

Systems Engineering Decision Making May Be More Emotional Than Rational!

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Abstract. Many subscribe to the hypothesis or generally accepted premise that professionals, e.g., systems engineers, make work-related decisions rationally, considering all the facts, while being objective, impersonal, and unemotional. A contrarian view would be that many, if not most, of our professional decisions are based primarily on emotion rather than reason, i.e., gut instincts about what would be best considering our own self-interests. The results of a simple survey are presented and discussed in an attempt to shed light on this issue. Despite the author’s hypothesis and the thrust of the paper’s title, the conclusion (based upon the five dozen responses received) is that most work-related decisions are indeed made rationally but many are made more emotionally than otherwise might be surmised.

The Issue

Introduction. Descartes asserted that human beings are rationale and discounted our emotions. (Demasio 2005) But David Brooks (Brooks 2011) counters with three fundamental tenets: 1) most of the mind operates on our subconscious; 2) we make decisions based mostly on our emotions;¹ and 3) our happiness depends mainly on the quality of our interpersonal relationships. All this motivated the current effort of sampling a selection of systems engineering colleagues to learn how they think professional decisions and their own personal decisions are made. The extent to which there is a significant difference in decision making in one’s personal life, e.g., whether we are more emotional outside the workplace, is one aspect of interest. Another is one’s feelings about future decisions while contemplating this exercise.

The author hypothesizes that: 1) If and when most systems engineers are queried by their management or others in authority as to how decisions are made on their programs or projects, the systems engineers would assert that most decisions are made rationally and are based on facts and supporting evidence; and 2) This response is offered because it seems politically correct and something the authorities want to hear, although privately the systems engineers know better, i.e., personal interests and emotions play a large part in decision-making. In speaking to several people informally about these two hypotheses, the author was somewhat surprised to learn that most acknowledged and seemed certain that there is a large emotional

¹ Our emotions assign relative values to alternatives, mostly through sub-conscious processes, and our (rational) left-brain merely selects the alternative with the greatest value. Also refer to (Kahneman 2011) for fast and slow systems that control the way we think and make decisions.

content in professional decision-making. The author felt it was important to gather additional opinions on the subject in a way that was non-threatening and anonymous with the objective of approaching the truth of how professionals actually behave.

One could ask whether people are being honest in responding to this survey. Although the author assumes the responses are genuine, he knows of no simple way to check on the respondents' veracity. So the results are accepted at face value.

Another indeterminate question is what an individual response says about the respondent's personality. The author was bemused by the difficulties some people had in interpreting the survey and completing their responses. Some people seemed to unduly agonize about the intent and how the survey could be misinterpreted or improved. Admittedly, the survey was an amateurish attempt by the author, and he did not avail himself of professional survey offerors, like SurveyMonkey, primarily because their available survey format options were not well-matched to the author's intent.² Nevertheless, the author took suggestions by respondents in his Pilot Group to clarify the survey for broader distribution. He opted to deal with any confusion on the part of potential respondents via E-mails or telephone conversations.

The Invitation

Decision Making Survey Invitation. The following invitation (with several variations) was sent to 117 potential respondents (of a Pilot Group and 2nd Group) via an E-mail (mostly) on 1 October 2011.³ In addition to a couple of reminders, other mailings were made to 35 3rd Group individuals on 22-27 October 2011, and 159 others to a 4th Group on 4 November 2011. After learning that the draft paper was accepted, the author sent another E-mail to 157 additional professionals, plus (as a reminder) those that had not yet responded to the earlier E-mails. The draft paper reflected 36 responses from just the Pilot and 2nd Groups; an additional 24 surveys were returned subsequent to the draft paper acceptance for a total number of respondents of 60.⁴ All recipients received blind copies of the invitation (or separate E-mails in subsequent correspondence) to protect anonymity; thus, none knew who else was being queried.

You are hereby invited to participate in my decision making survey for a potential International Council on Systems Engineering (INCOSE) Symposium 2012 paper. In this study, approximately ... professionals are being asked to rate their views concerning rational vs. emotional decision making. It should require no more than approximately 20 minutes to complete the questionnaire which is provided in a standard Excel format.

Your participation in this study is completely voluntary. I see no foreseeable risks associated with this project, and I think of this more as an opportunity to shed new light on decision making. However, if you feel uncomfortable answering any questions, simply do not respond to them, and just provide your partially completed copy of the Excel spreadsheet. Please know that it is very important for me to receive your opinions and a copy of your survey completely filled out.

² However, the author read and followed many of the suggestions of (Patten 2011) in developing the survey.

³ A similar invitation was sent earlier to 26 potential respondents (including the author ☺) as part of a pilot survey on 11-12 September 2011. Pilot responses deemed legitimate are counted in the overall results. More will be said about the pilot portion of the survey later in this paper.

⁴ A total of 468 requests were sent; 53 E-mail addresses did not work. So, presumably, 415 requests were received. The overall response rate was 14.5%, i.e., 60/415.

Your survey responses will be treated confidentially, and data from this research will be reported only in the aggregate. If you have simple questions at any time about the survey or the procedures, feel free to contact me ...

I would greatly appreciate receiving your completed survey within a couple of weeks to give me ample time to prepare my paper. ...

The Survey

Questions. Three basic questions were asked: 1) In your most recent project/program where systems engineering played a significant role, to what extent do you remember decisions being made based on reason vs. emotion, and how often was that? 2) In your personal life how would you characterize your own decision making? 3) After having thought about and filled out this survey, characterize your planned overall future decision making.

