ABSTRACT

Often maligned as a sign of weakness, indecision, or a lack of conviction; the flip-flop may be a viable alternative to the standard wisdom that there is one correct decision. This is particularly true in conditions of uncertainty or negative synergy. Often times, we know there are unintended consequences to decisions whether they be made through rational or heuristic methods. Perhaps we need to consider that changing our decisions openly may yield a good result. The paper examines when such an approach might be appropriate and how one goes about identifying the appropriate use of the flip-flop in the decision making process.

KEYWORDS: Decision Making models, synergy, negative synergy, utility function index, flip flop

INTRODUCTION

Selection of a course of action is often the result of following a deliberate decision or selection algorithm that results in a best choice among alternatives. Many expect their leaders to be decisive. Ideally, the leaders are seen as making correct decisions that are decisive and then diligently pursuing that decision to a successful implementation.

Indecisive decision makers may be perceived as being weak leaders if they flip-flop on issues. John Kerry, as a presidential candidate, made a comment saying he was against the Iraq War before he voted for it. His opponents made political hay from his highly characterized flip-flop on that reversed choice. At one point at the Republican Party National Convention, the delegates were shown waving pairs of flip-flop shoes whenever his name was mentioned. SpongeBob SquarePants makes Crabby Patties before he flips out in Flip-flop - a popular children’s game involving choice. The term flip-flop was originally suggested in 1919 by William Eccks and F.W. Jordan who invented the Eccks-Jordon two input electronics trigger circuit. The term flip-flop was associated with the sound made by two loudspeakers connected in the circuits during the triggering process between the circuits. (Eccks and Jordan) Major US Automobile manufacturers have had to flip-flop their position on fuel efficient vehicles after the price of crude oil skyrocketed and as stimulus money was injected into a program to remove clunkers from the highways. Medical doctors have announced that, contrary to previously
announced research, some childhood vaccines do not cause altruism. Although conventional wisdom would lead one to believe that a flip-flop is not desirable, this paper will investigate the prospect that the flip-flop is a viable alternative for decision making. The paper first establishes a historical perspective by looking at decision making in group settings, the effect of synergy upon those groups, and the perceptions and the role of perceived perceptions of risk in decision making. A utility model will then be introduced as a staring point for the remaining flip-flop discussion. And that utility function will then be expanded to include several distinct possibilities leading towards the flip-flop as another possibility involving group choices as an expansion of the decision making paradigm.

From the varied lexicology of the term flip-flop, it is essential to first establish what is meant by the term flip-flop. For the purpose here, a flip-flop is seen as a purposeful act that results in selective modification of potential outcomes to a situation requiring a group decision in the face of uncertainty and risk.

LITERATURE REVIEW

Traditional works dealing with groups do not normally consider situations where the group is uncertain as to the potential outcomes, especially in those situations where potential outcome could involve rapidly deteriorating situations that will be further identified and discussed as conditions of potential negative synergy. Of course, Von Neuman and Morgenstern have shown that it is possible to construct a set of values or utility functions for a particular consumer that can be used to predict choices in some uncertain situations. (Neuman, and Morganstein) However, continuing controversy about their work revolves around the ordinal or cardinal nature of their utility index.

Unfortunately, Von Neuman and Morgenstern utility functions are unrealistic when considering group behaviors. Their work assumes particular reactions are predictable to behavior which is considered to be a particular known consequence which is always known a priori. So, when considering group behavior, their analysis may prove to be unreliable.

This paper will now investigate this interesting aspect of human behavior and will develop a utility function that may be used to further describe situations or systems existing in an environment where negative synergy may exist. (Mathews) After a brief overview of general theories about groups, the concept of negative synergy will be introduced. It will then be followed by a discussion about flip-flops and finally a presentation of a utility function that could be the basis for future explorations of group decision activities when groups are risk avoiding, risk seeking, or are neutral in risk tolerance.

CLASSICAL MODELS OF GROUP DECISION MAKING

There are four widely accepted models of group behavior that may be applied to management decision making: the Rational or Classical Model, Simon’s Bounded Rationality Model, Vroom and Yetton’s Normative Model, and the Intuitive (or
heuristically based) Model. In addition, there are a number of protocols for enhancing group decision making activities; this section of the paper will discuss the four decision models and various suggestions for improving the efficacy of group activity.

