



## Rasmussen's legacy and the long arm of rational choice



Sidney W.A. Dekker

Griffith University, Safety Science Innovation Lab., Macrossan Building N16 Room 2.21, 170 Kessels Road, Nathan Campus, QLD 4111, Australia

### ARTICLE INFO

*Article history:*

Received 11 March 2015

Accepted 4 February 2016

Available online 18 February 2016

*Keywords:*

Rasmussen

Rational choice

Human error

Second victim

Incidents

### ABSTRACT

Rational choice theory says that operators and others make decisions by systematically and consciously weighing all possible outcomes along all relevant criteria. This paper first traces the long historical arm of rational choice thinking in the West to Judeo-Christian thinking, Calvin and Weber. It then presents a case study that illustrates the consequences of the ethic of rational choice and individual responsibility. It subsequently examines and contextualizes Rasmussen's legacy of pushing back against the long historical arm of rational choice, showing that bad outcomes are not the result of human immoral choice, but the product of normal interactions between people and systems. If we don't understand why people did what they did, Rasmussen suggested, it is not because people behaved inexplicably, but because we took the wrong perspective.

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### 1. Rational choice

Rational choice theory says that operators and managers and other people in organizations make decisions by systematically and consciously weighing all possible outcomes along all relevant criteria. They know that failure is always an option, but the costs and benefits of decision alternatives that make such failure more or less likely are worked out and listed. Then people make a decision based on the outcome that provides the highest utility, or the highest return on the criteria that matter most, the greatest benefit for the least cost. If decisions after the fact don't seem to be optimal, then something was wrong with how people inside organizations gathered and weighed information. They should or could have tried harder.

The rational decision maker, when she or he achieves the optimum, meets a number of criteria. The first is that the decision maker is completely informed: she or he knows all the possible alternatives and knows which courses of action will lead to which alternative. The decision maker is also capable of an objective, logical analysis of all available evidence on what would constitute the smartest alternative, and is capable of seeing the finest differences between choice alternatives. Finally, the decision maker is fully rational and able to rank the alternatives according to their utility relative to the goals the decision maker finds important. These criteria were once formalized in what was called Subjective Expected Utility Theory. SEUT was devised by economists and

mathematicians to explain (and even guide) human decision making. Its four basic assumptions were that people have a clearly defined utility function that allows them to index alternatives according to their desirability, that they have an exhaustive view of decision alternatives, that they can foresee the probability of each alternative scenario and that they can choose among those to achieve the highest subjective utility. Herb Simon, in his *Reason in Human Affairs*, described it as "beautiful" but showed all across his work how inapplicable it was to real human decision making (Simon, 1983, p. 13).

Rational choice theory has a long arm reaching out from history, morally holding up the premise that people who face a decision choose among fully reasoned, exhaustively considered alternatives. It stretches far back into the West's past—through Weber, Calvin, Augustine and the story by an author simply named "J" about how two humans rationally chose between following a rule or breaking it. Let's start with that story, of Adam and Eve, as many know it from the book of Genesis in the Judeo-Christian Bible. It has had a profound effect on how the West reads the primacy of human choice and subsequent disaster. All cultures evolve allegories about their own birth, but few place as much emphasis as J's on humanity's free will. J cast the serpent (who was going to beguile Eve into making the choice to eat the fruit) in antropomorphic terms, not capable of deploying asymmetric resources like some satan, but capable of a rational conversation. The serpent, said J, was crafty. But so was Eve. "Is it true that God has forbidden you to eat from any tree in the garden?" It was not just about eating, Eve explained to the snake. The fruit of the tree was not even to be touched, never mind the eating part. If they would, they would die. Eve made up the part

E-mail address: [s.dekker@griffith.edu.au](mailto:s.dekker@griffith.edu.au).

URL: <http://sidneydekker.com>

about touching. The regulation had only covered eating. This allowed J to show Eve as possessing independent wisdom and rationality, eventually moving her to indeed eat the fruit. The most influential interpretation of J's account for Western moral thinking comes from Augustine of Hippo (354–430 CE), who placed moral responsibility for bad outcomes on human choice. Writing in the early fifth century BCE, Augustine argued that:

... when an evil choice happens in any being, then what happens is dependent on the will of that being; the failure is voluntary, not necessary, and the punishment that follows is just (Yu, 2006, p. 129).

Rationality and freedom of action, without coercion, are necessary for moral responsibility (even if they may not be sufficient). Bad outcomes, in his interpretation, are caused by bad human choices. Eve's conduct perfectly matches current definitions of recklessness—of the kind that we now charge various practitioners with (see the case study below):

... to be reckless, the risk has to be one that would have been obvious to a reasonable person. It involves a person taking a conscious unjustified risk, knowing that there is a risk that harm would probably result from the conduct, and foreseeing the harm, he or she nevertheless took the risk ... recklessness is a conscious disregard of an obvious risk (GAIN, 2004, p. 6).

