Decision Support Versus Process Control: Caveat Emptor

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Robert R. Hoffman
IHMC

rhoffman@ihmc.us
https://www.ihmc.us/groups/rhoffman/

An entry presentation to managers about a new software tool often takes the form: "This will make things easier for your users." What follows is a run-down on all the glorious functionalities the tool provides. Run the clock forward. what do the users experience? Pain. A mega tool with scores of hidden functionalities. Another thrilling opportunity to set up a user account (ID, Password, hat size, etc.). Another steep learning curve heavily populated with the question "How do I do X?" An Instruction manual that would take days to read. And then there are the details, which might be un-spelled cryptic acronyms, microfonts, menu entries that make little sense. The user will often want to do something that should be straight-forward and easy. No way. Then, more time spent, now on creating kluges and work-arounds.

This essay is not a rant about bad interface design, though there are enough horrible interfaces around to make ranting easy. No, this is about how a designer-centric approach to decision support systems results in interfaces that make decision making harder, not easier.

I have seen this most recently in the advent of "editorial management systems" by journal publishers. What a nightmare. Prospective reviewers must be identified and registered by logging in all their factoids. That alone takes hours. And the reviewers will look forward to repeated and annoying robo calls reminding them of the things they have to do. And the editors... they no longer actually edit! They are just fat-fingering devices, slogging in factoids, shifting the burden over to the reviewers. Among the many consequences are submissions that are sent out for review but can be seen as not ready for peer review just by reading the first few sentences. Does all the fat-fingering actually make it easier for the reviewer to make substantive judgments and determinations?

So who is the real beneficiary of new decision support systems? The administrators. They can track things that they once had to actively manage. Hence, The software paves the way to the abrogation of responsibility.

Many software tools that are referred to as decision support systems are actually process control systems. They force the user to enter information according to the software designers' model of the workflow, and it often happens that this requirement does not match to the immediate needs, the actual decision contexts, and the decision requirements of the human. (For examples, see Hoffman and Yates, 2005; Koopman and Hoffman, 2003.)

What would it mean for a software system to actually support decision making?

A decision is generally understood as a mental event that occurs at a singular point in time—a psychological moment of choice—that leads immediately or directly to action (e.g., push the button, or wait 30 seconds and then push the button) (see for example, Boy, 2005; Gammack, 1992; Rigby, 1964; Smith, Shanteau, and Johnson, 2004). The decision is regarded as a point-like thing, a singular commitment, that marks the *end* of a sequence of *clear-cut* mental operations. Stripped of the details in the models, the basic scheme is: (1) Acquire Information, (2) Perceive and interpret the information, (3) Commit to action (a decision is made).

The final-point notion allows us to say that decisions are "made," but even in apparently simple and clear-cut cases, the *deciding process* is much more than this. The process of deciding entails a host of significant cognitive, evaluative, and affective activities that are parallel and interactive (See Hirokawa and Poole, 1996) and that actually extend well beyond moments of commitment (Hoffman and Yates, 2005).

Empirical work in myriad fields (e.g., psychology, health care, management, finance, engineering, law, operations, anthropology, counseling, politics, marketing) as well as analyses of many hundreds of incidents, converge on a number of fundamental questions that arise in real-life decision problems (Yates, 2003). Decision processes can be characterized as the means by which these questions are addressed. Any software system intended to be a genuine decision support system must address these questions:

Question 1—Need: *"Why are we (not) deciding anything at all?"*
This is about whether and how decision problems are recognized in the first place, how people come to recognize that existing or developing circumstances constitute threats or opportunities for the people of concern (Klein et al., 2003; Rostan, 1994).

Question 2—Mode: *"Who will decide, and how will they approach that task?"*
A major part of the "who" question concerns whether to defer authority, and to whom authority is deferred. The "how" question of the mode issue is about the nuts and bolts of how deciders carry out their work.

Question 3—Investment: *"What kinds and amounts of resources will we invest in the process of deciding?"*
This issue is about how and how well it is determined whether the "investment" of resources in the process of deciding—e.g., time, expertise, tools—is appropriate, neither too little nor too much (Klein, 2003).

Question 4—Options: *"What are the different actions we could potentially take to deal with this problem we have?"*
Expert navigation of the prospective solutions is not about increasing the number of alternatives considered. The ideal "option consideration set" for a given problem consists of only a single alternative—the best one. Recognizing and then deliberating over other options is often wasteful of time and resources vetting alternatives that ultimately will (or should) be rejected.

Deliberation over large consideration sets can also exact psychological costs, such as turmoil over the possibility of failing to pick the very best alternative (e.g., Schwartz et al., 2002).

Question 5—Possibilities: *"What are the various things that could potentially happen if we took that action—what do we care about?"*
This involves the macrocognitive functions of sensemaking and mental projection—recognizing outcomes of prospective actions that are capable of occurring, and which would matter greatly if they were to occur. The concern is not with whether those outcomes *will* or *would* occur, only whether they *could* occur, and what the consequences might be.

