Type II errors, encountered in statistical hypothesis testing, are analogous to the decision errors represented by false positives and false negatives respectively.

Other terms have been used for the same concepts, notably false alarms and failed alarms. Figure 4 shows interpretations of false positives and false negatives for a number of hypothetical applications of the archetype under discussion.

Domain	University admission	Policing	Loan approval	Investment financing	Problem diagnosis
Criterion	Grade-point average	Guilt or innocence	Repayment on time	ROI	Problem X is present
Threshold	SAT scores	Sufficiently suspicious behaviour	Credit rating	Hurdle rate	# of symptoms
False +ves	Admitted Homer Simpson	Arrested Mother Teresa	Approved a deadbeat	Enron, Worldcom,..	DiagnoseX but X is not present (false alarm)
False -ves	Rejected Einstein	Did not arrest Scott Peterson	Rejected Bill Gates	Google, Dell,…	Did not diagnose X but X is present (failed alarm)

Figure 4: False positives and false negatives in hypothetical applications

Using the vocabulary of false positives and false negatives in various situations, we recognize that there is a positive causal link from these factors to a pressure to increase the current threshold and a pressure to decrease the current threshold, respectively. Evidently an increase in each of these

pressures will have opposing effects on the threshold. Finally, to complete the causal loop diagram of the archetype, we note that an increase in the threshold (moving the vertical line in Figure 3 to the right) will lead to a decrease in false positives and an increase in false negatives. By this reasoning we arrive at a CLD for the archetype (Figure 5).

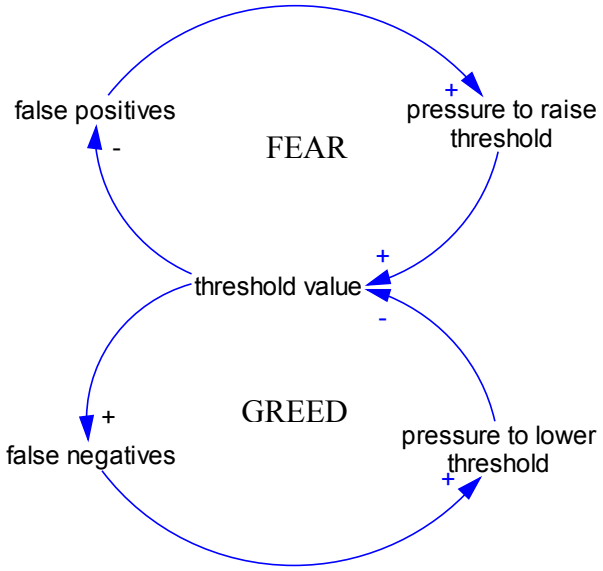


Figure 5: The causal loop diagram of the FEAR & GREED archetype

The name of the archetype was chosen on the basis of 'financial' examples like the loan approval case in which it is common to associate 'FEAR of loss' with excessive false positives and 'GREED for gain' with excessive false negatives. As shown in Figure 4, columns 3 and 4, the interpretation of the loops of the archetype in these cases and similar ones seems natural. It is claimed that similar interpretations can be found in the other cases where the 'values' involved are not purely financial[1].

