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**Social Comparisons and Cooperative R&D
Ventures: The Double-Edged Sword of
Communication**

Christopher L. Tucci
Maureen P. Lojo

June 1994

WP # 109-94

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*The International Center for Research on the
Management of Technology*

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Abstract

In this paper, we examine the communication-performance link in the R&D laboratory, with an eye toward the effects of task- and equity-related communications on the social environment. We argue that social comparisons (in which employees make comparisons between themselves and their coworkers) can have deleterious effects on performance under certain conditions, possibly negating the positive effects of increased communication. We discuss the theory and evidence behind the social comparison-performance link, and then propose mechanisms to promote the positive effects of social comparisons, while minimizing the negative. These mechanisms take the form of organization structure and human resource management policies. The conclusion is that while other factors, such as characteristics of the partners, technology, and market, are important in structuring the cooperative R&D venture, attention to social comparison theory's consequences may help the venture realize its full potential.

Keywords: social comparison theory, cooperative research and development.

1. Introduction

Cooperative R&D ventures (CRDVs) are becoming a popular complement to in-house R&D activities for many firms. For example, Hladik (1985) finds that the percentage of joint ventures formed to collaborate on R&D jumped from 10% to 20% between 1974 and 1982. Link & Bauer, in their book Cooperative R&D in Manufacturing (1989, p. 13), find in a survey of executives and technology managers that perceived importance of cooperative R&D has risen dramatically in the 1980s.

Concomitant with this rising interest in cooperative R&D has come a profusion of analyses of CRDVs, which have taken several analytical forms. The first of these shows through case studies how individual companies succeeded in forming CRDVs and profited from them (for example, Hamel, Doz, & Prahalad 1989). The second type of analysis examines organizational incentives to conduct joint R&D in terms of the profitability of the outcomes (see Katz 1986; Combs 1990; Sinha & Cusumano 1991). The third describes empirical work on returns to cooperative R&D investments (for example, Link & Bauer 1990; Friedman, Berg & Duncan 1979). The fourth approach is the comparative case study, highlighting the differences between current CRDVs and their advantages and disadvantages (Katz & Ordover 1990; Ouchi & Bolton 1985).¹

The studies cited above reveal a number of important factors that lead to the success of CRDVs, including lack of competition between partners, complementarity of skills, trust between partners, reciprocity, and lack of opportunistic behavior. Managers must take these factors into account, along with history (e.g., previous relationships between partners, changing conditions of partners) and environmental concerns (e.g., market characteristics, specific technology involved) in structuring the CRDV.

Another important stream of literature relating to performance in R&D labs emanates from the communications studies pioneered by Allen (1977) and Pelz & Andrews (1978). In very general terms,² these and other authors found that increased communication among researchers related to higher “performance,” including higher quality technical results.

By applying social psychological analysis to the study of technology strategy, this paper explores a little-examined issue: the effects of the comparisons researchers make among themselves (“social comparisons”) on motivation and performance in CRDVs. In the paper, we argue that while it is tempting to generalize the lessons of traditional

¹These classifications are somewhat arbitrary, since some of the papers fall into more than one category.

²Exceptions are discussed below.

communication studies of scientists and engineers to CRDVs, those lessons may not hold as strongly for the cooperative R&D venture as they do for the single firm's research labs.

The social comparisons that are made among researchers may have both direct and indirect relevance to managerial decision making in setting up a CRDV. The directly-relevant case is that an understanding of social comparisons may lead to different partner choice, location decisions, structures, staffing policies, or human resource management (HRM) policies that it would by evaluating according to the above-mentioned factors. The more likely, indirectly-relevant case is that once a venture is entered into, the HRM policies may be modified to take social comparisons into consideration.

To develop an understanding of how social comparisons affect performance in CRDVs, we first review the communications–performance connection. Then, in Section 2, we discuss the theory of how and why social comparisons affect performance in general. Finally, in Section 3, we reevaluate the connection between communications, social comparisons, and performance in light of the theory, and propose mechanisms that managers can use to create and modify CRDVs so they reach their full potential. Section 4 presents the conclusions of the paper.

1.1. Evidence of the relationship between communication and performance

For at least thirty years, scholars have studied the relationship between communication among researchers (scientists and engineers) and R&D productivity at both the individual and project levels. The literature suggests oral communication is a highly effective and efficient method of transferring information (March & Simon 1958; Myers & Marquis 1969). One implication of this finding is that effective research depends upon information processing capability or information “flow” within a lab (Allen & Cohen 1969).

Pelz & Andrews (1976) studied the communication patterns of 1300 researchers in eleven R&D labs. They asked questions about the frequency of communication and the number of colleagues consulted. They also gathered subjective and objective measures of performance for each scientist (e.g., judgments of scientific contribution, patents and publication frequency). Their analysis showed that, at an individual level, PhD-level researchers had higher scientific contribution the more frequent their contact with colleagues. Similar relationships were found between communication and other performance measures. Performance also increased with the number of close colleagues within the same group (up to nine), and for the number of close colleagues outside the group. In other words, Pelz & Andrews found that scientists' performance was positively correlated with the number of close colleagues with whom they consulted.