Question 6—Judgment: *"Which of the things that we care about actually would happen if we took that action?"*
If a decider recognizes (accurately or otherwise) that some decision-relevant event *can* happen, there must then be a judgment as to whether it *would* happen. The decision maker attempts to envision how the world would (or would not) literally create the event in question.

Question 7—Value: *"How much would anyone really care—positively or negatively—if this particular outcome happened?"*
This question centers on what makes decision problems so distinctive and difficult—differences in people's preferences and goals. Deciding involves a commitment to actions that are intended to result in outcomes that are satisfying to particular people (Yates and Tschirhart, 2006). A decider must make judgments about how other people feel about things.

Question 8—Tradeoffs: *"All of our prospective actions have both strengths and weaknesses. So how should we make the tradeoffs that are required to settle on the action we will actually pursue?"*
Every alternative has drawbacks. Decision research has been dominated by questions about deviations of people's actual decision behavior from what is predicted or prescribed by rules such as the expected utility, additive utility, and discounting models. This perspective reflects an idealized, rationalistic, conception of how people deal with tradeoffs in real life. It is also a reflection of the reductive tendency (Feltovich, Hoffman and Woods, 2004). People sometimes seek to avoid having to make an onerous tradeoff altogether by finding or creating a new alternative that makes the tradeoff unnecessary (cf. Shafir, Simonson, and Tversky, 1993). But that is never the end of things.

Question 9—Acceptability: *"How can we get the other stakeholders to agree to this decision procedure?"*
In most high-stakes situations, the decider is not a free agent but must contend with the sentiments of many stakeholders concerning what is decided, how it is decided, and how it is implemented. Negotiations are the most familiar context where the acceptability issue figures significantly, but the acceptability issue assumes significance beyond the realm of formal negotiations.

Question 10—Implementation: *"That's what we decided to do. Now, how can we get it done, or, can we get it done, after all?"*

While a decision aid might seek to get people *to* the commitment, things *follow* the commitment. A commitment to act does not necessarily have action as its primary functionality. Rather, it is a resolution to accept a particular understanding in the hope that the understanding will serve to help the decider to know when to be surprised after the action has commenced and the anticipated contingencies play themselves out, or not.

These questions can be thought of separately from the issue of workflow and process control. Regarding them as the questions that a decision support system should support, what form might that take?

Table 1 takes the questions one at a time and suggests the kinds of enhancements that intelligent technologies might make to help people address them.

Table 1. Some possibilities for intelligent decision aids.

Issue	**A Decision Support System might. . .**
Need?	Help people monitor and recognize threats and opportunities that warrant efforts to make decisions that address them.
Who?	Help people deliberate on whether and to whom authority should be delegated.
How?	Help people determine how well alternative procedures for addressing various other issues are suited to present circumstances.
Investment?	Help people monitor and minimize decision process costs without jeopardizing other quality dimensions.
Options?	Help people scan for and filter existing alternatives and organize their efforts to create new ones.
Possibilities?	Help people envision non-obvious but real and significant potential consequences of alternatives under consideration, such as "side effects" distinct from intended effects.
Judgment?	Help people anticipate the actual states of decision-relevant events and conditions.
Value?	Help people assess how the various parties to a decision feel about potential consequences.
Tradeoffs?	Help people decide how to deal with tradeoffs, including possibly obviating the need for tradeoffs through the identification of better alternatives.
Acceptability?	Help people anticipate how various stakeholders will regard a prospective decision or the process used to make it and to craft ways of achieving their acceptance.
Implementation?	Help people anticipate common impediments to decision implementation before finalizing decisions and to respond quickly and effectively to impediments that occasionally arise despite those efforts.

When the expert blacksmith hammers away at the anvil, he can make precise impacts time and time again, at just the right spot. Yet, measurement of the movements shows that the strokes are never exactly the same (Bernstein, 1996). When we trace the history of a real decision process, it

is always possible to identify a decision, a moment of choice. We can then describe history in terms of causal steps leading up to that moment, creating a causal model that might then be amenable to specification in terms of rules or calculations. But when one looks at deciding as it occurs, a different picture emerges. When we trace the history of a real decision process, it is always possible to identify *multiple* moments of choice. Like the blacksmith, people can reach moments of commitment that signal their occurrence clearly, but are never achieved by following precisely the same path. People are not engaging a cause-effect chain or a rule-based process. They are navigating a space of constraints and issues, involving contingencies and contextual dependencies (Klein, 2007a,b). It is always a challenge to capture such dynamics and interactions in ways that avoid making misleading and reductive causal chain theories (Jagacinski and Flach, 2003). Punctuated histories are what falls out as a result of our telling stories. Those who would create decision support systems might benefit from considering a macrocognitive view of deciding, one that is significantly richer than the domino three-step. To make intelligent decision aids that are maximally useful, designers might focus on trying to enhance consequential elements of the entire decision process, not just what culminates in a moment of commitment.

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