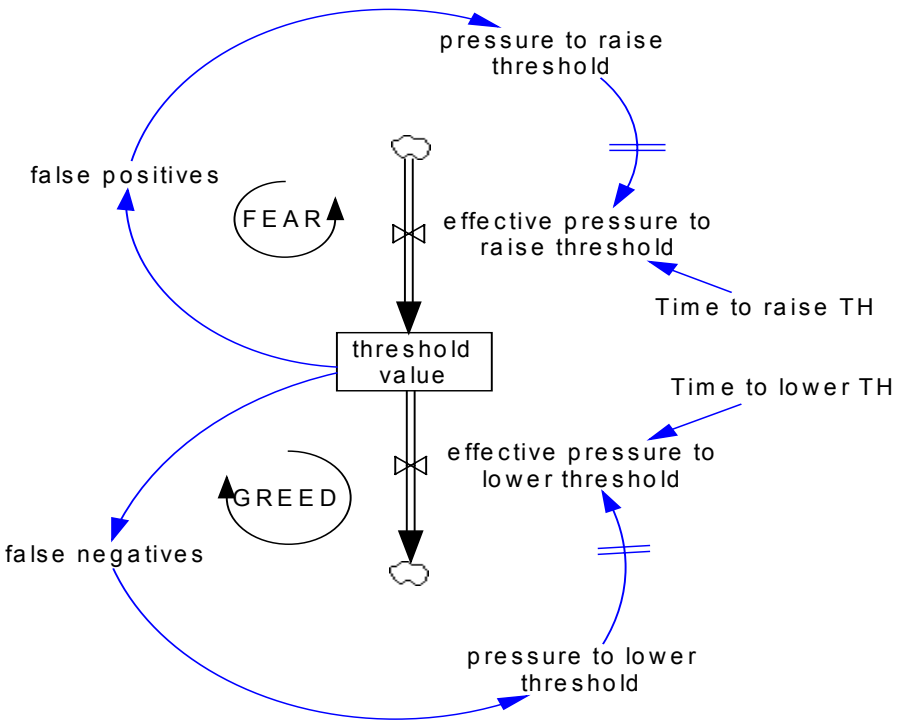
Behaviour of the archetype

Figure 6 shows the archetype as a generic model[2]. Delays have been inserted between the pressure variables and the corresponding rates that move the threshold value. A Vensim program of the model is included as an Appendix. The behaviour of the model developed by Weaver & Richardson was shown to have the following characteristics:

- Convergent if no delays in either feedback loop

- Oscillatory ('cycling') if delays or accumulations are present in one or both loops

The model in Figure 6 reproduces these behaviours. See [Weaver & Richardson, 2002] for more extensive tests of alternative structures.



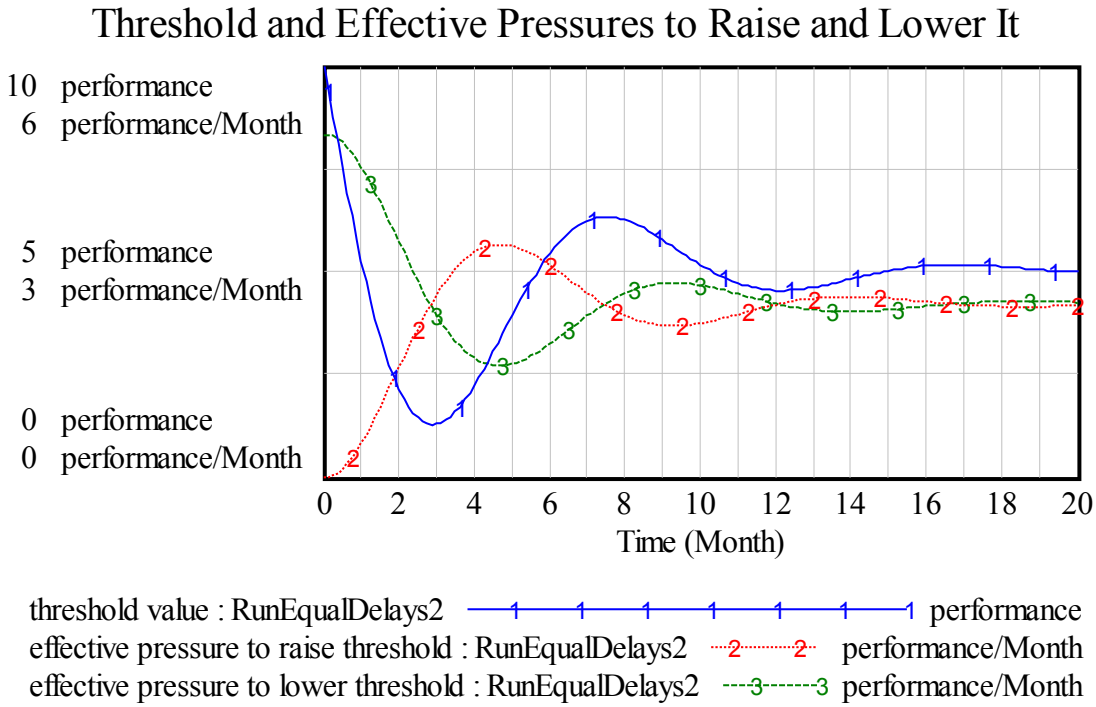


Figure 6: Stock & flow diagram of the FEAR & GREED archetype and a behaviour mode

Comparing the Archetype to Wolstenholme's Classification

Wolstenholme [Wolstenholme, 2003] forcefully argues for the classification of system archetypes [Senge, 1990; Wolstenholme, 1990] into four groups as a means of codifying the structures that give rise to many dynamic problems and corresponding structures that provide solutions. This classification describes four basic structures composed of two interacting feedback loops each of which is either of Balancing ('negative', 'goal-seeking') or Reinforcing ('positive', 'growth') type.

These four classes subsume the entire set of archetypes proposed by Senge [Senge, 1990], which are associated with the new classes as ‘semi-generic archetypes’. A characteristic of this classification is the emphasis on the basic structure that generates ‘intended’ consequences in one of the loops and ‘unintended’ consequences in the other loop, with the ‘unintended’ consequences being produced in a part of the system that is outside the ‘organizational boundary’ within which the ‘intended’ behavior is generated.