Whereas Pelz & Andrews provide strong evidence for the positive effect of communications on performance at the individual level, other scholars have sought to extend the findings to the project level. Tushman (1978), for example, collected data on scientists' oral communication and subjective project-level performance rankings in a study of an R&D laboratory employing 345 researchers. Distinguishing between tasks focused on research, development, and technical service, Tushman found that high-performing research-oriented teams communicated significantly more within their own project and division of the lab than low-performing teams.

Allen (1977) found additional evidence confirming the Pelz & Andrews results for project-level performance. Technical solutions generated by researchers in matched pairs of parallel projects were rated for quality, and the frequency and level of their oral communications within and outside their projects were recorded. Allen's analysis shows that the so-called "high-performers" communicated far more with researchers within the project than "low-performers" did, even controlling for different levels of effort (i.e., communications per hour of effort).

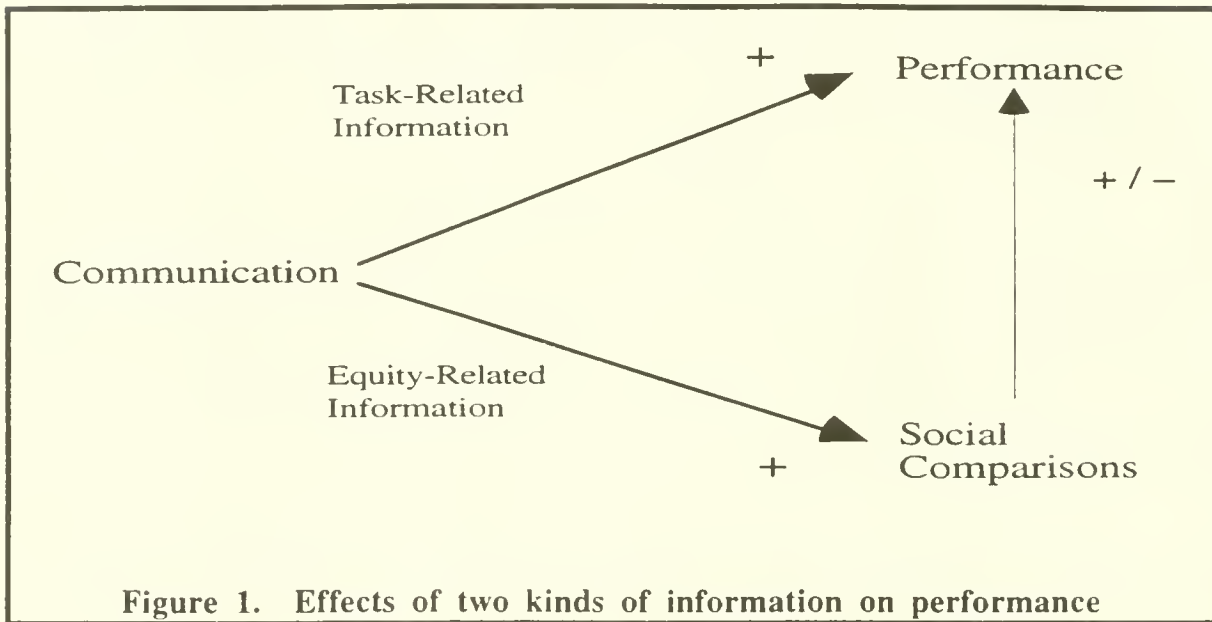
There is general agreement among all of these studies that a strong positive correlation exists between communication and performance in the R&D organization, at both the individual and group level. This has led to recommendations for management to increase communication among technical staff in order to increase performance.

There are, however, some inconsistencies in the data that merit further examination. In addition to the findings cited above, Allen found that more frequent communication with external contacts (by which he means colleagues outside the organization, not including vendors and customers) was associated with poorer performing groups. Furthermore, Tushman's data indicate that high performance on technical service tasks is associated with less project-level communication than low performance. In the next section, we discuss a potential explanation for these empirical puzzles.

1.2. Two types of information exchange

R&D is a highly complex endeavor that invariably involves the exchange of very task-specific information between researchers. In addition to communicating information of a scientific or technical nature ("task-related" information), researchers also communicate more general information about themselves and their coworkers that provides data on the relative standing of individuals in terms of skill, pay, status, etc. We will refer to this type of information as "equity-related." The argument made in this paper hinges on the assumption that it is difficult to communicate one kind of information without communicating the other. We propose that task-specific information exchange does increase performance in R&D projects (as demonstrated by the studies cited above),

however the exchange of equity-related information may have either beneficial or detrimental effects on performance, as illustrated in Figure 1. The negative effects of equity-related communication can potentially outweigh the benefits of exchanging task-related information.