The dominate model of group behavior since WWII has been the Rational Model. The model is based on the following eight steps:

1) identification of the problem
2) identification of the decision criteria
3) allocation of weights to criteria
4) development of alternatives
5) analysis of alternatives
6) selection of an alternative
7) implantation of the alternative
8) evaluation of the decision effectiveness (Robbins and Coulter, 2005)

The model is highly favored in statistical testing and quantitative decision making techniques which give the illusion of following a scientific approach. However, in reality, it has several inherent flaws. For instance, it assumes that the exact problem to be dealt with can be clearly identified. So, for example, according to the Rational Model, if the manager sees there is a problem with turnover in the organization, the model assumes that turnover is the problem to be solved rather than as a symptom of a larger problem within the organization. Possible errors in the identification of a problem can, obviously, lead to problems with the rest of the model since the original assumption in the eight step process may be erroneous. Other problems with the model lie in assumptions of rationality; that, for instance, assumes that there is only one single well defined goal to be obtained; all alternatives and consequences can be known; preferences are always clear and those preferences remain constant; there is unlimited time and monies available, and that a final decision can be an optimal decision. (Robbins and Coulter, 2013)

Problems with the Rational Model, led some, like Herbert Simon, a political scientist, to explore the limits of rationality in the model. Simon suggested, in his investigation of the model, that the Rational Model “leaves no room for regrets, second thoughts, or ‘weakness of will’.” (Robbins and Coulter, 2013) He suggested, instead, that business decisions are made under conditions of “bounded rationality.” (Robbins and Coulter, 2013) In this model of Bounded Rationality, the inherent flaws of the Rational Model are taken into consideration in the decision making process and suggests that managers make choices rationally, but are “bounded” by their inability to process the information required to make an optimal decision. Simon coined the term "satisfice" (Robbins and Coulter, 2013) to mean that managers, because of their limitations to process information, are not able to make an optimal decision, but merely a satisfactory and sufficient decision. (Robbins and Coulter, 2013)

The third widely accepted model of group behavior found in the business literature is the Intuitive or heuristically based model. The Intuitive model also points to problems in the Rational Model. For instance, Nutt said that when manager’s use the Rational Model to make decisions they “struggle to reach the 50% success mark.” (Robbins and Coulter, 2013). The literature suggests that the Rational model is being replaced by a more “holistic model”, a model that takes into account the threat of high decision costs, increased time constraints and more ambiguous, dynamic environments. The Intuitive Model suggests that manager’s make “gut” decisions or decisions based on past
experiences so they can “act quickly with what appears to be limited information.” (Robbins and Coulter, 2013) One study “revealed that almost one-third of (them) emphasized ‘gut’ feelings over cognitive problem solving and decision-making.” (Robbins and Coulter, 2013)

Finally, whichever the model followed, individual behavior is emphasized. Vroom and Yetton’s Normative Model is one of the few business models that emphasizes consultation and group dynamics. Vroom and Yetton based their group decision making model on the ideas that situational factors cause “almost unpredictable leader behavior”. (Robbins and Coulter, 2013). The authors explain that five different decision procedures are followed: two autocratic, two consultative and one totally group based:
A1: Leader takes known information and then decides alone
A2: Leader gets information from followers, and then decides alone
C1: Leader shares problem with followers individually, listens to ideas and then decides alone.
C2: Leader shares problem with followers as a group, listens to ideas and then decides alone
G2: Leader shares problems with followers as a group and then seeks and accepts consensus agreement.

Vroom and Yetton assumes that participation of those involved in a process increases acceptance of the results and that increased acceptance increases commitment to the resulting actions taken as a result of their decision. (Robbins and Coulter, 2013)

But even with the increased attention to participation by others in group processes, there are factors that suggest that the results of group activity are different than for individual activities. For instance, there “are some decisions which employees simply accept because they are indifferent to them.”. In addition, if there is little group commitment to a decision, then participation in the decision making process should be limited because it may impact the direction in which the decision maker wishes the solution to turn. (Holland and Nichols)

FORMS OF SYNERGY

Synergy is generally thought of only as a positive force in systems. However, as will be seen, negative forms may exist as well. Usually synergy is thought of as a positive force, as getting more done with less. In reality, synergy is found abundantly in a variety of natural systems. The idea that the whole is somehow greater than the sum of the parts of a system is divergently applied universally across such disciplines as engineering, medicine, chemistry, marketing, managerial leadership, psychology, and sociology. The benefits of shared energies are apparent. For example: a monkey and a gorilla stand under a banana tree each hungry for a piece of ripe fruit. Neither can reach high enough to gather it in. But, if the monkey stands on the shoulders of the gorilla, they can accomplish together what neither of them could have accomplished alone.