Question 1 had eight parts

- Technology (State-of-the-Art, Developing, Mature, etc.)
- Economics (Affordability, Fundability, etc.)
- Operations (User Needs, Capability Enhancements, Availability, Reliability, Maintainability, Interoperability, Fielding, Retirement, etc.)
- Politics (Mandates, Collaborations, Competitions, Rewards, etc.)
- Regulations (Acquisition Rules, Legalities, etc.)
- Programmatic Aspects (Costs, Schedules, Performances, Requirements, etc.)
- External Factors (Inter-System Dependencies, Sociology, Ecology, Organizational Change, etc.)
- Personal Factors (Perceptions, Preferences, Career Impacts, Intuition, Philosophical Mindsets, Psychology, Leadership Clout, etc.).

For each of the above parts, separately, the respondent was asked to rate the decision Trade-Off by selecting one of five categories, with the associated pairwise (Rational=R, Emotional=E) percentages (selected somewhat arbitrarily but with logically relative) values⁵

- Primarily Rational: (R=100%, E=0%)
- More Rational: (R=75%, E=25%)
- About Equal: (R=50%, E=50%)
- More Emotional: (R=25%, E=75%)
- Primarily Emotional: (R=0%, E=100%)

Footnotes are provided to suggest examples of

- Rational
Based on Reason, i.e., analysis, body of knowledge, calculation, causality, comprehension, computation, data, deduction, expertise, explanation, facts, history, implications, information, intellect, intelligence, justification, knowledge, logic, mathematics, observation, physics, practicality, rationale, reason, sanity, science, sense,

⁵ In the draft paper, this Trade-Off was associated with a Likert scale of 1 to 5, from Primarily Rational to Primarily Emotional, instead of the paired percentages shown. More will be said about this important change later.

soundness, state-of-the-art, synthesis, theory, thought, trade-offs, truisms, wisdom, ... and

- Emotional

Based on Feelings, e.g., anger, angst, anxiety, attitude, comfort, concentration, confidence, disgust, dread, enthusiasm, excitement, exhaustion, euphoria, faithfulness, fear, feeling, good spirits, gratitude, grief, guilt, happiness, hate, hysteria, indignation, intuition, jealousy, love, nervousness, obstinacy, pleasure, pride, resignation, sadness, shame, slyness, spirituality, sulkiness, surprise, temperament, well-being,

Then, for each part, separately, the respondent was asked to rate the decision Frequency by selecting one of five categories, as a (Likert scale 2011), with associated integer values

- Almost Never: 1
- Sometimes: 2
- Half Times: 3
- Most Times: 4
- Almost Always: 5

Finally, for each part the respondent was free to provide a brief comment to explain their choices if they so choose.

Question 2 also had eight parts

- Budgeting
- Career
- Entertainment
- Family
- Job
- Recreation
- Relationships
- Shopping

As in Question 1, the respondent was asked to rate the decisions with respect to the Trade-Off and the Frequency. Again there were places for voluntary comments.

Finally, Question 3 had only two parts

- Work Life
- Personal Life

As in Questions 1 and 2, the respondent was asked to rate the decisions with respect to the Trade-Off and the Frequency, and there were places for voluntary comments.

A hypothetical example of completing the spread sheet is shown in Figure 1.

Having a variable N_i is important for the following reason. One could have decided to enter a “balanced” score of About Equal and Half Times, $(50\%, 50\%) \times 3 = (1.5, 1.5)$, for each row left blank by a respondent. This would ensure that there was no bias regarding rational vs. emotional. However, that would not be an accurate representation of the respondent’s “non-voting”. Even more importantly, if one feels that a balance between rational and emotional decision making would be surprising because maybe one thinks we base most of our decisions on reason, then this balanced scoring would enhance that surprise unfairly. Thus, we took care to not score blank rows.

The R or E score variance of any row about the balanced scores of 1.5 is the square of the difference between the average row score and 1.5. The standard deviations are obtained by taking the square roots of the variances.⁷

Referring to Figure 1, note that the nominal (with the balanced selections of About Equal for Trade-Off: (R=50%, E=50%) and Half Times for Frequency: Weight=3) the total score over the 8 rows of Questions 1 and 2 is $(50\% \times 3, 50\% \times 3) \times 8 = (12, 12)$, and over the 2 rows of Question 3 is $(1.5, 1.5) \times 2 = (3, 3)$.

Helpful Survey Feedback from Some Respondents

Pilot Survey. Despite detailed instructions, primarily in the form of embedded comments, there was considerable confusion about completing the survey form. More importantly, a few had fundamental questions about what was behind the survey or whether it could even be completed unambiguously or with integrity.

Some potential respondents were confused by the hypothetical example showing Xs already filled in; they thought the wrong survey form had been sent rather than interpreting the initial presentation as simply an example of how one might complete the form. After this was explained in follow-up E-mails, most completed the survey as instructed.⁸

A more significant problem arose from placing the Frequency choices to the left of the Trade-Off choices, just the opposite of what is shown in Figure 1. In response to this source of confusion, the Trade-Off columns were changed to precede the Frequency columns. This made more logical sense; first one decides on the trade-off between rational and emotional thought, and then one assesses how often that trade-off was or would be exercised.

One colleague had lots of problems with the survey which we discussed iteratively via E-mail, and then finally by telephone. He helped the author simplify the instructions which could be misinterpreted, although he had second thoughts about this during our discussion. Nevertheless, after all that concern, attention, and valuable input, he did not complete the form!

One colleague did provide a survey response but only after several E-mail interchanges where she tried to influence the author to introduce a third decision-making category, in addition to “rational” and “emotional”, namely that of “intuitive” or for some people, “spiritual”. She explained a logical means of postulating criteria and options and then doing a trade study; the author thought that was essentially in the rational category. Similarly, she described spiritual

⁷ Standard deviations are used in the subsequent bar charts to highlight the relative scale of the bar heights.