Allen's and Tushman's findings, in some instances apparently inconsistent with the theory that communication and performance are positively correlated, can be reinterpreted in light of social comparison theory. Social comparison theory (Wood 1989) provides an appropriate vocabulary and framework for analyzing outcomes at the individual level between researchers having extensive contact with associates who may be different on various dimensions — more or less competent, or subject to different pay scales and career ladders, for example. Such comparisons, if not managed properly, may lead to conflict, decreased motivation, and poor performance.

What happens when we consider the cooperative R&D venture that involves two or more firms by necessity? Such ventures provide an institutional structure for ongoing interactions and comparisons between researchers. If more frequent communication may actually be detrimental to project performance, managing the interaction between partners can be a particularly challenging task in making a venture successful.

2. Social comparison theory

People have a strong tendency to compare themselves with others, and scientists in organizations are no exception. Theories concerning how and why people make comparisons were developed in the 1950s by Festinger (1954), among others. Early social

comparison theory held as its basic tenets that people make comparisons in order to collect objective information about themselves, in an environment that is neutral. The theory has since been extended to include goals beyond the collection of objective information and to address the influence of potentially active social environments (Wood 1989).

Here we use the term “social comparison theory” as a general theory describing why people compare themselves with others.³ In this section, we first discuss why people compare themselves with others, followed by the choice of people with whom they select to compare themselves. Then we examine the dimensions along which comparisons are made and the effects of the comparisons. Finally, we show how empirical work is consistent with the theory.

2.1. Reasons for social comparisons

Wood discusses three principal motivations individuals have for comparing themselves with others: (1) self-evaluation, (2) self-improvement, and (3) self-enhancement. Self-evaluation refers to people seeking accurate and unbiased estimates of their own abilities. This was the basis for Festinger’s original theory. In reality, people may not always receive accurate and unbiased estimates. In social settings, individuals’ only estimates may be derived from comparing themselves with others — a clearly inaccurate and biased estimate, but perhaps the only one readily available. People in research organizations may be especially prone to compare themselves to others for the purpose of self-evaluation because the uniqueness and complexity of their tasks makes it difficult to determine how they are performing.

Self-enhancement refers to people using comparisons to protect their egos or self-esteem and to build feelings of self-worth. In this case, individuals may not even want unbiased estimates of their abilities. With this goal, people tend to ignore evidence detrimental to their egos and accept evidence that bolsters them. This effect has found broad empirical support in the literature. As an example, Wood, Taylor, and Lichtman (1985) find that almost all breast cancer patients interviewed compared themselves spontaneously to less fortunate patients and not to healthy people.

To place this in the context of a research organization, scientific communities can be highly competitive (for resources, recognition, etc.), and researchers may find themselves in conditions that promote comparisons of this type. Self-enhancement, however, is generally not regarded as a constructive goal; thus, research managers may want to discourage such comparisons if they possibly can.

³For a more detailed discussion, refer to Masters & Smith (1987) and Nagata & Crosby (1991).

Self-improvement refers to the comparison of oneself to others to better oneself. It utilizes self-evaluation over time (with all of the biases and inaccuracies inherent in such evaluation) and combines it with learning and deriving inspiration from people with superior ability. As an example, Nosanchuk & Erickson (1985) show that bridge players who wanted to improve their game almost always chose to look at better players' strategies rather than equal or inferior players' strategies. From a research manager's point of view, self-improvement is clearly the most desirable goal of social comparisons.

2.2. Dimensions of social comparisons

Social comparisons are made between the individual and one or more people chosen as a "target"⁴ along "dimensions" of importance to the individual. The most important of these is the dimension under consideration, which is the dimension about which the individual is most concerned. At the same time, the individual must choose the target by focusing on a "related" dimension. In this section, we discuss both of these kinds of dimensions and how difficult they are to assess.

According to theory, social comparisons are made along dimensions that are relevant to the self-esteem of the comparer. Esteem-relevance is based on how similar the target (or "comparison-other") is, and how important the dimension under consideration is to the subject. Examples of possible dimensions of interest for researchers may be technical skill and knowledge, recognition from peers, autonomy in setting research agenda, and perceived value to the organization. *The greater the esteem-relevance of the dimension, the stronger the effects of the social comparison will be.*

Related or surrounding dimensions determine how similar the comparer is to the target of the comparison. Examples of related dimensions are age, educational background, organizational tenure, and other demographic characteristics. These characteristics are usually apparent to individuals working together. Some companies have even numbered their identification badges by hire date, producing the unintended result of announcing an individual's organizational tenure. Related dimensions may be predictive of performance on the dimension of interest, or may simply indicate that the comparer and comparison-other are similar in some way. For example, gender does not predict skill, but women might tend to compare themselves with other women on the dimension of skill because they view other women as similar to themselves. Related dimensions are not esteem-relevant, at least not in relation to the comparison being made. *The greater the similarity of the comparison-other, the stronger the effects of the social comparison will be.*

⁴Targets are discussed in the next section.