Doctors know that certain medications are useful in treating diseases. A person who is diabetic may reduce the risk of death through damage to their heart, liver, eyes, nerves and kidneys by taking insulin injections. Or the patient may reduce the risk of death through blood clots which can induce strokes and heart attacks by simply taking a
children’s strength dose of aspirin every day. But when both are taken together, the risk of death is dramatically reduced to levels that greatly enhance longevity.

A business that has a potential advertising budget of two million dollars might spend the entire amount on magazine ads and expect to gain an additional five million dollars in revenue. Or they may elect to apply the increase to their personal selling budget by that amount and obtain a four million dollar increase in revenue. But the more powerful result might be to apply one and a half million to advertising and the other half million to personal selling with a resultant increase of revenue of twelve million dollars. Why? The marketing manager would say that each promotion method reinforces the other. But, in reality, this is but an excellent example of synergy. The whole is greater than the sum of the parts.

Synergy has an important place in all aspects of systems theory as seen in science, medicine, and business. Understanding when and how to apply synergistic relationships may be a key success factor for many business and industrial leaders.

On the other hand negative synergy may be thought of as the logical opposite of (positive) synergy. What is often not as well recognized nor appreciated is this reverse effect: negative synergy which represents a condition where the sum of the subsets of a system is less than the sum of the whole. But this negative synergy concept, too, has widespread but under-recognized applications. For example, the loss of a right eye has serious consequences. The beholder may lose peripheral vision, there may be a loss of depth perception, and some disfigurement may exist. Likewise, the loss of a left eye may result in similar serious consequences: the beholder may lose peripheral vision, there may be a loss of depth perception, and some disfigurement may exist. Either eye is obviously a subset of the whole vision system. The loss of either subset is not desirable. But now consider the loss of both eyes. The consequences are much more severe than the loss of either eye (subset) alone. Total blindness then has a negative synergistic effect that is much more adverse to the total visionary system than that experienced by the loss of either individual subsystem.

In the Sudan, relief efforts are frustrated. The region is characterized by overpopulation, too many people. Additionally, poor soil conditions coupled with low annual rainfall results in overgrazing by the animal population to the point that herdsmen lose a significant number of animals each year due to malnutrition and drought. Likewise, the region will not provide enough surface crops to sustain the number of people living in the area. An epic surge of HIV/AIDS related deaths has left entire generations of children without any surviving parents or home life of any form. Any of these issues would be difficult to overcome but the sum of all of them is devastating. The cumulative effect of negative synergy is so overwhelming that the solution to the situation in the Sudan is almost beyond human comprehension or understanding. The result of the effect of negative synergy leaves policymakers without a clue as to how to best proceed. (Matthews, 2011)

Hurricane Katrina provided an example of how a series of natural and human factors can saturate decision makers with conditions that are of such a magnitude that they are unsolvable. Driving winds and devastating rains set up conditions of failure that could have been anticipated: power outages, flooded streets, fallen trees, and damaged bridges. A barge chaffed at its mooring, broke loose and breeched the levy at one
location resulting in unimaginable problems with serious flooding. Rainfall caused Lake Pontchatrain to swell its banks but that, too, could have been anticipated based upon models in place by the National Oceanographic and Weather Service. The US Army Corps of Engineers certainly knew the design parameters for the levees surrounding New Orleans. Repairs to the levies had revealed that the footer or foundation under portions of the levy were inadequate in some areas. These footings gave way permitting sections of the levy to topple and allowed a massive invasion of water into the Ninth Ward. The inadequate design and poor quality construction work was known. The concurrent destruction of wetlands and the effect of that destruction on the ocean shoreline was a matter of public record. Even a barge chaffing at its moorings may have contributed to levy failure as the storm brewed. Each of these factors represented a significant threat. But no one recognized the impact that negative synergy would have on the city. None were prepared for an event where the result was much worse than the component parts.

Negative synergy is a force to be reckoned with eventually. Decision makers must be aware of its potential impact on their decisions. They must be as aware of the possibility of negative synergy appearing in those decisions as they are aware of the effects of positive synergy.