The classification also includes two sorts of archetypes: problem and solution versions that emphasize, respectively, the use of archetypes for conceptualizing a dynamic problem or its components and for assisting in the implementation of measures to improve the behaviour of the system.

The archetypal structure in Wolstenholme’s classification that is similar to the Fear & Greed Archetype of Figure 5 is the Relative control problem archetype shown in Figure 7. In the causal-loop diagram, the upper loop represents the structure of the ‘intended’ behaviour of decision-maker ‘a’ to control the relative outcome for ‘a’: as the relative outcome approaches a goal set by ‘a’ (not explicitly represented in the diagram), the control action is reduced or changes in a direction opposed to the change in relative outcome and the effect on relative outcome is felt after a delay. The bottom loop represents the ‘unintended’ behaviour: the compromising reaction that appears after a delay opposes further change in the relative outcome for ‘a’. The system boundary that cuts across the lower loop represents the kind of boundary that Wolstenholme argues must be acknowledged in the model of the dynamic problem and dealt with in the solution.

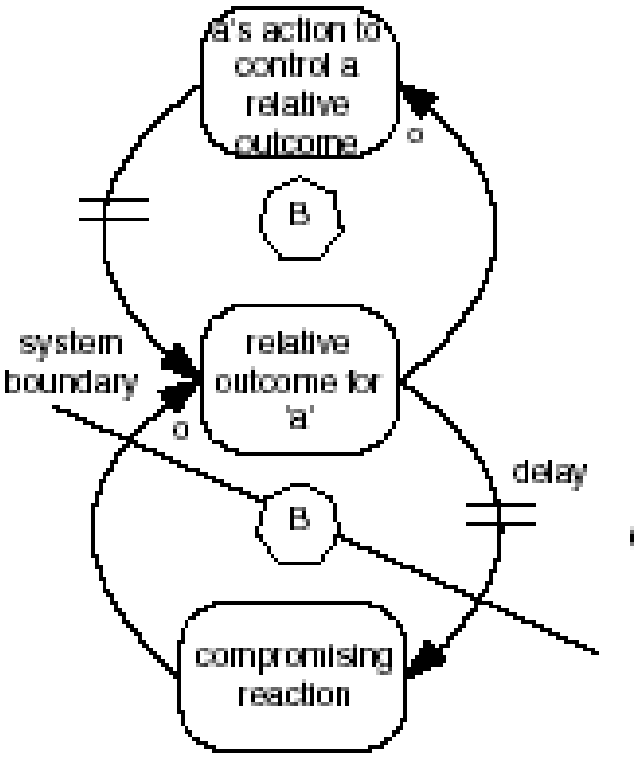


Figure 7: Relative control archetype [Wolstenholme, 2003]

In the following paragraphs we deal with similarities and differences between the Fear & Greed Archetype of Figure 5 and the Relative Control problem archetype of Figure 7.

Unintended consequences & Boundaries

As noted above, central to the definition of an archetype in Wolstenholme's paper is the inclusion of unintended consequences, which calls for inclusion of organizational boundaries that obscure the sources of the dynamic problem, and that must be dealt with in developing a solution. The boundaries may be more or less 'opaque' and the author argues cogently for their importance and the necessity of dealing with them explicitly.

While not denying the importance of organizational boundaries, this paper argues that there are many cases, especially in the public policy sphere, where "unintended" consequences are anticipated even if they are not always dealt with effectively. The difference in viewpoint may have as much to do with the relative efficacy of control that decision-makers in the private and the public spheres can exercise as it does with the relative levels of development of socio-political and organizational theory.

The FEAR & GREED Archetype deals explicitly with both sides of the pressures acting on the contested threshold thereby bringing into consideration at the problem-defining stage the major components of the problematic situation. This representation of a two-sided conflict makes the FEAR & GREED archetype a '**political archetype**' in which the problem of opposing views on policy is exposed, as distinct from 'decision archetypes' where the appropriate policy to guide decisions, and the links to support and incorporate that policy are paramount. The difference is one of designing policies in view of the opposing forces rather than in spite of them. It is a question for future investigation whether removing the boundary in the other three classes of archetypes would produce similar results of interest.

Two-loop structure

Both archetypes are similar in having two balancing loops but the dynamics of the corresponding semi-generic 'Relative control' archetypes, called 'Escalation' and 'Drifting goals', does not seem to encompass oscillations. As well, a significant difference with the 'Drifting goals' archetype lies in the focus of FEAR & GREED on the 'threshold value', a movable 'goal' that is actively manipulated, not simply 'drifting'.

Although delay markings are not shown on the FEAR & GREED archetype, it is shown in [Weaver & Richardson, 2002] that at least one loop must have a delay in order to generate 'cycling'. It is conjectured that the location of the delay(s) may be of little or no dynamic importance as is the case in generic production control models [Sterman, 2000; Yasarcan and Barlas, 2005]. It is a particular feature of the FEAR & GREED archetype that it provides a cogent causal explanation for oscillations in a variety of problem situations. Considering the importance of oscillations as one of the three main behaviour modes of dynamic system, it is useful to have an archetype that incorporates this behaviour explicitly[3].