⁸ The hypothetical Xs were deleted on the later mailings starting 1 November 2011; this lessened the confusion. ☺

but the author thought that was in the emotional category. So the author stuck to the original two categories of rational and emotional.

Main Survey. Some recipients were still confused about filling out the form despite simplified and significantly improved detailed instructions based on pilot survey feedback. Further, several more people had significant philosophical problems with the survey.

A few either omitted an X somewhere in a row or put too many Xs in a row. These “errors” were corrected through a further exchange of E-mails.

One respondent declined to complete any of the rows of Questions 2 and 3 (the personal ones; refer to Figure 1, for example), feeling only Question 1 was “relevant”.

One much respected respondent who did not complete the Economics row said (upon being queried) that it “was intentional.—I couldn't give honest responses. As you know, it is sometimes difficult to choose the correct response, instead of the response that reflects your image of yourself ...” [Wouldn't that be an indication of more emotional decision making? 😊]

One respondent looked at the footnotes about Rational and Emotional and tried to answer based on these suggested examples though she did not agree with some of them. Also, this person thought a survey like this was too analytical and needed discussion to provide more depth. Actually, that's related to the author's purpose in this paper. Nevertheless, she supported writing about this issue.

A dozen or so respondents provided pithy and telling comments, some of which are repeated

Technology: “Often driven by top-down decisions” “... an irrational desire for a technology to be mature may sway the decision.” “A technological solution was chosen on a hunch that it would meet operational needs—it didn't”

Economics: “Everyone has a cost estimate. Whether it is accurate is another story.” “Assumptions about [h]eritage and ‘happy path’ estimations always push the estimated cost low and the expected enthusiasm for a project by its promoters push estimates of potential investments high.” “Showing the program on cost was more important than showing program progress. This led to multiple re-baselining.”

Operations: “Operators often drive program decisions with limited data” “This represents the reality for existing or block upgrades. For revolutionary changes (1st GPS, 1st Cell Phone...) Operations needs are unknowable unknowns ...” “The functional sponsor presented clear and concise requirements—most had an objective basis, some were guesses.”

Politics: “Based on my last job where operations was a political wedge used for control. All emotional Decisions were often outright wrong. The entire organization suffered.” “Since politics includes aspects such as competitions and rewards, it tends to be emotional when judging people” “Rational politics is an oxymoron.”

Regulations: “I did not mark this as primarily rational because sometimes the wording in legalities can cause people to be swayed by their emotions.” “Standards, Guidelines, etc.,

have complex impacts and no bounding model exists, so all decisions about what it should do and not do is based on the emotional (what is the right) feeling of the seniors.”

Programmatic Aspects: “Engineers want logic and certainty and reality constantly causes issues. So often the Chief Engineer has to apply experience (gut feeling) as often as not in decision making to make it all work out.” “Program managers consistently tried to present decision makers information they thought the decision makers wanted to hear. Decision makers were never provided the true status of the program.”

External Factors: “Usually Classical SE ignores any concerns other than interfaces with externals and always all externals are considered static.” “Organizational change management was based on a series of if-then statements. At first, if the system does x, then the users will benefit by y. Later, if the system doesn't do x, then the user will do y some other way.”

Personal Factors: “Some true expertise was hired, but most positions were filled on the gut hunches of the hiring authorities—not necessarily the program/project managers.”

Quoting another respondent to show a high degree of angst exhibited

... I have to admit to having some significant problems: I am not sure that reason vs. emotion is a clear-cut discriminator. My experience is that ... decisions are based on reason, but often on the wrong reason. E.g., promoting your career rather than what is best for the project, or, with an eye to the next election, considering only short-term effects rather than whole-of-life. [That's emotional decision making!] Or simply following the path of least resistance, which is a reason (?), if not a very admirable one.—So, I am not certain how these cases fit into your survey. I find the two aspects, i.e. rational vs. emotional, and “how often”, to be not independent (not orthogonal coordinates). ... So, I have essentially filled out only the first aspect of the survey. ... [I.e., he specified Most Times for every Frequency choice.] [To help several the author explained that if one rarely would have to make a decision on Technology, for example, then the Frequency Almost Never should be chosen, no matter what Trade-Off was selected.]

And another (who chose not to complete the survey) showed even more anxiety

Brian—I would like to help just because it's you—but—I am constitutionally unable to cope with surveys. The questions always get me tied up in knots about what is or is not asked and how I should interpret what is asked. And then there is the fact that I tend to get involved in projects and teams and processes that are outliers—my projects are relatively speaking small, I generally own them and either make or structure the decisions, and I [favor the view] that rational decision making is not a reality. [Note this is consistent with the author's hypothesis; refer to the Abstract and The Issue section above.] Do you think you can get people to answer this survey in any way honestly? Maybe a few, but I doubt the predominant replier is going to know, let alone share, the extent that emotion biases and dominates—all with of course rational post-decisional trappings. [The author suspects this may also be true.] ... I'm confused with the frequency columns. Are you referring to multiple decisions per category in the “last” project, or across many projects? ...

Brian, I filled in the matrix the best I could. However, if you have read *The Black Swan* you will recognize that distinguishing between “historical fact based” logic driven decisions versus “internal gut” feeling driven decisions may be a false distinction. This is because all “stories/theories” developed are based on selective remembering of the facts that support

the desired world view. [Good point!] In a world with dynamic hyper turbulent context and co-evolving ventures, the individual's response is always a mix of rational and irrational. [(Douglas 2011) suggests that if one has difficult choices to make, a heavy dose of irrationality may be just what you need.] Consider the OODA loop used in aerial battle, each decision is good if and only if the fighter survives to make the next decision. So whether the decision is based in logic or in feeling is not as important as the results of the decision in the success (survival) of the decider. [Another good point.]

