

# : *What theories are especially relevant to decision support?*

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Decision support is an applied field of study like accounting, engineering, and medicine. Design science, improvement of computational methods, and user experience testing are important. Research grounded in theory is also important to understanding how decision making can be improved and "what works when". A theory is an organized set of ideas that explain a phenomenon. In decision support research a theory might explain use or lack of use of a decision support capability. A different relevant theory might explain adoption of decision support capabilities. Theory might explain the failures and successes of decision support. Finally, theories might inform impacts of decision support capabilities on organizational behaviors and organizational functioning and success.

There are many theories linked to Information Systems research (Larsen, Allen, Vance, and Eargle, 2015). Jarvis (1976) in an early discussion of Decision Support Systems theory argued "DSS is not a separate science; it is an idea whose time has come. Namely, that by combining the computer's computational power with the decision maker's intuition and judgement in an interactive manner, better decisions will result than by either the computer or human taken separately." Researchers interested in studying various decision support capabilities and technologies and in designing novel systems can potentially benefit from a more focused summary of theoretical frameworks. The following theories and frameworks seem especially useful:

## **1. Behavioral decision theory**

Slovic, Fischhoff, and Lichtenstein (1977) concluded "because of limited information-processing capacity and ignorance of the rules for optimal information processing and decision making, people's judgments are subject to systematic biases. (p. 14)" Normative theory like Multi-attribute Utility Theory (MAUT) prescribes courses of action based upon a decision maker's beliefs and values. Descriptive decision theory examines these beliefs and values and how people incorporate them into their decisions.

## **2. Bounded rationality theory**

Herbert Simon (1957) argued "The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world." Based upon that generalization, Simon suggests

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decision makers are satisficing rather than maximizing goals and outcomes. Decision-makers have cognitive limitations related to both knowledge acquisition and retention, and to computational capacity. The rationality of human decision makers is inherently bounded and limited.

### **3. Cognitive fit theory**

Vessey (1991) proposed that correspondence, congruence or fit between task and information presentation format resulted in superior task performance for individual users. Vessey and Galletta (1991) concluded that "providing decision support systems to satisfy individual managers' desires will not necessarily have a large effect on either the efficiency or the effectiveness of problem solving. (p. 82)"

### **4. Cognitive load theory**

Cognitive load refers to the effort being used by a person to process data and information. System designers must consider the amount of cognitive load. Driver and Streufert (1969) postulate that "individuals and groups can be viewed as information-processing systems which respond in a curvilinear fashion to three components of input load: complexity of information, noxity (unpleasantness) and eucity (pleasantness)." They postulated there is an optimal input load where each system is expected to achieve maximum complexity in information-processing.

### **5. Garbage Can theory**

Cohen, March, and Olsen (1972) describe an organization as "a collection of choices looking for problems, issues and feelings looking for decision situations in which they might be aired, solutions looking for issues to which they might be the answer, and decision makers looking for work".

### **6. Information processing theory**

Information processing theory equates the human mind to a computer or information processor. A person receives inputs, processes the input using prior learning, and delivers output. The information processing capability of a person is limited by memory capacity and processor characteristics like speed and parallel processing.

## **7. Multi-attribute utility theory**

Many decisions can be structured so that alternatives can be compared in terms of how well each meets the multiple objectives of interest to a decision maker in a specific situation. Multi-Attribute Utility Theory (MAUT) is a structured methodology designed to handle the trade-offs among multiple objectives. MAUT is a multi-attribute theory of choice that is prescriptive yet is also seemingly descriptive of some decision behavior.

## **8. Prospect theory**

This cognitive theory (Kahneman & Tversky, 1979) describes how people choose between probabilistic alternatives that involve risk, where the probabilities of outcomes are uncertain. Prospect theory holds that people tend to value gains and losses differently from one another, and, as a result, will base decisions on perceived gains rather than on perceived losses.

## **9. Socio-technical systems theory**

Socio-technical systems theory emphasizes the design and performance of any organisational system. At an organization level decision making can only be improved and understood if both 'social' and 'technical' aspects of the systems are both examined and each component is an interdependent part of a complex, interacting system. System theory investigates both the principles common to all complex entities and the models to describe them. A system is a cohesive set interrelated and interdependent parts with a shared purpose.