Information on comparison-others' standing on the primary dimension of interest is not always readily available. For example, scientists do not have access to complete data on their peers. Even public information, such as number of publications, may be costly to collect; the more closely guarded facts such as salary may be all the more so. In cases in which formal measures are unavailable, people will generally use informal measures of the dimension of interest. In the case of salary this may involve seeing what neighborhood they live in or what kind of car they drive.

Performance along dimensions of interest are generally meaningful only relative to others' performance on the same dimension. Although salaries, skill, etc. may be measurable on absolute scales, the absolute value is somewhat irrelevant. The literature on relative deprivation has consistently found that beyond a very low stipend, people almost exclusively care about their salaries only relative to what others make (Olson et al. 1986; Messé & Watts 1983; Crosby 1976). For example, Messé & Watts found that executives with ten years' tenure who were making more money than they had ever anticipated became unhappy and resentful when confronted with the circumstance of a newly-hired employee with a higher salary.

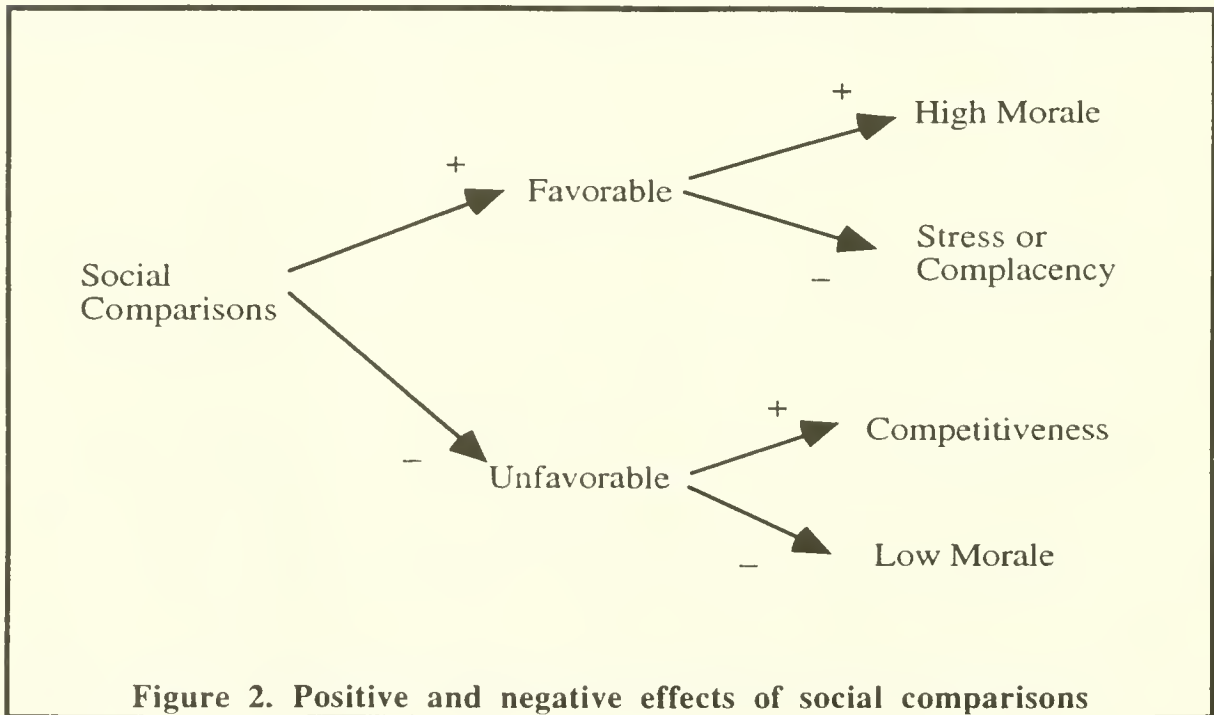
2.3. Targets of social comparisons

According to social comparison theory, an individual selects a target, or comparison-other, with whom to make a comparison. This target will vary depending on the goal of the comparison, as discussed in Section 2.1. The theory calls for individuals to make comparisons with others who are similar in some way. For the self-evaluation motive, the theory would predict selection of comparison-others who are presumed similar in some related dimension. Individuals can then gauge their own performance on the dimension of interest relative to the comparison-other. In the case of the self-improvement motive, the target will probably be someone who is presumed superior in terms of the dimension of interest, and can therefore serve as a model. For self-enhancement, the target will be someone who is assumed to be worse off or inferior on the dimension of interest.

Another scientist or manager of similar responsibility is a likely comparison target in an R&D lab, since responsibility is highly observable. Position in the hierarchy, number of reporting employees, and total number of employees under a manager are readily apparent in an organization. Likewise, the relative authority of individuals to make capital acquisitions or decide on research directions, and even their personal influence, are well-known among members of an organization.

