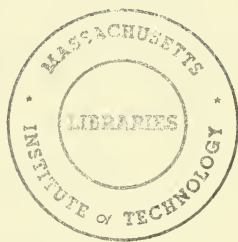


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Systematic Bias in Perceptions
of Product Success

by

Gordon Walker

February 19, 1982

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A maxim frequently used to describe current management practice is: short term drives out long term. Hayes and Abernathy (1980), for example, in a very popular article, criticize the conduct of American managers for its short term orientation. However, the temporal orientation of the members of an organization has not been systematically operationalized. Such an operationalization is the purpose of the present study. The research will show that short term bias does in fact occur for the members of the firm studied here, but only for a certain type of goal, and that the pattern of bias may be discussed in terms of constraints on perception imposed by a specific technology and by pervasive, albeit theoretical, characteristics of organizations.

Temporal orientation in decision making is approached here as a dimension of individual causal maps. A causal map can be defined as a subjective system of events linked by features which suggest a causal relationship. Such systems have been called by a number of names: cause maps (Bougon, Weick and Binkhorst, 1976; Weick, 1979); scripts (Schank and Abelson, 1977; Abelson, 1976); implicit theories of events (Ajzen, 1977); causal schemata (in attribution theory, Kelley (1967, 1972); in the study of judgment under uncertainty, Tversky and Kahnemann (1978); knowledge structures (Martin et al., 1980); and cognitive maps (Neisser, 1976). These systems differ in several ways, such as the number of events in the system, the degree of emphasis on specific features linking events, the kind of events in the system, and the degree to which means or ends are emphasized. Yet these differences are overshadowed, for present purposes, by the fact that the systems all refer to a subjective ordering of specific events according to a scheme of causal inference.

Individual causal maps can clearly be large in the number of events that compose them and complex in the number of relationships that connect these events (see e.g., Bobrow and Collins, 1975). Moreover, individuals may have separate causal maps for different kinds of general outcomes, e.g., personal or organizational success; and maps with different outcomes may be only loosely connected to each other. Therefore, to be able to identify and compare individual causal maps and relate them to other phenomena in an organization, a relatively narrow and specific focus must be taken. The present research focuses on causal maps in which the generalized end is product success, in particular of computer software products.

Four types of product success, performance, generativity, coherence, and currency, are suggested as theoretically useful for understanding individual differences in causal maps for product success. Other events which are important for product success are proposed to contribute to the theoretical types. The types are ordered in a typology the dimensions of which are proposed as the causal features linking other events to the types in the causal map (see Tversky and Gati, 1978 for a similar approach using attribute dimensions to structure a feature matching tasks). The dimensions of product success are time and space (see Figure IA).

The temporal dimension of the typology orders the types according to whether they indicate short or long term success and the spatial dimension orders the types in terms of whether success occurs inside or outside the organization. This ends framework for analysing causal maps makes it possible to assess bias in the way a population of respondents, in the present case the members of a computer software products firm, see events contributing to product success. The meaning of each type of success is described below in greater detail.

Performance is a type of product success which occurs in the short term within the organization. For software products, performance is indicated by the event which combines achievement of design goals and efficiency in run time and storage space. The effectiveness and efficiency of a software product have long been important considerations in the evaluation of the product's technical worth; and consequently, many rules and procedures for improving them have been suggested, aimed both at the process of managing projects producing software and at the structure and content of the code (Van Tassel, 1978). These methods are themselves a matter of debate, indicating that standards for achieving a high performing software product are not yet generally accepted. Consequently, individual causal maps may vary in the degree to which certain events are seen to be important for software performance.

The software products industry is growing rapidly, particularly in terms of new products introduced. The development of new products is consequently an important concern in many if not all software firms. Furthermore, software products, because they manage, either directly or indirectly, the information needed to run a user's business, must be able to respond to changes in the way information is structured. Very often this means that the product must be reworked into a new version of itself (Goetz, 1978). Products that either have valuable parts which contribute to new product development or are easily modified into new versions of themselves can be thought of as generative. Unlike performance, generativity takes place in the long term, but like performance it occurs inside the organization.

A software product is most often used by people outside the organization that developed it. These users are generally unfamiliar with the technical properties of the product but can be expected to understand its purpose and

use it effectively. A software firm can work on making its product more understandable and acceptable to users; the verdict, however, is in user perceptions, not those of the developer. The coherence of a product is a type of success involving user perceptions and effective use of the product outside the development organization and is relevant in the short term.