THEORETICAL DEVELOPMENT/MODEL/INTRODUCING THE FLIP-FLOP

Oftentimes, we look at business leaders like the former CEO of General Electric, Jack Welsh, whose directive leadership and unilateral decision making style helped create an enormously successful business as the model for action. (Carley, 1997). There is an abundance of literature throughout the last four decades discussing the value of an appropriate mix of leadership style and coordinate decision making style in terms of decision efficacy. And in the latter part of the 1980s and into the 21st century there are a number of articles that attempt to ascribe the benefits of decision science theory and risk aversion to quality of decision making. (Carley, 1997)

But even within the relatively defined parameters of minimization of risk, and the “establishment of value functions, generation of viable alternative, assessment of likelihoods “is the idea that “intransitive value functions” are often deemed “irrational”. (Friedman, 1999). When the decision makers become “irrational” or “intransitive” in their decision making, decision quality drops. This idea of “intransitive” or “indecision” decision-making is very infrequent in the literature, particularly as it relates to business decision-making or leadership style driven decision making. It appears to be most studied under the guise of voting behavior and career choice. Although a 1964 article in the Journal of Counseling Psychology suggested there be the development and validation of an “indecision scale” since “the ability to make satisfying a ‘good’ decisions within a brief period of time is commonly assumed to be a sign of personal effectiveness.” (Holland and Nicols, 1964.) But even that article dealt with career choice rather than business decision making.

This idea that intransitive, indecision based, vacillating choices happen and happen particularly within groups is what the authors are referring to as “flip-flop” decision making. Flip- flop decision making is centered on the idea that “During the process that precedes the decision, no mention is made of what the answer might be. . . . Thus the
whole process is focused on finding out what the decision is really about, not what the
decision should be according to Peter Drucker.

THE INITIAL UTILITY INDEX FUNCTION

Von Neuman and Morgenstern utility functions consider a mapping whereby particular
indicators (I) are followed by specific outcomes (O) which are known, a priori, in advance
so that I → O where I={a,b,c ...} and where O= {m,n,o...}. And likewise, every a → m,
b→n, c→q, etc. But, in reality such a mapping is unrealistic. Such convenient mappings
do not always exist... For example: All laptop computers produced at the same
production facility do not always exhibit the same operating characteristics. As a result of
variances in component characteristics and in assembly standards, some substandard
computers are produced. In reality, three distinct possibilities exist. Therefore, consider
the following outcomes instead: Let A = a situation where a group acquires a satisfactory
standard computer. : Let B = a situation where a group acquires no computer. And let C =
a situation where a group acquires a substandard computer. Also assume that the
group prefers to purchase A to B and that it also prefers to purchase B to C. In other
words, not having a computer is assumed to be preferred to having a substandard one
because of the nuisance involved in trying to operate a computer with inferior
components or assembly. Given a choice there preferences possibilities seem to exist:
(1) The group may choose to maintain the status quo, i.e., to have no computer at all.
This choice has a certain outcome. Therefore the probability of alternative A is such that
p = 1. (2) The group may elect to enter into a risk situation where the purchase may
result in owning a satisfactory computer (alternative A) or an unsatisfactory one
(alternative C). Again, the probability of alternative B is that p = 1. (3) Or perhaps the
group may opt for the null alternative B and will not purchase a computer at all. Again,
the probability of alternative C is that p = 1.

It is possible to construct a utility index of group choice in the face of uncertainty if the
group choice conforms to the following six axioms:

- **Continuity.** If A is preferred to B and B is preferred to C, then there exists some
  preference probability, p, where 0 ≤ p ≤ 1 such that the group is indifferent to outcome
  {p, B} with certainty and the alternative risk of an undesirable purchase {(1-p) A, C}.

- **Transitivity.** If A is preferred to B and B is preferred to C, the group will prefer A to
  C.

- **Independence.** If the group is indifferent between A and B, then C is any other
  acceptable outcome. If one group option G, offers outcomes A and C with probabilities
  (p,) and (1 - p,) and another outcome G2 = B and C with the same probabilities (p,) and
  (1 - p,), the group is indifferent between the two outcomes G1, and G2. Similarly, if the
  group prefers A to B, then the group will prefer G1 to G2.

- **Preferences.** For two alternatives A and B, the group must either prefer A to B,
  prefer B to A, or the group is indifferent between A and B.

- **Unequal probability.** If the group prefers A to B and if the group prefers G1 = {p,
  A, B} and G2 = {p2, A, B}, then the group will prefer G1 to G2 only if p1 > p2.