Eve took the risk knowingly and consciously, even though it was unjustified (there would have been plenty of other fruit). She knew that harm would probably result. Foreseeing this harm, she took the risk, consciously disregarding it. Eve was reckless. A rational, reasoning being, she chose to err, she freely elected to violate, knowing that she was doing it, and knowing the consequences.

Calvin (1509–1564), instrumental in shaping the West's interpretation of this ethic of rational choice and individual responsibility, relied heavily on Augustinian thinking (Han, 2008). In *The Bondage and Liberation of the Will* (1543), a publication that mainly addresses the freedom of human will and human choice, Calvin includes many citations from Augustine—significantly more than from any other patristic authors (e.g. Tertullian, Pelagius), agreeing on the essential links between human choice, sin and evil. Sociologist Max Weber subsequently traced these ideas into what he called the 'Protestant ethic' in 1904. This is the view that a person achieves success through individual hard work, commitment, diligence, engagement and thrift, and that such success is a sign of salvation. The opposite is easy to imagine: failure is the result of a lack of individual hard work, application, commitment. Individual workers, in the Protestant Ethic, were responsible for the creation of their own salvation; their own choices determined their success at this; and their actions got measured by the consequences, the outcome. Such thinking "is still present and pervades contemporary organization and management ... though today it is rarely referred to in religious terms, nor typically called salvation" (Dyck and Wiebe, 2012, p. 300).

Rational choice theory remains dominant in safety work, and it has led, in Rasmussen's view, to attribution errors when "highly skilled people depart from normative procedures" (Rasmussen, 1990b, p. 1192). In hindsight, we might ask how people back then and there did not see what we now know was important—what sloth, bloody-mindedness, immorality or stupidity clouded their choice to do the right thing? Accident probes and managerial reactions to failure are often founded on the premise that people's decision making was driven by rational, fully informed choices, concluding that they either must have been amoral calculators who

prioritized production or personal goals over safety (Vaughan, 1999) or made shortcuts that Reason once chose to call "violations" (Reason, 1990). The long arm of rational choice can be seen in an explanation of bad outcomes in an otherwise well-designed system (such as paradise) in a sister journal not long ago:

It is now generally acknowledged that individual human frailties ... lie behind the majority of the remaining accidents. Although many of these have been anticipated in safety rules, prescriptive procedures and management treatises, people don't always do what they are supposed to do .... This undermines the system of multiple defences that an organisation constructs and maintains to guard against injury to its workers and damage to its property (Lee and Harrison, 2000, pp. 61–62)

"Unsafe acts," a term coined by Heinrich in the 1930's, remains a trope in Reason's popular accident model (1990), reifying the belief that things ultimately don't go wrong (however the odds are stacked up) until and unless a frontline worker "adds the final garnish" (p. 173).

## 2. Case study

A 16-year old patient died after a nurse named Julie accidentally administered a bag of epidural analgesia by the intravenous route instead of the intended antibiotic. Julie was a 15-year veteran nurse in a midwestern hospital obstetrics ward. During a busy holiday season, nurses were asked to 'please help' manage staff shortages, to pitch in. Julie did. Around that time a new barcode technology was introduced. As is common, the scanners had trouble reading barcodes off clear plastic infusion bags. That meant information about the medication had to be entered manually. The antibiotic and epidural bags were very similar: both were clear plastic with identical ports to fit the infusion pump and tubing. Also, a work-around had been put in place that got nurses to prep patients for an epidural—obtain the medications, insert and prime tubing and put medications on the infusion pump—all before the anesthesiologist arrived with the written order. Anesthesiologists' satisfaction increased.

After a busy double shift (almost 17 h), Julie had a few hours of sleep in the hospital before starting yet another shift. A young mother, about to give birth and in pain and distress, was one of her first patients. In the wake of the mother's sudden death (the baby survived), Julie collapsed, was admitted to the hospital as patient herself, then fired and criminally charged by the state attorney general. She returned to the hospital one day for pastoral care, but was barred at the entrance by one of the directors and told to leave the property (Dekker, 2010; Denham, 2007).

When I met Julie later, she described how a director dismissed her with an anxious, angry, hissing "You can't be here ... !" and pointed to the end of the street—away from the hospital. Facing years in jail, a large fine, a loss of licence, a destroyed career, a lost identity as carer, she was abandoned into the "heart of darkness" that can engulf any clinician after killing or harming a patient (Christensen et al., 1992). Julie must have flirted with the place where other second victims have ended up: nowhere to turn but suicide (Ostrom, 2011).