So you can see that several addressees really agonized (more than the author thought was justified over such a simple survey), and could have spent far less time just in answering the questions at face value. The author finds this reluctance to commit one's opinions in writing typical of many of his professional colleagues. A common joke among systems engineers: Ask 10 systems engineers for their opinion on a subject, and one receives 20-30 (say) opinions! ☺

Survey Results

Pilot Group. Table 1 contrasts the total scores of the Pilot Group's 15 respondents⁹ compared to a "perfect balance" between Rational and Emotional which is 12, 12, and 3, for Questions 1, 2, and 3, respectively, as noted earlier. We see that Questions 1 and 3 total scores favor Rational over Emotional, and Question 2 yields a slight edge to Emotional over Rational. Figure 3 captures these data graphically. Note that relatively large standard deviations emphasize departures from perfect balance for Questions 1 and 2.

Detailed Question 1 results for the Pilot Group are shown in Figure 4. Rational decision

Table 1. Numerical Data for Pilot Group

Question	Perfect Balance	Total Rational Score	Total Rational Standard Deviation	Total Emotional Score	Emotional Standard Deviation
1	12	17.067	5.067	13.667	1.667
2	12	15.625	3.625	15.732	3.732
3	3	3.875	0.875	3.339	0.339

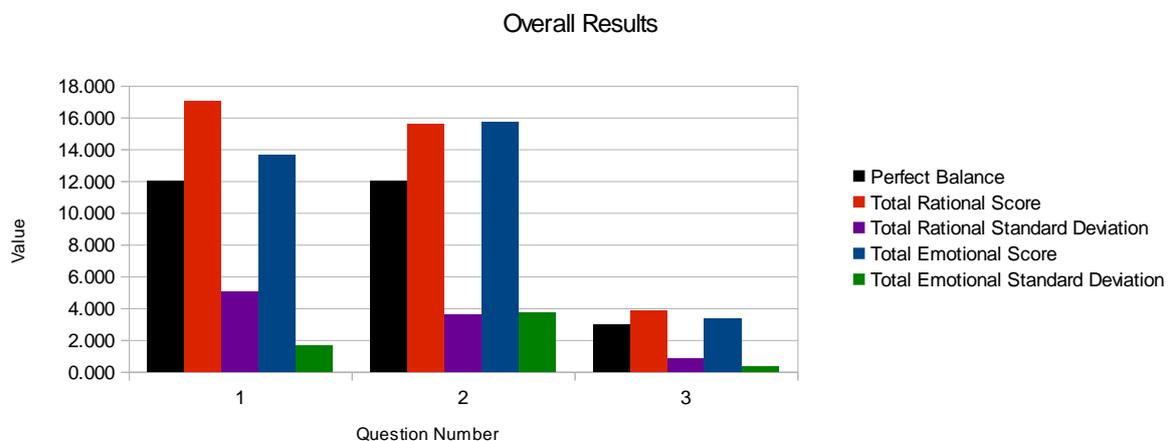


Figure 3. Overall Results for Pilot Group

⁹ 25 invitations to respond to the pilot survey were sent (11-12 September 2011), so this response rate was 60%.

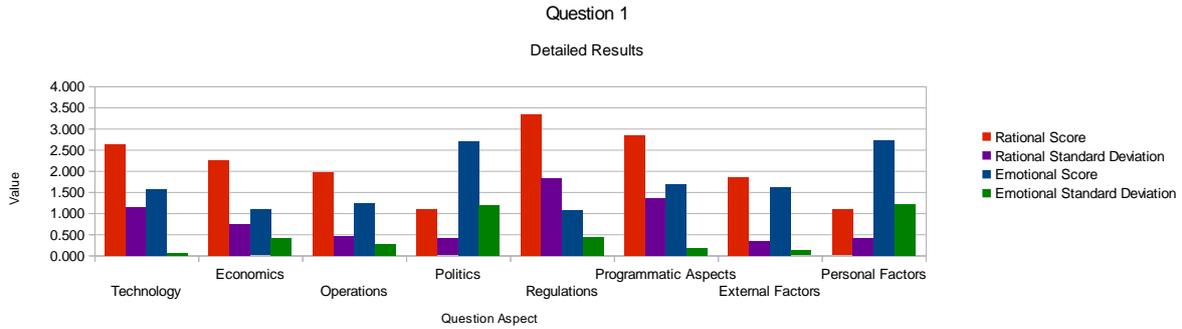


Figure 4. Detailed Question 1 Results for Pilot Group

making prevails over Emotional decision making for the Question Aspects of Regulations, Programmatic Aspects, Technology, Economics, Operations, and (just barely) External Factors. Emotional decision making dominates for Politics and Personal Factors. Perhaps none of these results are surprising in themselves, but the degrees to which Emotion plays a role is notable. Politics and Personal Factors loom the largest. Programmatic Aspects is next followed by Technology and External Factors. These first two are especially significant in suggesting that emotion plays a greater role (than is usually assumed compared to reason) in programmatic decisions and technology selection. And if one is not in control of External Factors that would seem to lead to more emotional decisions in that aspect. Finally, Operations, Economics, and Regulations (scoring below 1.5) show an increasing bias towards Rational.