- **Compound outcomes.** If G1 = (p1, A, B) and G2 = (p2, P3, P4) and where G3 = (p3,
  A, B) and G4 = (p4, A, B) and; if any outcome is acceptable, then it follows that G2 ≅ G4
  if p1 = (p2 p3) + (1-p2) (p4) given the probability of obtaining conclusion A through G2 is p2.
  Likewise, the probability of obtaining A through G4 is (1 – p2) (p4). In other words, the
  group will only evaluate the options, one at a time in terms of obtaining a favorable
outcome. The number of times the group is exposed to the outcome does not vary the expected outcome.

It should be noted that for presentation convenience, this paper only considers situations with two outcomes. The analysis could be extended to cases with any number of outcomes \( G_n = (p_1, p_2 \ldots p_{n-1}, p_n; A_1, A_2 \ldots A_{n-1}, A_n) \) where \( n \) = the number of possible outcomes; and where \( 0 < p_i < 1 \) is the probability of outcome \( A_i \). It should also be noted that, although the value for \( p \) can be obtained by various means; for the purpose of this paper, \( p \) represents the group's perceived probability of a particular outcome as a result of group actions and choice alternatives. Various protocols are available as to how the group arrives at their point estimate of \( p \) but such protocols lie beyond the scope of this paper.

**DEVELOPING A GROUP PREFERENCE BASED UTILITY FUNCTION**

Assume that the negative/positive synergy index \( (u) \) with Lickert Scale assigned values from 1 to 5 for positive synergy and values -1 to -5 as appropriate for negative synergy. A single point value estimate (of the overall utility or wealth \( (W) \) of the function is simply the product of \( p \) (the perceived probability of an event value \( (A) \), with an assigned synergy index \( (u) \), That point estimate \( W = puA \), which also conforms to the above previously listed probability axioms. Accordingly, the expected utility (E) for the two outcome group choices \( G = (p, A, B) \) would be

\[
E[u(G)] = p\ u(A) + (1 - p)\ (u)\ (B)\ 
\]

If the group faces choices \( G_1 = (p_1, A_1, A_2) \) and \( G_2 = (p_2, A_3, A_4) \), an expected theorem would state that, if \( p_1 \) is preferred to \( p_2 \); then \( E[(P_1)] > E[u(P_2)] \). The significance of this observation is helpful to this discussion because it provides that uncertain situations can be analyzed in terms of maximization of the expected utility of the group decision. Under conditions developed by Henderson and Quandt (p 54-55) infer that the following observations may be inferred about group decision making following the above listed axioms:

- Any positive monotonic transformation of the utility function will leave the rankings of the decision unchanged. This result does not also hold true for rankings of uncertain outcomes in terms of expected utility.
- Expected increasing utility rankings are invariant under linear transformations.
- The expected utility function presented above may be used to construct utility values for any group that conforms to the Von Neuman - Morgenstern axioms.
- The utilities derived from a Von Neuman - Morgenstern analysis are cardinal since they are derived from a group’s risk behavior and are valid for predicting choices as long as the group strives for maximum utility.
- Utility values are derived from decisions about mutually exclusive choices (as long as the group strives to maximize the expected utility). Therefore it would be meaningless to attempt to infer from the utility of event \( A \) and the utility of event \( B \), the utility of joint event \( A \cup B \).
- If \( uA = KuB \), it is not meaningful to assert that the group will prefer choice \( A \) \( K \) times as much as choice \( B \). However, the use of an interval scale does imply that the group would. chose one over the other.

**GROUP BEHAVIOR UNDER UNCERTAINTY**
So far, the group utility function has been treated only in the most general terms. Now it is time to be more specific as to how groups behave under conditions of uncertainty. Five new assumptions are now introduced here in regard to the previously generalized utility function: (1) the utility function is measured in terms of wealth \( w \), a monetary unit; (2) the utility function is a strictly increasing function; (3) the utility function is continuous; (4) the first order derivative is continuous; and (5) the second order derivative is continuous. The expected value \( E \) of a group decision or choice which results in different wealth levels \( w \) may be expressed as:

\[
E (w) = p w_1 + (1 - p) w_2
\]  

(2)

Such a group is risk neutral as to the outcome of a decision by the group when the expected value of the choice is equal to the expected utility of the choice. That is:

\[
U [p w_1 + (1 - p) w_2] = p U (w_1) + (1 - p) U (w_2)
\]  

(3)

Such a group is driven by expected values and is oblivious to risk. If the group is risk neutral toward all choices, the equation above implies a linear utility function of the form \( U = \alpha + B w \) \( (B > 0) \).