2.4. Effects of social comparisons

Major et al. (1991) examine the conditions under which social comparisons have positive and negative effects on individuals in terms of self-esteem, motivation, stress, and satisfaction. The authors distinguish between two basic types of comparisons — upward and downward. An upward comparison is one in which the target is superior on the dimension of interest, i.e., the comparison is unfavorable for the comparer. Similarly, a downward comparison is one in which the target is inferior, and thus the comparison is favorable for the comparer. Both upward and downward comparisons have potential effects that are either positive or negative, as illustrated in Figure 2. The critical determining factor is perceived control, the subject's perception of how manipulable the outcome has been and will be in the future. Perceived control is based on the general feeling of the stability of the dimension as a measure and on the subject's perceived ability to maintain or change the relative standing.



In the first case, individuals feel that they compare favorably to similar others on self-relevant dimensions. If they feel that their relative standing is stable and under their control, they experience satisfaction and enhanced self-esteem. Alternatively, if they believe that their superior standing is subject to change, and they have little control over it, they may feel vulnerable and experience symptoms of stress or depression. Another possible effect not addressed by Major et al. is complacency. If relative standing is

perceived to be stable, but not a direct consequence of personal effort, individuals may respond by reducing effort and resting on their undeserved laurels.

In the second case, individuals feel that they compare unfavorably to similar others on self-relevant dimensions. If they believe their relative standing is changeable and under their control, increased striving and competitiveness will result. However, if individuals feel that their standing is unlikely to change regardless of their efforts, they will experience dissatisfaction, depression, and jealousy of those with higher relative standing.

2.5. Empirical support

Empirical research on social comparison theory has largely confirmed the effects of interpersonal comparisons on motivation and morale. In this section, we examine some of the major studies showing the comparison–performance link.

A classic example of the deleterious effects of interpersonal comparisons is provided by Stouffer et al. (1949), who examined the satisfaction of Army units with respect to their pay and promotions. They described a situation in which military policemen, who were almost never promoted, were far more satisfied with their promotion system than servicemen in the “air corps,” in which advancement was often rapid. The authors argued that since individuals in the air corps compared themselves to their friends whom they saw promoted,⁵ such comparisons led to low morale. In contrast, military policemen were almost never promoted, so there were no negative comparisons to be made. Paradoxically, even though the air corps was absolutely better off, social comparisons hurt their morale.

More recent studies of the effect of social comparisons on motivation and performance manipulated both the goals of completing a task and the perceived ability of subjects in an experimental setting (Elliott & Dweck 1988). When the goal was to receive a positive evaluation of performance, subjects with low perceived ability⁶ exhibited “helpless” behavior by avoiding challenges and not persisting with solutions. This can be interpreted as a comparison on an esteem-relevant dimension, because the goal was to avoid negative feedback. On the other hand, when the manipulated perceived ability was high (i.e., subjects initially compared favorably with comparison-others), subjects exhibited “mastery-oriented” behavior with high motivation and persistence. When the goal was learning (i.e., lower esteem-relevance), the performance of subjects with both high and low perceived ability was not significantly affected.

⁵Even though promotion in general was rapid compared to the MPs, at any given time only a small number of people were promoted, leaving the majority dissatisfied.

⁶Perceived ability was manipulated by assigning the subjects a bogus score on a pretest.

Ames (1984) shows markedly similar results: “competitive” environments lead to a significant increase in helpless behavior compared with “individualistic” (i.e., less esteem-relevant) environments. Dweck & Leggett (1988) report a series of quasi-experiments that confirm previous studies: performance goals and comparisons are associated positively with avoiding challenges, perceptions of low ability, negative attitudes, and low motivation and persistence.