Question 2 results for the Pilot Group are shown in Figure 5. Entertainment decisions have the greatest Emotional content with Recreation second. These results should not be surprising. Next come Relationships and Family, again not surprising in order or degrees. Budgeting, Career (Emotion was perfectly balanced at 1.5), and Job are quite Rational. Shopping could have been even more Emotional than shown, one would think, especially for men, the gender of the vast majority of the respondents.

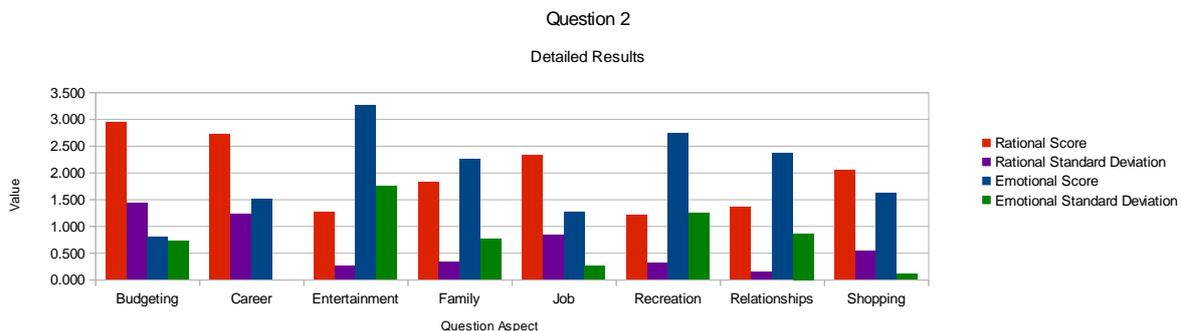


Figure 5. Detailed Question 2 Results for Pilot Group

Question 3 results for the Pilot Group are shown in Figure 6. Both future Work Life and Personal Life would be somewhat more Rational than Emotional, Work Life is closer to being perfectly balanced. It is interesting that both future Work Life and Personal Life decisions would have roughly equal Emotional and Rational contents.

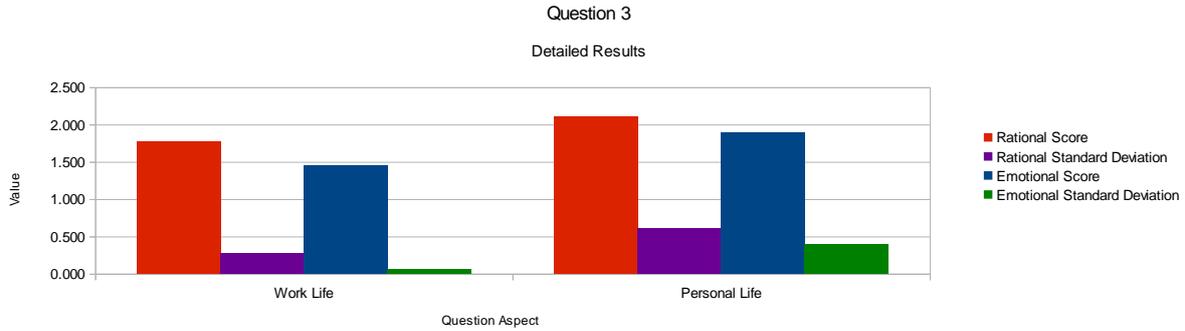


Figure 6. Detailed Question 3 Results for Pilot Group

2nd Group. Table 2 contrasts the total scores of the 2nd Group of 21 respondents¹⁰ compared to a perfect balance for Rational and Emotional. Figure 7 captures these data graphically. This time, compared to Table 1 and Figure 3, we see that all three scores favor Rational over Emotional, particularly for Question 1. But again, there are significant Emotional components.

Table 2. Numerical Data for 2nd Group

Question	Perfect Balance	Total Rational Score	Total Rational Standard Deviation	Total Emotional Score	Total Emotional Standard Deviation
1	12	19.925	7.925	11.423	0.577
2	12	16.595	4.595	14.976	2.976
3	3	4.560	1.560	3.298	0.298

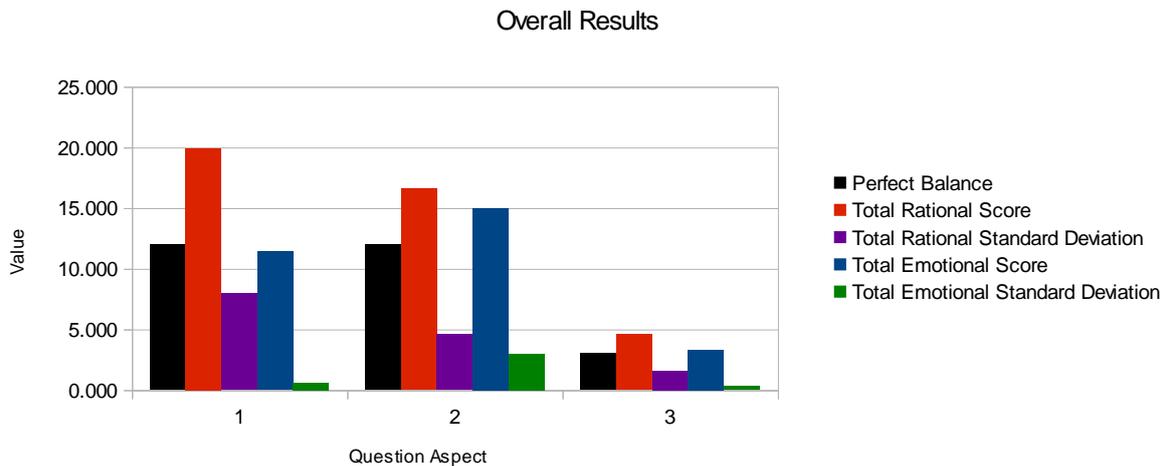


Figure 7. Overall Results for 2nd Group

Detailed Question 1 results for the 2nd Group are shown in Figure 8. Again, Personal Factors and Politics have the largest Emotional scores but with less Emotional contents compared to the Pilot Group of Figure 4. This time External Factors shows more emotion than Programmatic Aspects. Economics, and Operations come next, with Economics having a little more Emotional content compared to the Pilot Group. Technology and Regulations are quite Rational and both more so than for the Pilot Group.