Software products may also be useful outside the organization in the long term. User perceptions of a product may change significantly over time. The growth rate of the software market, the changing characteristics of software products, and new information management needs of users lead to a deterioration of product usefulness. Current users of a product will develop new needs which a product must satisfy. Furthermore, new users may have needs for the management of information that are different from the needs of old users. To expand its market the product must be able to meet these needs of potential users. The currency of a product refers to its continued viability for old users whose demands have changed and its ability to attract new users who have requirements unlike those which the product was originally intended to satisfy. Like coherence currency is judged outside the organization. The perception of the product's ability to satisfy new requirements, whether or not the product's design has changed, is the key determinant of currency; a product will sometimes do more than it was originally meant to do.

Each type of success may occur independently of the others. A product may perform according to specifications but be neither coherent to users nor contribute to any new product. Likewise, a product may be coherent without performing well or contributing to future needs inside or outside the organization. A product may perform badly and be incoherent and yet be valuable as a source of parts for the development of new products. Finally, in enough time, a product may meet new user needs, having served old needs

badly. Combinations of types may also occur. A product can perform well and be coherent and generative and yet perform badly and lack currency, and so on. Thus there are no theoretical constraints on the importance events may have for the occurrence of the types of success: an event may contribute to one or more types of success virtually without restriction.

Methods and Results

Ninety-three members of a computer software products firm participated in the study. Eight nominal groups (Delbecq et al., 1975) were run to derive a list of events which, in the language of firm members, contributed to software product success. The list, containing 352 events, was content analysed into 52 categories. A pilot test was run with seven members of the firm to identify those events which contributed in significantly different degrees to the four types of product success, each of which was operationalized as an event (see Figure I-3). Thirty-one events were selected from the results of the pilot test as discriminating significantly among the types of success. These events are listed in Table 1A. All subjects were asked to indicate how important each of these events was for the accomplishment of each type of product success.

Their responses were input to CANDECOMP, an n-mode, n-way individual differences scaling program (Carroll and Chang, 1970; Carroll and Arabie, 1980), with three and two dimensional solutions specified. The third dimension added only 5% to variance explained and so the two dimensional solution was selected for interpretation. The positions of the thirty-one events and the four types of product success in the two-dimensional solution are shown in Table 1B.

The axes of the scaling solution were interpreted according to the weights of the types of success. The horizontal axis was labeled the space dimension since the inside types of success are on the right side of the space and the outside types to their left. The vertical axis was interpreted as the time dimension because the weights of both long term types were greater than those of the short term types.

Four pairs of events were then selected, each pair from a region of the space that could be associated with a particular type of product success. These pairs are shown in Table 2A. A subset of members were asked to compare the eight events in terms of the similarity of their contribution to product success in general. Responses were input to INDSCAL, a two-mode, three-way individual differences scaling program (Carroll and Chang, 1970; Carroll and Arabie, 1980) with a two dimensional solution specified. The results of the scaling are shown in Table 2B. Note the resemblance between the INDSCAL and CANDECOMP patterns (allowing for a sign change on the horizontal axis).

Finally, the strength of the causal features linking the events to the types of success was assessed. Members were asked to choose between three alternative causal relationships: either an event led to a type of success, the type of success led to the event, or both directions were equally possible (see Tversky and Kahnemann, 1978). The four pairs of events, each pair linked to a type of product success, were used to form eight causality questions. These questions and the percentage of respondents who chose the alternatives in each question are shown in Table 3.

Discussion

The three ways perceptions of product success were measured are consistent in that each shows a bias against long term success outside the firm. The results of the causality tests suggest why the bias against currency in the scaling solutions occurred. The reason is that firm members do not generally identify a causal feature linking events to currency, but do identify causal features for the other types of product success. Since, in the absence of time as a causal feature linking them, events and types of success are connected by cues indicating location, coherence and currency are seen close together. Furthermore, because a causal feature is perceived between events and coherence, currency lies closer to the short term side of product success rather than coherence closer to the long term side.

The distribution of events in the CANDECOMP solution shows that, in general, the events which describe product characteristics are associated with long term success and those associated with organizational or production characteristics with short term success. Also, events which refer to users are linked to coherence and currency and those not referring to users to performance and generativity. Thus user-product events are in the long term/outside region of the space. In the short term/outside region are interactions between users and the organization.

Both CANDECOMP and INDSICAL produce weights (not shown) for each individual on the time and space axes. Predicting individual differences in these weights, using variables from such theoretical frameworks as task characteristics (Hackman and Oldham, 1975), socialization (Schein, 1971), modes of organizing, including function, product, user and geography (see, e.g., Galbraith, 1974) and network role structure (White, Boorman and Breiger, 1976), would aid organization designers concerned with increasing the detail of long term scenarios for decision makers.