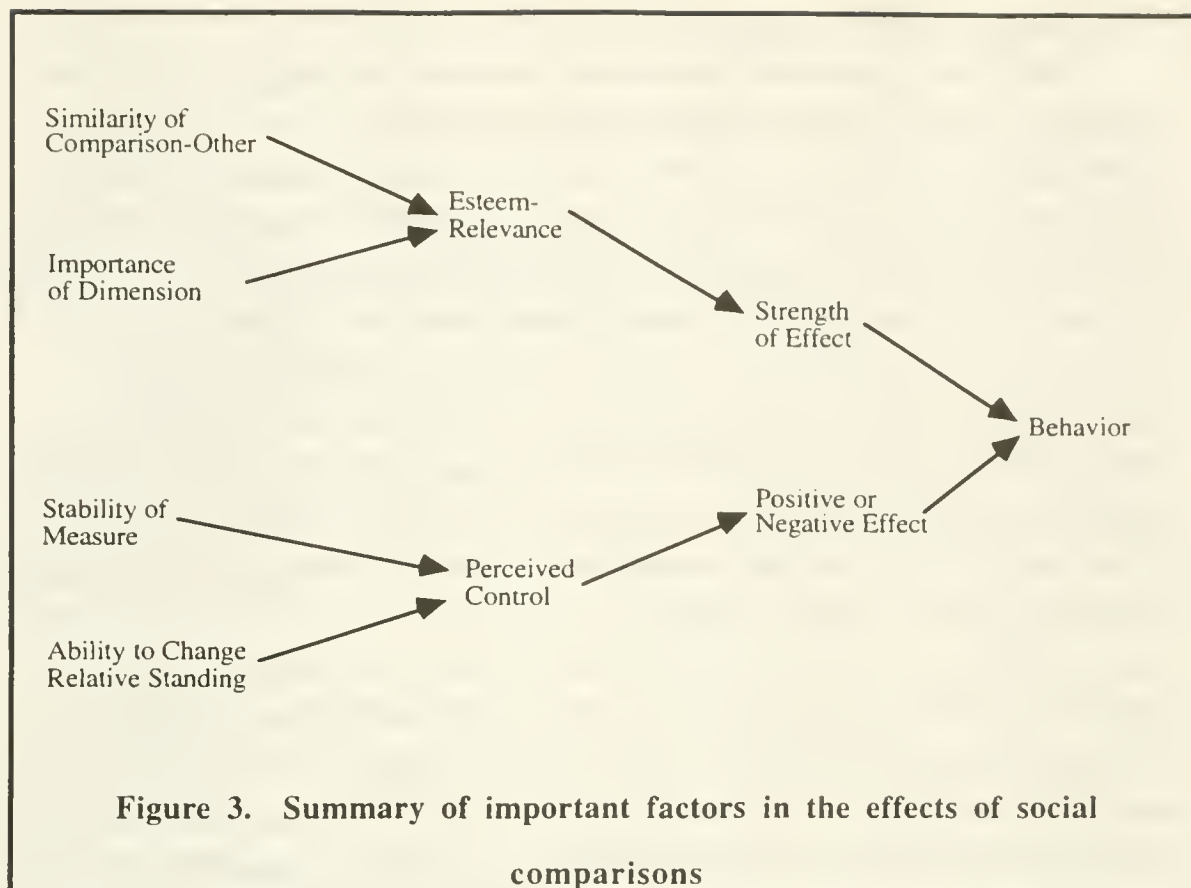
Although the works cited above assume that comparisons affect motivation and performance, it is also true that performance affects comparisons, thus forming a feedback loop. Farris (1969) noted that performance codetermines many aspects of the social environment, and actually precedes some aspects of it. Is the link between comparisons and performance strictly one-way? Even though Farris found that “contact” (communication) was an antecedent of performance and not a consequent, social comparison theory provides some reasons why performance may also drive comparisons in a feedback loop. From Figure 2, we can see that performance outcomes can play a role in two ways: through the development of a similar comparison-other and through the perception that there is little control over the outcome.

Through performance, a formerly dissimilar comparison-other may be developed. For example, a successful employee may be promoted into a position of higher responsibility or salary, thereby bringing that person into the sphere of similarity to other managers. Likewise, an underperforming employee may be held back from responsibility, thereby becoming more similar to a cohort with lower organizational tenure.

The change in status due to performance may also affect perceived control. A rapidly advancing employee (or group of employees) may lead others to believe that there is no chance of competing well along a certain dimension, leading to poor motivation and performance. We can see, therefore, that the potential for a feedback loop exists. Social comparisons may lead to performance differentials, which may lead to more comparisons, and so on. The effects and consequences could snowball to unforeseen sizes if not anticipated and planned for in advance.

2.6. Summary

Thus, as illustrated in Figure 3, theory and empirical evidence suggest that highly esteem-relevant comparisons combine with low perceived control to produce negative effects, regardless of whether the comparison is favorable or unfavorable. This is more apparent when the subject is worse-off than the target, since low perceived control means that the subject will remain inferior. However, perhaps surprisingly, it is also true when the subject is superior to the target, since the subject will either feel unable to maintain superiority, or will expect to remain superior effortlessly.



In what form do the effects of social comparisons manifest themselves? Negative effects take the form of actions and feelings regarding the self ("self-directed"), the dimension ("dimension-directed"), and the target ("comparison-other-directed"). Self-directed responses include lower self-esteem, depression, stress, and dissatisfaction, while dimension-directed responses include decreased motivation, playing down the importance of the dimension, and claims of other more relevant dimensions. Comparison-other-directed responses include jealousy, avoidance, envy, derogation, and, occasionally, even violence (Salovey 1991). Such behavior in the workplace would obviously not be conducive to high levels of productivity.

Do dissatisfaction and lack of motivation at the individual level translate into poor performance at the group level? The case of CRDVs is backed by the evidence cited above, because many of the comparisons are group-based; that is, the comparisons are made precisely by employees of different groups and have similar effects on all members of the group. The bipolar nature of two distinct cultures interacting in the CRDV allows us to consider social comparisons' effect on performance at the group level.

