# A COGNITIVE THEORY OF THE FIRM

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**Abstract**

This paper reviews and criticizes existing theories of the firm, which take a technical or a governance perspective. One point of criticism is that they do not offer an adequate treatment of learning and innovation, while such treatment is of high priority. With some exceptions, existing governance theories, in economics, neglect the importance of trust. This paper offers a cognitive theory to deal with learning, innovation, and trust. It also incorporates technical and governance perspectives, but emphasizes a competence perspective, in 'dynamic capabilities' of innovation and learning. On the basis of a constructivist theory of knowledge, it offers the notion of 'cognitive distance', and proposes that the boundaries of the firm result from the determination of 'optimal cognitive distance'. This is achieved by a 'cognitive focus', yielding the notion of a firm as a 'focusing device'.

## Introduction: theories of the firm

Central questions in the theory of the firm are the following.

1. What constitutes a firm's identity?
2. What is the purpose and rationale of a firm: why do different activities have to be integrated more or less durably?
3. What determines the boundaries of the firm?
4. How does the co-ordination of activities in and between firms take place?
5. What other forms of organization of economic activities are there, beside the firm, and how do they differ from the firm?

The universal answer to the first question is that the firm has a legal identity, in some form, with rights of ownership and use (including destruction) and legal liability.

An old answer to questions 2 and 3 is given in the technical view of a firm as a 'production function'. According to this view, resources of different types need to be combined and attuned in order to produce an output. This is related to the view of a firm as needed to utilize technical opportunities for economies of scale and scope (Chandler). There are several forms of economy of scale. The best known form, going back to Adam Smith (his 'pin factory'), is economy of scale due to division and specialization of labour. This requires coordination of dissimilar, mutually dependent activities.
This shades into the notion of economy of scope, defined as more efficient production in the combination of different, mutually dependent activities. Thompson (1967) distinguished different types of dependence. In sequential dependence, activities are ordered in sequence, with output of one stage serving as input for a subsequent one. This is typical of many manufacturing and service processes. A second type is 'pooled dependence', where different activities share a resource. A textbook example is sheep grazing between trees in an orchard, thereby utilizing otherwise unused space. A third type is 'reciprocal interdependence', where individuals need to interact in the execution of their tasks. The textbook example is the need for two men to move furniture. Another example is a surgical team or a symphony orchestra.
Williamson (1975) noted, correctly, that scope is an argument for integration in a firm only when it is 'inseparable'. The following is a textbook example of separable scope: after separating hide and meat, in slaughter, the skin can be processed to leather in another firm than the firm that processes the meat.

Another example is the rolling of steel after it is poured. It is economic to do that immediately, while it is still hot and malleable.

Another conception of the firm, which includes the notion of the firm as a 'nexus of contracts', the principal-agent view, and transaction cost economics (TCE), derives from considerations of governance: integration may be needed to monitor and control activities and establish efficient incentives. There are obvious advantages in 'outsourcing' activities to outside firms. These lie in economy of scale of specialised production for multiple users, and in 'high powered incentives' to perform efficiently in independent firms that are responsible for their own survival. However, a division of tasks between different firms can yield lock-in due to 'specific investments', which may yield 'hazards of opportunism', in 'hold-up'. For an illustration, let us go back to the steel example. If the rolling of steel is conducted in a separate firm, that firm would have to be located on the doorstep of the melting unit. This may entail a location-specific investment, in the sense of TCE. That is the case if the location of the rolling plant, next to the melting plant, is far from any other smelting plant, and thus has no alternative use, which creates lock-in. If such hazards cannot be adequately controlled between firms, there is an argument for integration in the 'hierarchy' of single firm. The core argument, in TCE, is that integration in the firm, under the control of 'administrative fiat', under a 'generalized labour contract', in an organizational 'hierarchy', allows for more scope and flexibility of governance than could be achieved under a contractual relationship with an outside firm. There, in the last resort one can force the supply of information or impose a solution of conflict only on the basis of a contract, through a court of law. The problem with such specific contracts for specific activities is that they can rarely be complete, specifying all possible contingencies. Furthermore, litigation is expensive and its outcome not always predictable. It is this issue, TCE claims, that determines the boundary of firms.
In the later version of TCE, Williamson (1985) recognized that in spite of asset specificity there are arguments to engage in inter-firm relations. There, governance of the hold-up risk, and coordination of activities more in general (question 3), may take place by means of (incomplete) contracts, dependence, reputation mechanisms or hostages. The use of such instruments for governance, in 'bilateral governance', and the use of intermediaries, in 'trilateral governance' between firms, yields 'forms of organization between market and hierarchy'. These forms of organizations are not, however, firms, since they lack the legal identity that a firm has, in its 'hierarchy'. According to TCE, trust is not a reliable instrument of governance. Trust does not mean anything if it does not go beyond calculative self-interest, and if it does, it will not survive in markets (Williamson 1993).