A second group is risk averse to a choice if the expected value of the choice is greater than the expected value of the utility. In other words:

\[
U [p w_1 + (1 - p) w_2] > p U (w_1) + (1 - p) U (w_2)
\]  

(4)

Such a group would prefer a certain outcome to an uncertain one with the same unexpected value. If this above utility function holds true for all cases of \( 0 < p < 1 \) and all values \( w_1 \) and \( w_2 \) are within the domain of the utility function so described, then the utility function is strictly concave over its entire domain. This group is risk adverse over the entire domain of \( w \).

\[
\frac{D^2 U}{D^2 w} < 0
\]  

(5)

In general, it seems that most groups are risk adverse most of the time. This opinion is not research based and might be a potential topic for further research. But, to make this a comprehensive analysis, the analysis must also cover groups that prefer decisions with uncertain outcomes. Such a group is would be a risk seeking group that prefers choices with uncertain outcomes. A group is risk seeking when the utility of the expected value of the wealth level is less than its expected utility. In other words the inequity described above is now reversed.

\[
U [p w_1 + (1 - p) w_2] < p U (w_1) + (1 - p) U (w_2)
\]  

(5)

\[
\frac{D^2 U}{D^2 w} < 0
\]  

(5)

If \( \frac{D^2 U}{D^2 w} > 0 \), the utility function is strictly convex and the group is risk seeking.
A third group is also apparent which involves group activities that are risk neutral. That is to say that the circumstances are such that the group is indifferent to the outcome. Either of the two is equally acceptable. The expected value of the wealth is equal to the expected utility. That is to say

\[ U [ p w_1 + (1 - p) w_2 ] = PU (w_1) + (1 - p) (w) (w_2) \]  

(6)

and

\[ \frac{d^2 U}{d w^2} = 0 \]

(7)

Since \( U = 0 \). The utility function is neither convex nor concave and group is risk neutral.

**THE FLIP-FLOP**

Antidotal observed behavior shows that groups may develop a synergistic relationship within the group that is at times risk averting and at other times risk seeking and yet for other times may be risk neutral. The effect of synergy only serves to amplify the utility index when it is strictly concave.

\[ U [ p w_1 + (1 - p) w_2 ] < PU (w_1) + (1 - p) (w) (w_2) \]  

(8)

Of course, if \( \frac{d^2 U}{d w^2} < 0 \) and the utility function holds for all values of p in the range \( 0 < p < 1 \) and \( w_1 \rightarrow \in \{w_1, w_2\} \), then the strictly concave function represents a group that is risk adverse.

Meanwhile, actual observed behavior shows that a group may be adaptively comfortable with situations that are sometimes seen in an environment that is at times characterized by positive synergy and at other times by negative synergy. Consider, for example, a college football team that is playing an opponent with significantly higher standing. College players who make up the team are almost always risk adverse. They want to be noticed, recruited, and accepted by high paying professional clubs. Normally, the team will take the safer play. But, with the team behind by one point at twenty to twenty-one and with thirty-five seconds left in the game, the quarterback’s utility function is defined such that he is willing to go for the extra two points with an expected value of one in a million (i.e., the opponent is really good) to win the game by a two point conversion rather than a more probable one point goal attempt. At first, such behavior might appear inconsistent. But, as negative synergy comes into play on the more probable single point play; his utility function may assume the general shape of an ogee curve: convex over some of the domain and concave over another portion. If \( w_1 \) is the team’s point potential loss if the two point play does not succeed and \( w_2 \) is the team’s teams point potential gain if the kicking attempt succeeds, the general utility function is strictly concave over
the domain $0 \leq w_n \leq w_\Theta$, and strictly convex when the $w_\Theta < w_n$. In other words, a quarterback is risk averse in situations where the outcome is no greater than $w_\Theta$. Nearly all anecdotal experiences seem to lay within the domain $0 \geq w_n \geq w_\Theta$. But when $w_n \rightarrow w_\Theta$, the team may be willing to take a chance on winning the game and improve their opportunity for $U_{w_{max}}$.

To determine the effect of synergy upon decision making, examine the sign of the second derivative. However, recall that, by axiom, it is invariant under linear transformation. Accordingly, the second derivative cannot be used to indicate the level of synergy affecting the group.