## **10. Task-technology fit**

This theory states Information Technology (IT) is more likely to have a positive impact on individual performance and be used if the capabilities of the IT match the tasks that the user must perform (Goodhue and Thompson, 1995). They defined task-technology fit (TTF) as "the degree to which a technology assists an individual in performing his or her portfolio of tasks (p. 216)". Also, Goodhue and Thompson (1995) explored measurement of TTF.

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## 11. Technology acceptance model

Technology acceptance is a function of the perceived usefulness of a system and its perceived ease-of-use. The model suggests that when a person encounters a new technology these two factors influence the decision about if, how and when to use it. Perceived usefulness (PU) is "the degree to which a person believes that using a particular system would enhance his or her job performance". Perceived ease-of-use (PEOU) is "the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989).

## 12. Work systems theory

According to Alter (2013), in a work system human participants and/or machines perform work, processes and activities, using information, technology, and other resources to produce specific products/services for specific internal and/or external customers.

## Conclusions

This list is a work-in-progress. Please suggest changes and enhancements. The large number of theories relevant to decision support research topics suggests the wide variety of interpretations of the decision support phenomenon and the varying context for studying the use of decision support. Current theories support the notion that it is desirable and useful to develop tools and procedures to improve problem solving and decision making. This analysis is an attempt to build new theory and improve existing theory related to decision support. An enumeration of decision support relevant concepts and their interrelationships may show how, when and/or why the phenomenon of decision improvement occurs. In various contexts using a variety of computer-based systems, managers and researchers have observed benefits from decision support and observations have also shown limitations and problems. Sometimes the cause of problems is attributed to the software that was used, sometimes to the decision makers, and sometimes to the task or to the absence of facts. Enhanced theory can perhaps find a simple and testable explanation for past observations.

## References

Alter, S., "Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future" (2013), Business

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Analytics and Information Systems, Paper 35.  
<http://repository.usfca.edu/at/35>

Barros, G., "Herbert A. Simon and the concept of rationality: boundaries and procedures," *Brazilian Journal of Political Economy, Rev. Econ. Polit.* vol.30 no.3 São Paulo July/Sept. 2010 at <http://dx.doi.org/10.1590/S0101-31572010000300006>

Cohen, M.D., J. G. March, and J. P. Olsen, "A garbage can model of organizational choice". *Administrative Science Quarterly*. 17 (1), 1972, pp. 1-25. doi:10.2307/2392088

Davis, F. D., "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, 13 (3), 1989, pp. 319-340, doi:10.2307/249008, JSTOR 249008

Driver, M. J. and S. Streufert, "Integrative Complexity: An Approach to Individuals and Groups as Information-Processing Systems," *Administrative Science Quarterly*, 14(2):272, June 1969, DOI: 10.2307/2391105

Goodhue, D. L., "Understanding User evaluations of Information Systems," *Management Science*, 1995, 41, 12, pp. 1827-1844.

Goodhue, D.L. and R.L. Thompson, "Task-technology fit and individual performance," *MIS Quarterly*, June 1995; 19, 213-236 at URL <https://pdfs.semanticscholar.org/668e/58d4e3479317257a41ce66c688a8aa663399.pdf>

Jarvis, J. J., "Decision Support Systems: Theory," Final Report - Delivery Order No. 0999-01, DAAG29-76--D-0100, Jan 1976 (some references 1978?) at URL <https://apps.dtic.mil/dtic/tr/fulltext/u2/a104885.pdf>.

Kahneman, D., and A. Tversky, "Prospect Theory: An Analysis of Decision under Risk" (PDF). *Econometrica*. 47 (2), 1979, pp. 263-292 at doi:10.2307/1914185

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Larsen, K. R., Allen, G., Vance, A., Eargle, D. (Eds.) (2015). Theories Used in IS Research Wiki. Retrieved June 20, 2015 from <http://IS.Theorizeit.org>.

Slovic, P., B. Fischhoff, and S. Lichtenstein, "Behavioral Decision Theory," Annual Review of Psychology, Vol. 28:1-39, February 1977 at URL <https://doi.org/10.1146/annurev.ps.28.020177.000245>

Simon, H. A., Models of Man; Social and Rational, John Wiley, 1957.

Vessey, I., "Cognitive Fit: A Theory-Based Analysis of the Graphs Versus Tables Literature," Decision Sciences 22,(2), 1991, pp. 219-240.

Vessey, I. and D. Galletta, "Cognitive Fit: An Empirical Study of Information Acquisition," Information Systems Research, March 1991 2(1):63-84 DOI: 10.1287/isre.2.1.63

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