But how generalizable are these results? First, they may be constrained both by the technology and stage of development of the software industry. Software firms are focused on product in a unique way. Their production process is virtually trivial and process innovations tend in any event to be advances in software technology (Lecht, 1977, Chapter 10). Also, the industry is young and growing rapidly (Goetz, 1978); therefore, its cost structure is governed almost exclusively by product development and marketing rather than production. However, one wonders whether software firms do not therefore present the best case for perceptions of the time dimension since organizations less focused on product than process should make fewer distinctions between what a product is now and what it might need to become. For such firms the difference between short and long term success inside the organization might therefore be less than the difference shown in the data here.

To what degree, though, is the firm in the present study representative of software firms in general? This question is difficult to answer because the software industry is emerging and fragmented. Most software products companies are quite small because they are so new. It might be accurate to say that the firm is representative of a strategic group (see Porter, 1980) in the software industry. The mapping of different orientations towards product success onto strategic groups in an industry would increase the specificity of general statements like that of Hayes and Abernathy and is a task for future research.

In a very general sense, however, the data may reflect a constraint on inferences about product outcomes which is inherent in all organizations. Such a constraint might be imposed because change inside the organization is more predictable than change outside. Thompson's (1967) concepts of technical

and organizational rationality are apposite. In the technical core the dominant focus is on achieving instrumental and economic rationality (in Thompson's terms), and long run considerations are clearly separate from these purposes. Those components subject to organizational rationality manage the demands of the firm's environment and coordinate the various activities of the organization, in order to maintain the ability of the technical core to pursue its goals. Technical and organizational rationality are related to success within the firm: short term product success inside the firm by definition is a technically rational outcome and long term success inside meets contingencies and is thus organizationally rational. However, outside types of success are not distinguishable in this way and are perceived therefore as much more similar.

How strongly short term bias towards product success outside the firm, as found in the results presented here, can be attributed to strategic group, industry, or general organizational characteristics is a question that falls under the general heading of cognitive organization theory, the seminal work in which is March and Simon's Organizations (1958). Questions under this heading should be addressed and answered before the interplay of culture and cognition, discussed by Hayes and Abernathy, becomes the dominant issue in debates about managerial style.

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Table 1

Results of CANDECOMP Scaling of Events and Types of Success

A. Events

1. There is close contact with the end user during development.
2. The developer has a precise picture of who will be using the product.
3. The product is portable across machines.
4. Product structure is modularized.
5. The development team has intrinsic ability.
6. An effective user system can be demonstrated.
7. The price of the product.
8. The vendor is committed to the product.
9. The product has good documentation.
10. The developer knows the trends that affect the life of the product.
11. The development company has a good reputation.
12. The product developer supports the user.
13. In a phased approach to product development, each phase is completed with a review by knowledgeable individuals.
14. What base software and hardware the product runs on.
15. Product has unique aspects from users point of view.
16. Product delivery is on schedule.
17. Product solves a timely problem.
18. The development organization supports the product all the way through.
19. The product is easy to use.
20. The product is easy to install.
21. The terms and conditions associated with licensing and purchasing the product.
22. The product is pilot tested.
23. The level of experience required of the user.
24. The users of the product are trained.
25. The product is highly advanced technologically.
26. The product interfaces easily with existing products of the vendor.
27. Using the product is efficient in terms of human resources.
28. The number of bugs encountered when the product is installed.
29. The product is accurately represented by marketing.
30. The product approaches a problem in a way that seems natural to the user.
31. The user has a specific requirement.

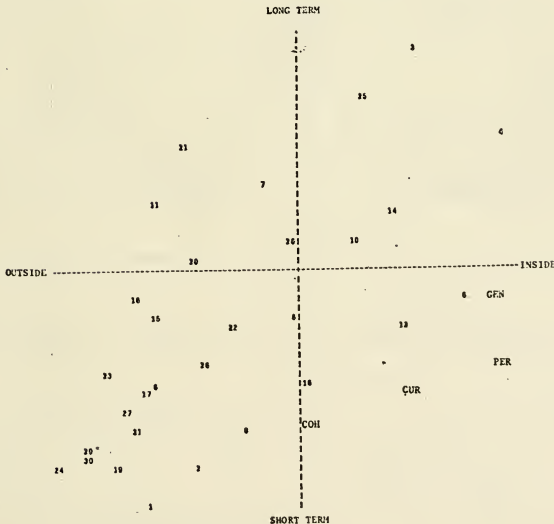
B. CANDECOMP Scaling of thirty-one events and Four Types of Product Success $R^2 = .30$ 