3. Influencing social comparisons

Let us now examine the relevance of this theory to structuring the CRDV. Employees of two or more distinct organizations working together may be subject to different policies regarding compensation, incentives, career advancement, research autonomy, and so on. They will naturally tend to compare themselves with each other on these dimensions and will experience some set of the effects described above. Will these be constructive or destructive to the overall mission of the CRDV? How can managers mitigate the negative effects and create an organization that is conducive to the positive effects? Recent work in social comparison theory holds that the social environment may invite or force social comparisons (Wood 1989). In other words, the social environment is important — and the individual's perceptions and actions are affected by it. A major assumption of this paper holds that managers can and do have some influence on the social environment through various mechanisms.

In light of social comparison theory, CRDVs require that management pay special attention to interpersonal communication among scientists and engineers. In particular, CRDVs may be structured in such a way as to optimize the effects of communication, social comparisons, and performance. While in most cases, history constrains a firm's ability to manipulate organization structure and human resource policies⁷ (Nelson & Winter 1982), in CRDVs, these are subject to negotiation. While the partners in a CRDV are each internally constrained by their own histories, they are generally less constrained in setting up their joint research endeavors. Even if the CRDV cannot be freely structured, however, an understanding of social comparison theory may help focus management's attention on potential problems before they fully develop.

In this section, we discuss various options or mechanisms that affect the level of social comparisons made. We first show how the structure of the CRDV influences the kinds of comparisons that can be important for a venture's success. We then examine some human resource management policies and their influence on the comparison environment. Finally, we provide recommendations for minimizing negative social comparisons and maximizing positive ones.

3.1. Organization structure

CRDVs can take many organizational forms. For example, partners can take an equity stake in an entirely new enterprise or form a general partnership; partners can be competitors, suppliers, or customers; partners can be from different countries or the same

⁷We are calling the judicious planning and implementation of the three mechanisms "structuring." This is supposed to be different from "organization structure," which is one of the mechanisms.

country; the term of the cooperation can be limited or unlimited in duration; partners can share a lab or perform research solo; and so on. The subsequent discussion will concentrate on those aspects of organization structure that we find most interesting and most critical to social comparisons: employee motivation, and organizational incentives: internationalization and collocation. Internationalization refers to the degree to which the partners in the CRDV are based in different countries. Collocation refers to whether the collaborative research is conducted jointly in the same laboratory.

Internationalization

Mowery (1992) identifies four types of collaboration most amenable to international partners:⁸ (1) research alone; (2) exchanging proven technologies across a single product line; (3) joint development of one or more products; and (4) collaboration across different functions (e.g., marketing and research). Using examples from these four types, Mowery shows the conditions under which international collaboration is preferred to licensing or direct foreign investment (DFI). International collaboration is preferred to licensing when the technology in question is complex, new, or has weak patent protection. International alliances are preferred to DFI in cases with weak appropriability, weak control, large minimum efficient scale, and high site-specific learning. International collaboration is also preferred when contracts are limited or difficult to enforce, and when it is difficult to ascertain the value of participants' contribution.

Comparing international and domestic CRDVs, Tucci (1994) proposes three main differences between them: (1) the level of competition (degree of substitutability of products) between firms in an international collaboration can often be lower than between domestic partners; (2) it is more difficult to coordinate and transfer results in an international CRDV; and (3) it is more difficult for firms outside of the CRDV to obtain the results in an international collaboration. The competition effect is the most important of the three, with the benefits of lower competition often outweighing the costs of linguistic and cultural differences.

Given the above, how does the internationalization of the venture affect the social comparison environment? The international CRDV provides far fewer social comparisons by working through esteem-relevance in Figure 3. The international venture makes the comparison-others less similar because language and cultural differences are barriers to the development of a shared identity. Internationalization also makes the measures less comparable. For example, using pay as a comparison yardstick is a problem in the

⁸Although structuring the CRDV often occurs after the partner is chosen, there are occasions wherein the firm is searching for a partner with whom to cooperate.

international case since buying power can be different in different countries and exchange rates fluctuate. Therefore pay differentials in the international CRDV are less likely to generate dissatisfaction than they would in the domestic case.⁹

Collocation

To decide whether or not to collocate researchers in a CRDV, the tradeoff between incentives for truth-telling and coordination / administration must be understood. When performing research separately, the incentives for parties to tell the other participants about promising results are lower than they would be if the research were conducted jointly (Ciborra 1991).¹⁰ This is not just an organization-level phenomenon, since individual scientists often “trade knowledge” and withhold recent information that would hurt their own firm (von Hippel 1987; Schrader 1991). On the other hand, joint research involves higher setup and administrative costs, such as procuring property at a “neutral” location and monitoring the venture to ensure that results are transferred back to the participating companies.

It is clear that joint research provides a greater opportunity for interaction, communication, development of a shared identity, and social comparisons. While maximizing communication would lead to joint R&D, highly unequal treatment of groups within the venture would call for separate R&D due to negative social comparison effects. Social comparison theory cannot and should not be considered in isolation, but putting diverse researchers in the same room may negate some of the beneficial effects of frequent communication, particularly if there is low perceived control over the dimensions of comparison and/or individuals' relative standings on it.