¹⁰ 113 invitations were sent to the 2nd Group (109 on 1 October 2011 and 1 each on 3, 10, 12, and 16 October 2011), so this response rate was only 18.6% compared to 60% for the pilot group.

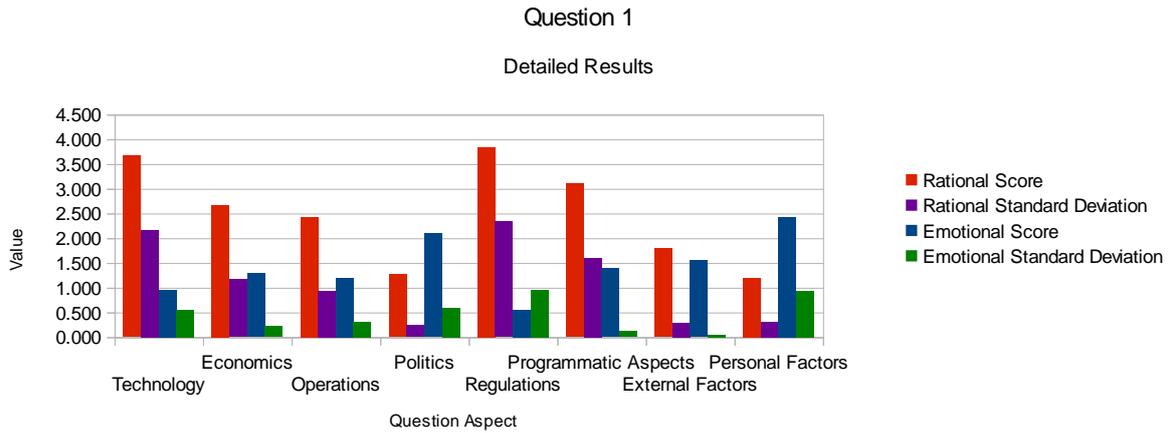


Figure 8. Detailed Question 1 Results for 2nd Group

Question 2 results for the 2nd Group are shown in Figure 9. Again, Entertainment, Recreation, and Relationships decisions have the greatest Emotional content with Relationships, a close third, rating higher emotionally compared to the Pilot Group; Family, Shopping, Career, and Job are lower while Budgeting is higher.

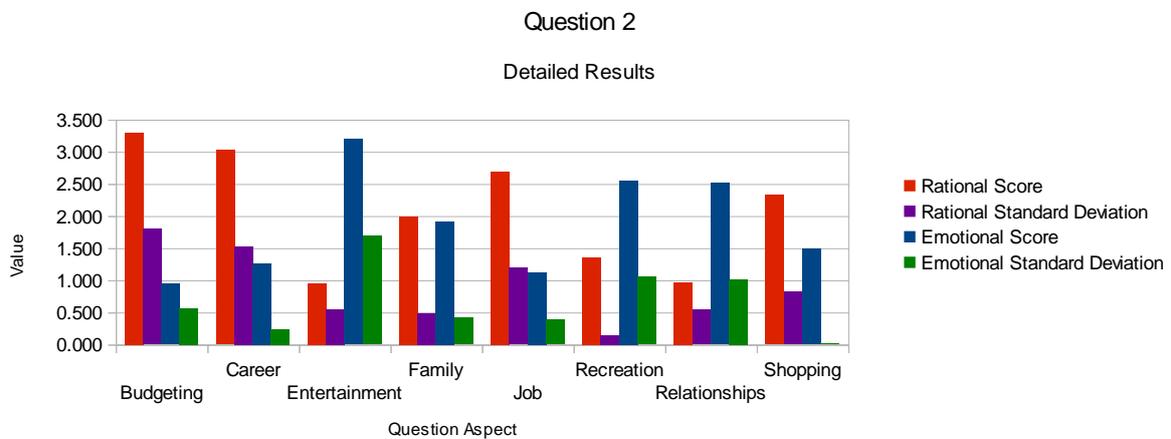


Figure 9. Detailed Question 2 Results for 2nd Group

Question 3 results for the 2nd Group are shown in Figure 10. This time Work Life is much more Rational compared to the Pilot Group, while Personal Life is equally Rational and Emotional.