Model examples

Although the presentation of model examples was not the objective of Wolstenholme's paper, the author did provide causal loop diagrams of well-known models in their essential form for all of the semi-generic archetypes that were classified into the four generic archetypes. The FEAR & GREED archetype was derived from reported descriptions of models of the university admissions case and the policing case. Figures 5 and 6 show the causal loop and dynamic structure of a model based on

the FEAR & GREED archetype. The generality of the concepts represented by the variables in the model suggest that the model is a candidate for inclusion in the set of 'molecules' of structure that are available for use with Vensim.

Conclusions

The contributions of this paper have been to make the structure of the FEAR & GREED archetype explicit, to relate the archetype to previous work on archetypes as such and to describe several contexts, not explicitly mentioned by Weaver & Richardson in their publications, that could use this archetype to aid in developing or explaining models of specific issues.

It is open to further study to determine if other useful 'political' archetypes can be developed to enrich the current library subsumed in Wolstenholme's classification.

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threshold value= INTEG (
effective pressure to raise threshold- effective pressure to lower threshold,
10)
~ performance
~ Model "without delays" can be formed by using 'pressure to (raise/lower) \
threshold' in place of 'effective' pressures in this equation.
|
effective pressure to raise threshold=
DELAY1(pressure to raise threshold, Time to raise TH)
~ performance/Month
~ |
Time to raise TH=2
~ Month
~ |
pressure to raise threshold= WITH LOOKUP (
false positives,
([(0,0)-(10,5)],(0,0),(2.5,1.25),(5,2.5),(7.5,3.75),(10,5)))
~ performance/Month
~ |
false positives= WITH LOOKUP (
threshold value,
([(0,0)-(10,10)],(0,10),(2.5,7.5),(5,5),(7.5,2.5),(10,0)))
~ errors/Month
~ |

effective pressure to lower threshold=
DELAY1(pressure to lower threshold , Time to lower TH)
~ performance/Month
~ |
Time to lower TH=2
~ Month
~ |
pressure to lower threshold= WITH LOOKUP (
false negatives,
([(0,0)-(10,5)],(0,0),(2.5,1.25),(5,2.5),(7.5,3.75),(10,5))))
~ performance/Month
~ |
false negatives= WITH LOOKUP (
threshold value,
([(0,0)-(10,10)],(0,0),(2.5,2.5),(5,5),(7.5,7.5),(10,10)))
~ errors/Month
~ |

Simulation Control Parameters
FINAL TIME = 20, INITIAL TIME = 0, SAVEPER = TIME STEP, TIME STEP = 0.125
~ Month
~ The final time, initial time for the simulation, the frequency with which output is stored, the time step for the simulation

[1] In the case of social systems, several acronyms based on the phrase 'FEAR & GREED' could be used to summarize the forces and activities underlying the dynamics of the structure, of which two are:
FEAR: Forces Erode Actual Reputation: the 'fear' is that lowering the threshold will destroy the reputation for high quality, high academic standards, high regard for civil liberties or other social norms and this fear provides the energy and the rationale to raise the threshold or to oppose lowering the threshold.

Alternative interpretations for F.E.A.R. are Frenzied Exploitation of Available Resources and Factors Eroding Available Resources where the 'fear' is that such exploitation or erosion, if allowed to continue without sufficient regard for matching resources with demands, will lead to an effective lowering of the threshold unless it is opposed.

GREED: Grasping REsponse to Expected Demand: the 'greed' is intended to increase the production of products or services such as useful products, educated students, civic safety and this drive or 'response' to reach for and grasp increasing demand for these outputs provides the energy and the rationale to lower the threshold or to oppose raising the threshold.
The reader is invited to invent other useful interpretations for 'FEAR' and 'GREED' that would be useful in describing the essential character of the two opposing feedback loops of the archetype.

[2] The model file (in Vensim) accompanying this paper provides, via a comment field, a means for adding an extra link between 'threshold value' and 'effective pressure to lower threshold' that serves to prevent the (nominal and arbitrarily-valued) threshold from going negative, if necessary. In a realistic application, the structure needed to keep a threshold value 'in bounds' would have to be modeled for the specific case and according to good practice.

[3] An archetype of a different class-the 'Out of control' problem archetype- can, in some cases, show oscillatory behaviour but its structure is composed of a Balancing and a Reinforcing loop. The semi-generic archetype of 'Fixes that fail' can represent cases where 'fixes' are applied repeatedly as they fail repeatedly to deal with the underlying problem.