3.2. Human resource policies

If partners in CRDVs have different organizational policies concerning esteem-relevant dimensions, social comparisons between researchers associated with the different companies have the potential to create negative effects on motivation and performance. Compensation, resources, autonomy, and control of research results are four areas that are highly esteem-relevant for researchers.

Compensation. Although wages may be difficult to compare across national boundaries, as discussed above, other forms of compensation are readily comparable. Benefits, holidays, vacation, and expected working hours are examples. While these may have lower esteem-relevance than wages in domestic CRDVs, differences can nonetheless

⁹Of course, these very factors that preclude social comparisons also make oral communication an inefficient and somewhat expensive medium (March & Simon 1958; Katz & Kahn 1966).

¹⁰Ouchi (1984) points out that this problem is especially acute among American firms.

produce friction among researchers, especially in international ventures, in which they may be the most salient points of reference.

Resources. Scientists and engineers require a great deal of resources: equipment, office and laboratory space, support staff, travel budgets to attend conferences, etc. Even well-funded CRDVs have resource constraints; thus, these items are highly prized and are likely to be an esteem-related dimension of comparison.

Autonomy. Bailyn (1984) defines two kinds of autonomy: strategic autonomy is the freedom to define the direction of one's own research; operational autonomy is the ability to choose how to pursue research directions. First, employees desire the responsibility to determine the course of the research project, or some subset of a project. It is natural for employees to compare this level of responsibility allowed, and, in fact, it seems that strategic autonomy is one of the most easily observed variables available to other employees. Operational autonomy is less observable, but not invisible to employees. Both forms of autonomy can be seen as a sign of (or reward for) maturity or organizational trust.

Control of results. The opportunity to publish seems at first glance to be an unlikely dimension of comparison because most companies either allow it or they do not. It is fairly rare that, within the same research organization, some people are allowed to publish and some are not,¹¹ but it is certainly a possibility within a CRDV. Ability to publish is also highly observable, and so can be viewed as a potential dimension of comparison. Approval to present results at technical conferences is another example quite similar to the opportunity to publish. Patent ownership is a third possibility related to control over research results and can be a powerful motivator, especially if royalties are involved.

3.3. Recommendations

What actions can managers take to minimize negative effects of social comparisons while at the same time maximizing the positive ones? In choosing partners for CRDVs, managers should consider the effects of internationalization on the comparison environment. Researchers from different countries will view each other as less similar than partners in domestic ventures, and so the strength of both positive and negative effects will be diminished. Furthermore, some of the measures used in social comparisons will be less stable in international CRDVs, thereby lowering perceived control.

Once a partner has been chosen, managers can address the structure of the CRDV. In general, we recommend creating a shared identity to the greatest extent possible, by collocating the collaborating researchers and standardizing the policies concerning human

¹¹This does occur, for example, in defense-related aerospace companies.

resource management. Although this will increase the similarity of the researchers, and thus the strength of the effects of social comparisons between them, taking actions to improve perceived control will favor the desirable positive effects, and discourage negative effects.

Human resource management policies are critical for enhancing perceived control. Many of the comparison dimensions reflect the organization's values and priorities. These can be conveyed through chosen methods of performance evaluation and managerial acknowledgments of individual effort. If employees have significant input into these choices, they will feel greater control over them. Furthermore, perceived control over relative standings on the dimensions of interest can be increased by providing organizational resources for self-improvement efforts. For example, allocating time and financial support for additional training or attendance at technical meetings should increase individuals' ability to increase their standing on dimensions that will greatly benefit the organization, as well as the employees' self-esteem and morale.

4. Conclusions

In this paper, we examined the communication-performance link in the R&D laboratory, with an eye toward the effects of task- and equity-related communications on the social environment. We argued that in cooperative R&D ventures, social comparisons can have effects on performance, possibly negating the positive effects of increased communication. We discussed the theory and evidence behind the social comparison-performance link, and then proposed mechanisms to promote the positive effects of social comparisons, while minimizing the negative.

This conceptual paper has also provided a base from which future research can spring. In particular, one could seek empirical support for the effect of social comparisons on performance both within individual laboratories and CRDVs. In addition, empirical tests could be performed on the effect of organization structure, staffing, and HRM policies on social comparisons and overall communication patterns. Finally, further work in theory development could center on how unique aspects of different groups, such as scientists and engineers, may require unique organization structures and policies.

In summary, managers responsible for deciding upon the structure of the cooperative R&D venture should take into consideration many factors, including characteristics of the partners and the environment. In addition, both the direct and indirect communications effects of organizational structure and human resource policy mechanisms should be considered. If the partner has been decided, the manager should concentrate on the structure of the venture. If the structure has been decided, the manager should pay

careful attention to human resource management mechanisms. Thus it may be that attention to social comparisons allows the CRDV to reach its full potential.

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