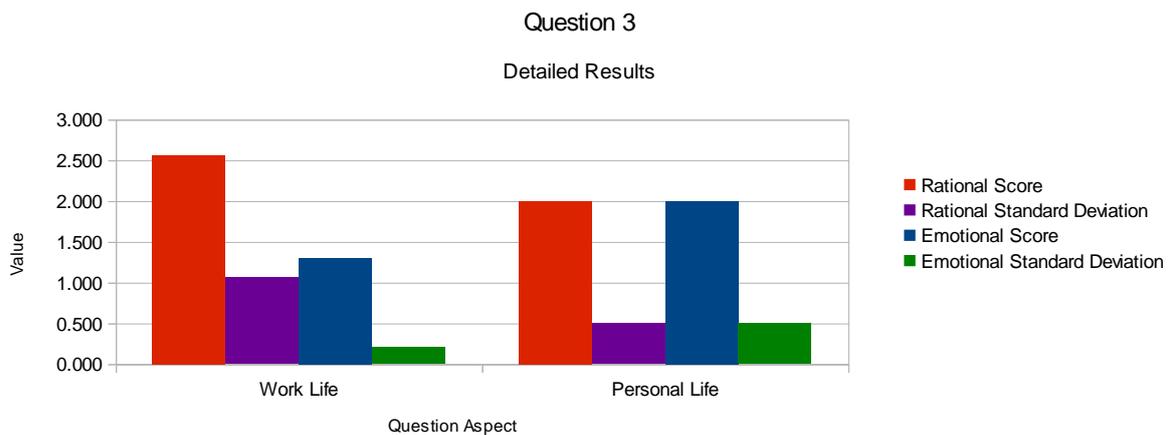


Figure 10. Detailed Question 3 Results for 2nd Group

Demographic Differences Between the Pilot and 2nd Groups. The Pilot Group consisted of close friends and/or colleagues of the author. The 2nd Group comprised colleagues whom the author either knows personally and/or the invitees know the author by reputation, conference publications/presentations, or through professional association. The response rate of the Pilot Group was significantly higher (60%) because these invitees were hand-picked by the author to be more likely to provide constructive feedback on the survey. Although the author was disappointed in the lower response rate (18.6%) of the 2nd Group, understandably most everyone is busy, don't care for surveys, and may not want to bother figuring out how to fill out the survey's Excel spreadsheet. As noted, even though some contacted the author to get help on the latter, they failed to follow through with a completed survey.

Combined (Total) Results of All Groups. Table 3 contrasts the total scores of all groups (invited both before and after the draft paper) of 60 respondents compared to a perfect balance between Rational and Emotional. Figure 11 captures these data graphically. Rational decision making is prevalent in Question 1 but there is a strong Emotional component. Emotional edges Rational in Question 2 but they are almost equal and both significantly above the perfect balance total of 12. Rational wins over Emotion in Question 3 but not by very much.

Table 3. Numerical Data for All Groups

Question	Perfect Balance	Total Rational Score	Total Rational Standard Deviation	Total Emotional Score	Total Emotional Standard Deviation
1	12	18.754	6.754	11.936	0.064
2	12	15.462	3.462	15.538	3.538
3	3	4.230	1.230	3.499	0.499

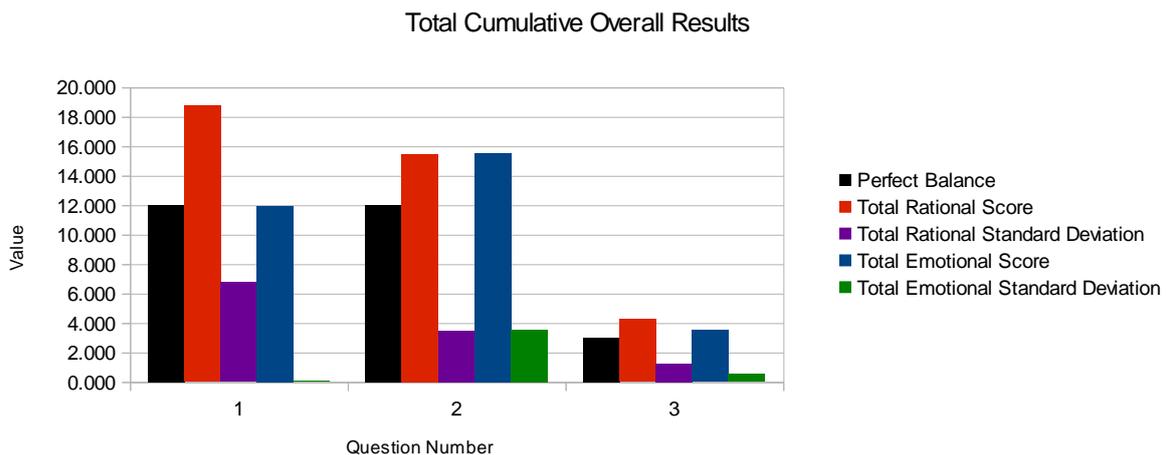


Figure 11. Overall Results for All Groups

Detailed Question 1 results for the all groups are shown in Figure 12. Personal Factors and Politics are the largest in Emotional content. External Factors and Programmatic Aspects come next. Regulations and Technology have the strongest Rational contents. Economics and Operations follow Programmatic Aspects in Rational content.

Question 2 results for the all groups are shown in Figure 13. Again, Entertainment, Relationships, and Recreation decisions have the greatest Emotional content followed by Family. Budgeting, Job, and Career (just slightly lower than Job) have the largest Rational content, followed by Shopping.