A measure of an absolute level of synergy, $s$, may be provided by the ratio of the second and first derivatives.

$$s = \frac{U^n(w)}{U^m(w)} = \frac{d \ln u_s(w)}{dw}$$

(9)

This measure is positive, negative, or zero as the group decision process exhibits positive and negative or zero synergy.

If $V = a + bU$ and if $(b > 0)$ then

$$s = \frac{V^n(w)}{V^m(w)} = \frac{\beta U^n(w)}{\beta U^m(w)} = \frac{U^n(w)}{U^m(w)}$$

that establishes the desired invariants.

**GRAPHIC PRESENTATION**

The following four figures show situations where group decisions are made under conditions of being risk adverse, risk seeking, risk neutral and flip-flop decision situations. The y-axis represents the utility received from a group decision as an increase in wealth, well being, satisfaction, or reward as a result of the decision. The x-axis shows the cardinal amount of wealth, well being, satisfaction, or reward as a result of the decision. Figure 1 shows a situation where the group is risk adverse. The plot is concave indicating that, when more reward or payoff is at stake, the group gains less utility satisfaction. The group’s risk to remain in an adverse relationship. Such groups do not seek additional risk. Figure 2 represents the opposite situation. Now the group is risk seeking. Note that the plot is now concave indicating that satisfaction increases when more payoffs is at risk.

Figure 1
Risk Adverse
Utility

Potential Payoff

Figure 2
Risk Seeking

Figure 3
Risk Neutral
A risk seeking group is more prone to an outcome that is, more uncertain. The group is willing to pay a premium to take such risks. Figure 3 shows the effect of a group that is risk neutral. Such a group strives to achieve balance between task and the anticipated potential reward.

It is Figure 4 which presents the more interesting plot, however. Note that as a matter of convenience the plot shown starts out representing a group utility function that is concave, the group is initially risk adverse. However, as the utility function continues to increase, \( y' \) continues to increase at a decreasing rate, At point \( \Theta \) the slope of the concave function is the same as that for the convex function, the group is risk neutral and may transition into risk seeking perceptions, the group flip-flops and perceptions of risk adapt accordingly. The flip-flop takes pace at the point where the group is risk neutral.
The group may initially be either risk avoiding, risk seeking or risk neutral. The important transition is made when the group finds itself at a point of intersection (which is risk neutral) and it then moves into an opposite direction. Consider the politician who is against gun control. But the congressional district which she represents is rapidly transitioning from a rural to urbanized setting. At one time, hunting was a way of life, a rite of passage. Schools closed for the opening of deer season and every hunter dreamed of bagging that fourteen point buck. Now the constituents like in close proximity in neighborhoods where it is unsafe to discharge firearms. The majority of the voters see deer hunting as animal cruelty with PETA chapters pressing their agenda at every turn. The politician has a choice. Either the congressman flip-flop on the issue or must face the reality of a lost election. Decision makers flip-flop regularly. The perceived probability assigned to the alternative really drives the flop. Change may demand it.

But a single flip-flop may not be the end of the story. As the perceived probability of an event changes, the expected value of the utility function may chance as well. It is entirely possible that a shift may subsequently change again. Another flip-flop. In the event that such a change takes place, it may mean that the flip – flop is an excellent reactive too; to give groups a way to respond to changing perceptions and to revised weak probabilities that are based upon the original definition of the solution space of the original choice. Instead of being a sign of weakness, the flip-flop may be seen in the future to be the key to reactive, real time decision making under conditions of flouting uncertainty and payoff.

Further research is indicated to validate the utility index. The impact of synergy and the perception of risk are essential factors in this analysis and the usefulness of actual data cannot be underestimated.

**SUMMARY**

This paper has developed a two group utility function that can be used to describe perceptions of risk under conditions of uncertainty in group decision making. The conditions were expanded without proof to encompass conditions where groups are risk adverse, risk neutral, and risk seeking.

In reality, when considering the effect of synergy – both negative and positive - a group will exhibit risk aversion in some situations and risk seeking behavior in others. At first such behavior may appear inconsistent. But, if second derivatives of the group behavior utility function were convex in some domains and concave in others, the flip-flop might be a possible explanation of this apparent inconsistency and should be the subject of further investigation.

Without question, the significant contribution of this paper is the group decision making paradigm has shifted towards recognition that the flip-flop is a valid response for group decision makers. Even more to the point, group decision makers may flip-flop as the perceived perception of an event changes.
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