Fortunately, some time after the incident, Julie was embraced by several patient safety leaders internationally and asked if she could help turn her story into a learning case to prevent similar harm. How could this happen to Julie, and how could it happen to any other nurse? It must have made sense for Julie to do what she did—with the similar bags and interchangeable ports, tired to the bone, with a distressed patient clamoring for pain relief now, with

scanners that weren't up to the job, and anesthesiologists who weren't yet on the job. It must have made sense, otherwise she wouldn't have done it. And if it made sense to Julie, it would have made sense to her colleague nurses as well. Or will in the future, if nothing else changes.

### 3. Rasmussen and rational choice

Rational choice was always an illusion, of course. People's choices, and their capacity to decide, are constrained by so many things (including the error-trap design of interchangeable intravenous ports). Pushback against assumptions of full rationality have accompanied the Calvinistic tradition in the West. Almost two centuries past, Marx saw the human subject not as a free, universally rational being but rather as an ensemble of social relations. What any person can see, or understand, or construe as rational, is dependent on where and how they are configured in the larger web of society. Freud (1856–1939) suggested how human rationality is constrained and influenced by the unconscious mind, which allows only a distorted, partial human consciousness, ever subjected to the drives and repressive vetoes of the id (Freud, 1950). Foucault (1926–1984) argued that the human subject is a finite and historical entity; that what the subject can know is always the relative and questionable expression of a particular constellation of relationships in which that subject is configured (Foucault, 1970).

In real conditions under which people perform work, cognitive and resource limitations, as well as uncertainty and the sheer dynamics of unfolding situations all severely constrain the choices open to them. Van den Hoven (2001) called this “the pressure condition,” (p. 3) where practitioners such as nurses and pilots and air-traffic controllers are embedded in a narrow “epistemic niche.” They can only know so much about their world at that time. All rationality is local: based on people's knowledge, understanding and goals at the time, not based on some universal ideal overview of all the possible pathways and risks associated with them. As a result, Claus Jensen, in his review of the Space Shuttle Challenger accident, wondered whether there still is:

any point in appealing to the individual worker's own sense of responsibility, morality or decency, when almost all of us are working within extremely large and complex systems ... According to this perspective, there is no point in expecting or demanding individual engineers or managers to be moral heroes (Jensen, 1996, p. xiii).

Of course some believe that there is such a point. Speaking to those workers' actions in the same accident, Feldman (2004) invoked the unique fiduciary relationship in which the expert understands something that others do not. This supposedly full, or at least fuller, rationality places a higher moral burden on that expert: the burden to speak up, to act in accordance with a harm prevention ethic, to explain what happened or warn about what might happen, even under the threat of sanctions if you don't:

Engineering societies need to require engineers to act in accordance with the prevent-harm ethic. This requirement must include both training to inculcate the prevent-harm ethic and sanctions—up to losing one's license—when the ethic is violated (p. 714).

Yet Rasmussen actively and richly contributed to the critique of the very idea (and moral implications of the illusion) of rational choice. The critique stresses the influence of context on human action. Pioneering work by Fitts and Jones (1947), Chapanis (1970),

Senders and Moray (1991) and others demonstrated how the ideal of fully rational, regulative human action is constrained by design and operational features. Design things in certain ways and some errors become almost inevitable. Simon's critique of rational decision making lent theoretical weight. Using a mix of computational argument (the potential problem space is far larger than the cognitive capacity of the decision maker), empirical observations and thought experiments, he argued that human rationality is not omniscient but ‘bounded’ (Simon, 1959, 1969, 1983). The assumptions of behavioral theory about human capabilities, he proposed, should be far weaker than those of rational choice theory and make modest, realistic demands on the knowledge and computational abilities of human agents (Newell and Simon, 1972). Work on hindsight and other decision biases (Fischhoff, 1975), cognitive fixation (De Keyser and Woods, 1990) and social dynamics of decision formation (Janis, 1982) added questions about the accuracy and relevance of rational choice assumptions in human work (Klein, 1998; Orasanu and Connolly, 1993). ‘Bounded’ rationality, however, still both invoked and denied full rationality (since rationality can be ‘bounded’ only in contrast to some full ideal). It was gradually replaced by the label ‘local’ rationality (Woods et al., 1994). The notion of local rationality fit characterizations of cybernetics (Ashby, 1956): knowledge is intrinsically local and subjective, an imperfect tool used by an agent to help it achieve its goals. The agent not only does not need perfect rationality; it can never achieve it. It locally senses its inputs and notes its outputs (actions), inducing regularities that hold in its environment. What these agents do is locally rational—assessments and actions make sense given the agent's active goals, current knowledge and focus of attention.