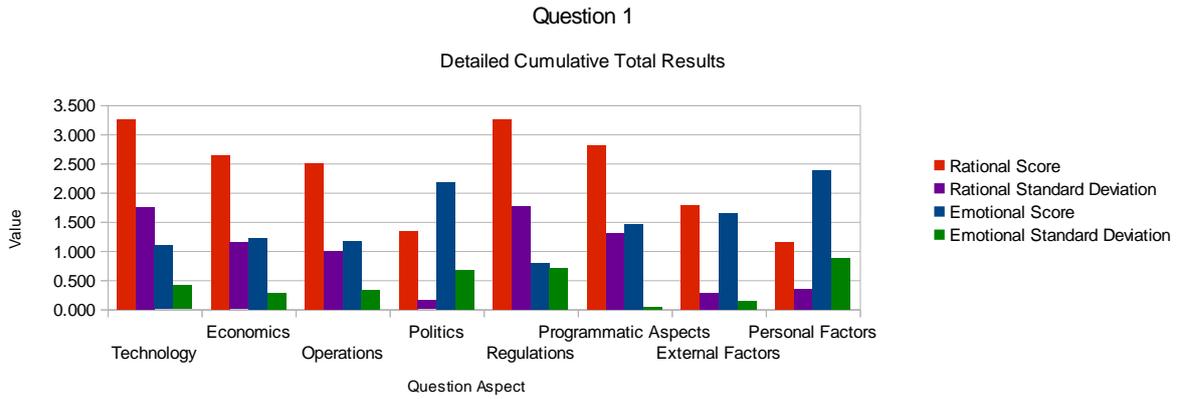


Figure 12. Detailed Question 1 Results for All Groups

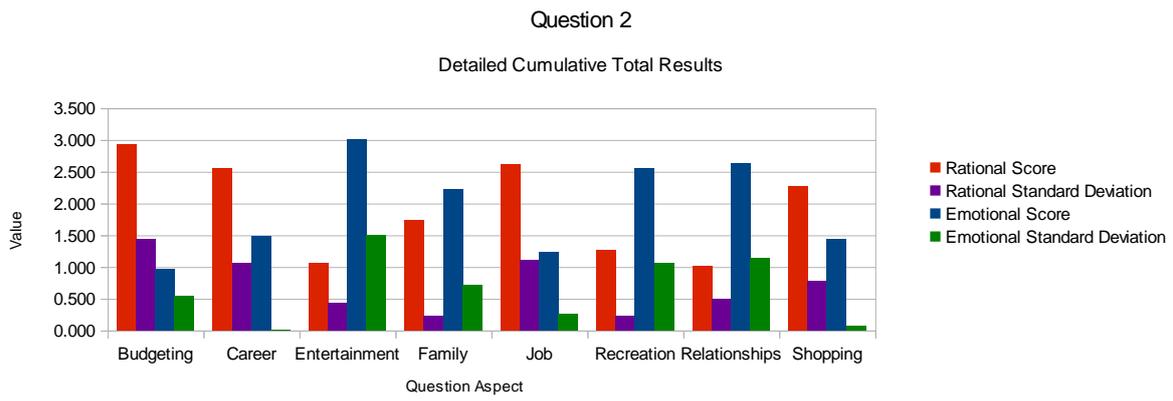


Figure 13. Detailed Question 2 Results for All Groups

Question 3 results for the all groups are shown in Figure 14. Work Life promises to be significantly more Rational in the future, but Personal Life is more Emotional (cf., Figures 6 and 10).

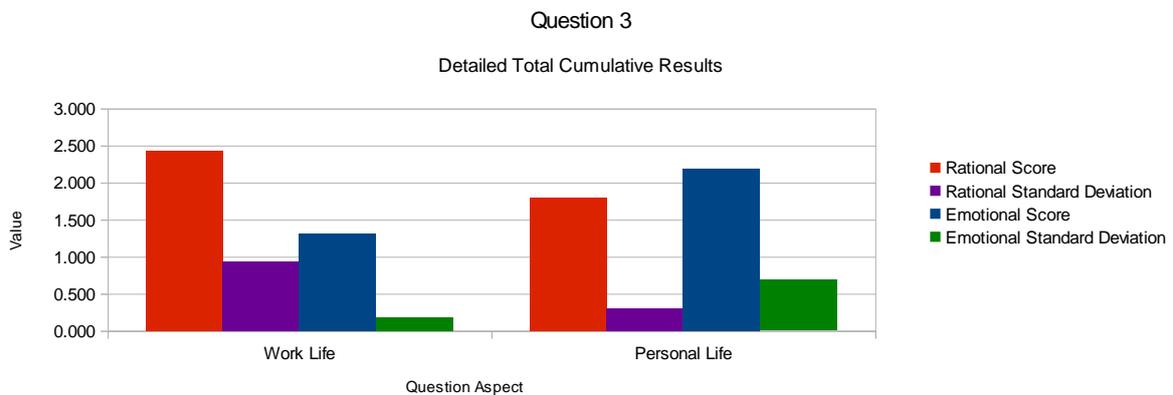


Figure 14. Detailed Question 3 Results for All Groups

Conclusions

Considering all survey groups (total results), for Question 1 (Work Place) it is notable that there is significant Emotional content in Politics, Programmatic Aspects (just under a perfect balance), External Factors, and Personal Factors. Rational dominates in Regulations,

Technology, Economics, and Operations. For Question 2 (Personal Life) Emotion dominates in Entertainment, Relationships, Recreation, and Family. Career and Shopping are nearly perfectly balanced and have significant Emotional content, although less than Rational. Budgeting, Job, and Career have the most Rational content. For Question 3, Rational dominates Emotional in future Work Life but Emotional wins in future Personal Life.

Several of the correspondents questioned the authenticity of the responses and suggested that the Emotional component of decision making might be stronger in actual practice than the survey data presented in this paper reflect. Clearly, the author agrees! ☺

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Biography



Brian E. White received Ph.D. and M.S. degrees in Computer Sciences from the University of Wisconsin, and S.M. and S.B. degrees in Electrical Engineering from M.I.T. He served in the U. S. Air Force, and for 8 years was at M.I.T. Lincoln Laboratory. For 5 years Dr. White was a principal engineering manager at Signatron, Inc. In his 28 years at The MITRE Corporation, he held a variety of senior professional staff and project/resource management positions. He was Director of MITRE's Systems Engineering Process Office, 2003-2009. Dr. White left MITRE in July, 2010, to offer a consulting service, CAU←SES ("Complexity Are Us" ← Systems Engineering Strategies).