TABLE 2

Results of Individual Differences Scaling of

Eight Events Using INDSCAL

A. Events

Performance:

1. The development team has intrinsic ability
2. In a phased approach to development, each phase is completed with a review by knowledgeable individuals

Generativity:

3. The product is portable access machines
4. The product is highly advanced technologically

Currency:

5. An effective user system can be demonstrated
6. The product solves a timely problem

Coherence:

7. There is close contact with the end user during development
8. The developer has a precise picture of who will be using the product.

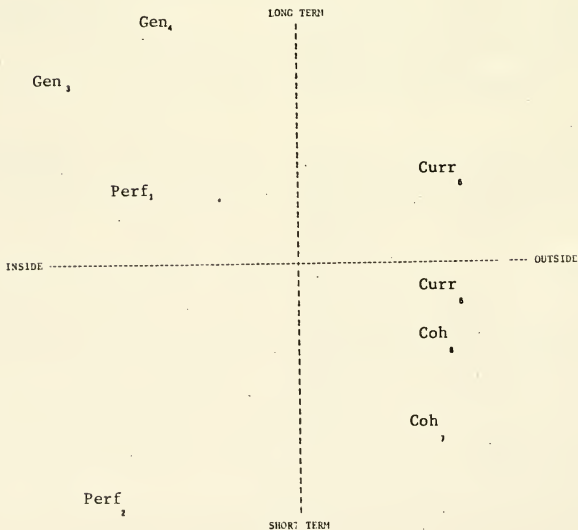
B. INDSCAL Scaling in Two Dimensions of Eight Events - $R^2 = .52$ 

Table 3

Results of Tests for Causal Feature

Linking Events to Types of Product Success

I. Performance

Description

- Event₁: The development team has intrinsic ability
- Event₂: In a phased approach to product development, each phase is completed by knowledgeable individuals
- Performance: The product meets its design goals and runs efficiently in time and space

A. Results for Event₁

	<u>No. of Responses</u>	<u>%</u>
1. Event ₁ leads to performance	32	58.2
2. Performance leads to event ₁	14	25.5
3. Relationships in both directions	9	16.4

B. Results for Event₂

	<u>No. of Responses</u>	<u>%</u>
1. Event ₂ leads to Performance	51	92.7
2. Performance leads to Event ₂	4	7.3
3. Relationship in both questions	0	0

III. Cohherence

Description

- Event₁: There is close contact with the end user during development.
- Event₂: The developer has a precise picture of who will be using the product.
- Cohereence: The product is accepted, used effectively, and understood by current users.

A. Results for Event₁

	<u>No. of Responses</u>	<u>%</u>
1. Event ₁ leads to Coherence	56	98.2
2. Coherence leads to Event ₂	0	
3. Relationship in both directions	1	1.8

B. Results for Event₂

	<u>No. of Responses</u>	<u>%</u>
1. Event ₂ leads to Coherence	37	66.1
2. Coherence leads to Event ₂	12	21.4
3. Relationship in both directions	9	12.5

II. Generativity

Description

- Event₁: The product is advanced technologically
- Event₂: The product is portable across machines
- Generativity: The product can be easily made into new versions of itself and contributes to new product development

A. Results for Event₁

	<u>No. of Responses</u>	<u>%</u>
1. Event ₁ leads to Generativity	28	51.9
2. Generativity leads to Event ₁	12	22.2
3. Relationship in both directions	14	25.9

B. Results for Event₂

	<u>No. of Responses</u>	<u>%</u>
1. Event ₂ leads to Generativity	33	70.4
2. Generativity leads to Event ₂	10	18.5
3. Relationship in both directions	6	11.1

IV. Currency

Description

- Event₁: The product solves a timely problem.
- Event₂: An effective user system can be demonstrated.
- Currency: The product can meet the new needs of current users and the needs of new users.

A. Results for Event₁

	<u>No. of Responses</u>	<u>%</u>
1. Event ₁ leads to Currency	15	25.4
2. Currency leads to Event ₁	31	52.5
3. Relationship in both directions	8	13.6

B. Results for Event₂

	<u>No. of Responses</u>	<u>%</u>
1. Event ₂ leads to Currency	9	16.4
2. Currency leads to Event ₂	43	78.2
3. Relationship in both directions	3	5.5



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