This has had consequences, picked up early by Rasmussen and colleagues, for how we look at norms and ‘violations’ in work. In the early 1970's, when studying electronics technicians, Rasmussen and Jensen found rapid sequences of simple decisions on informationally redundant observations. These seemed inefficient in terms of information economy (i.e. why check the same thing three times from different angles or approaches?) and thus not at all rational. But seen from the inside of the job, with goals such as minimizing time on task or mental load, these informal procedures were locally rational (Rasmussen and Jensen, 1974). The distinction between two images of work (Hollnagel, 2014), already articulated on the European continent in the Francophone ergonomic tradition (De Keyser et al., 1988), was given additional theoretical and empirical weight by Rasmussen's work. In one image, there is a set of rational choices to be made by the worker in order to reach a goal. These decisions are supported or directed by written procedures that the worker should follow. In the other image of work, there is not a one-to-one mapping from written guidance to task, but rather a “many-to-many mapping between means and ends present in the work situation as perceived by the individual.” As explained by Rasmussen, “there are many degrees of freedom which have to be resolved at the worker's discretion. ... Know-how will develop ..., ‘normal ways’ of doing things will emerge. ... Effective work performance includes continuous exploration of the available degrees of freedom, together with effective strategies for making choices, in addition to the task of controlling the chosen path to the goal” (Rasmussen, 1990a, pp. 454–455). This constitutes the local rationality in the way the individual does and develops the most sensible way to work—even if that is not the rationality of the designer, the manager or the procedure. “Humans tend to resolve their degrees of freedom to get rid of choice and decision during normal work and errors are a necessary part of this adaptation, the trick in the design of reliable systems is to make sure that human actors maintain sufficient flexibility to cope with system aberrations, i.e., not to constrain them by an inadequate rule system” (p. 458).”

Through his influence on the field, Rasmussen helped the world look at work and incidents this way (Rasmussen, 1990b; Rasmussen et al., 1987). Bad outcomes are not the result of human immoral choice, but the product of normal, locally rational interactions between people and systems through which control is often maintained, and sometimes lost. “System breakdown and accidents are the reflections of loss of control of the work environment in some way or another” (Rasmussen, 1990a, p. 458).

#### 4. Summary and conclusion

So what could be expected on Julie's behalf? Give her barcode scanners that don't work well on transparent bags, have anesthesiologists come see the patient only when they are ready for it, provide an IV design whose ports were interchangeable. Pour fatigue and nursing shortages liberally over the top of it. Then introduce a young patient in severe pain and acute distress. Have a nurse, on her own, maintain control of the whole package. And, oh, when something goes wrong, blame and exile the nurse. Because you can't possibly understand how it made sense for her to get things so mixed up. Rasmussen would make us see that sense, though. “The behavior in work of individuals is, by definition, oriented towards the requirements of the work environment as perceived by the individual” (Rasmussen, 1990a, p. 455, emphasis added). Or as Kim Vicente later paraphrased: If what those individuals did doesn't make sense to us, then it isn't because they were behaving inexplicably. It is because we have taken the wrong perspective (Vicente, 1999).

Taking that wrong perspective is apparently easy enough. Even though it has real consequences for real people—and for who we are, collectively, as humanity. Driven ultimately by Augustinian and Calvinistic thinking, and Weber's ethic, the hospital's response to Julie was to meet hurt with more hurt. They had, as Leape would put it, “come to view an error as a failure of character—you weren't careful enough, you didn't try hard enough” (1994, p. 1851). Again, fortunately Julie responded positively to the invitation to contribute to learning from her incident, and generally welcomed opportunities to speak. Yet it took a tremendous emotional toll on her. But when she was in that ‘heart of darkness,’ her world was given a little bit of humanity, a little bit of hope, a sense of normalization, a renewed goal by some who understood that if other people's actions don't make sense, it is because we have taken the wrong perspective. They helped her to show the world her perspective and how it made sense after all. That, if anything, is Jens Rasmussen's legacy. His is a contribution to a world where we can argue forcefully for Fitts' and Jones' insights that ‘errors’ are normal, explicable experiences that are systematically connected to features of people's tools and tasks (Fitts and Jones, 1947). We can make an effort to see matters through their eyes: by taking, as much as possible, the perspective they had at the time. Rasmussen contributed to a world that meets the suffering of people like Julie with an understanding of why her assessments and actions made sense for her. Rasmussen contributed to a world where we have better arguments to meet hurt not with more hurt—but ultimately with learning and healing.

#### Acknowledgments

No specific funding sources or conflicts of interest were declared.

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