A fundamental problem with both the 'technical' and the 'governance' view of the firm is that they do not tell us anything about innovation and learning, while those have been crucial features of firms for a long time. Admittedly, there have been attempts to model innovation with 'innovation production functions', with, typically, a hazard rate of success in an innovation process, and a probability density function of revenues after success, in 'patent races' between firms (Loury 1979, Dasgupta and Stiglitz 1980, 1981, Lee and Wilde 1980, Nooteboom 1991). However, a fundamental shortcoming of such models is that with the assumption of a hazard rate and a probability distribution of revenues, they do not deal with radical uncertainty (in Knight's sense). Such uncertainty entails that the sets of possible outcomes and choice options are not given, so that hazard rates and probabilities are not defined, and there is no longer a basis for calculative rationality. In view of this fundamental shortcoming, in this paper I propose a 'cognitive theory of the firm', designed to deal with innovation and learning. It deals with both issues of competence (knowledge, technology) and governance. Next to the instruments of governance offered by TCE, it includes trust as a viable, and in fact indispensable, feature of governance, beyond 'calculative self-interest'. Trust and learning are related: trust can emerge in an interactive learning process.

The paper proceeds as follows. First, it elaborates a bit on my criticism of TCE. I discuss its inadequate treatment of time and of bounded rationality. Note, however, that in spite of fundamental criticism of TCE, it still contains elements that are useful. In particular, the notion of specific investments is still useful, with the insight that they create switching costs, and hence create dependence, with a

resulting risk of 'hold-up', which requires attention in the governance of relations. While TCE neglects trust, it does yield insights in possible instruments of governance, next to contracts, such as a balance of mutual dependence, the use of hostages, and the use of third parties in 'trilateral governance'. Also still valid is the consideration that integration in one firm may yield opportunities for governance that are not available between firms. In sum, I reject the underlying 'deep structure' of TCE, with its fundamental views on time, rationality, and trust, but I adopt some 'surface elements': the notion of specific investments, and some instruments for governance. Similarly, I reject the view of a firm as a purely technical arrangement, while I retain insights in economies of scale and scope. The analysis is interdisciplinary, combining insights from economics, sociology, social psychology, evolutionary psychology, and cognitive science. The theoretical claim is that this can be done in a coherent fashion. Next, I summarize some essential features of trust, and the theory of knowledge I use. This includes considerations from social psychology, and leads to the notion of 'cognitive distance'. Subsequently I develop my cognitive theory of the firm, and give the answers it yields to the questions specified above. The core argument will be that boundaries of the firm are established by optimal cognitive distance.

## CRITICISM OF TRANSACTION COST ECONOMICS

### Transaction cost economics, time, learning and trust

One objection to TCE, raised by many, is that it neglects trust, in its assumption that in the 'governance' of relations we need to safeguard against opportunistic behaviour. I do not wish to neglect the possibility of opportunism, but I do wish to recognize that next to the possibility of opportunism there is also the possibility of trustworthiness, and that neither should be neglected. TCE does not claim that everyone is opportunistic, but that one cannot reliably assess the degree of opportunism so that the possibility of opportunism should be taken into account. I will argue that to a significant extent, in time the degree of opportunism can be inferred from observed behaviour, and opportunism can decrease.
The analysis starts from my claim that in classical (Williamsonian) TCE there is a peculiar inconsistency in the way it deals with time, uncertainty and bounded rationality (Nooteboom 1992, 1999, Lindenberg 2000). Williamson claims that his theory is inter-temporal, incorporating the passage of time, and indeed he claims that this is central to TCE (1999: 1101). And indeed, up to a point TCE does incorporate inter-temporality. It makes a distinction between ex ante considerations, before commitment of transaction specific investments, en ex post considerations, after their commitment. This yields the 'fundamental transformation' from a large to a small number 'contracting'. The theory also is inter-temporal in the sense of taking uncertainty concerning future contingencies into account. However, TCE is not consistent in this. Williamson (1999: 1101) does claim that: 'governance structures are predominantly instruments for adaptation, it being the case that adaptation ... is the central problem of economic organization; organization has an inter-temporal life of its own ...'. He admits, however, that this '... is not to say that it [TCE] has worked all of these out in a satisfactory way. I entirely agree that transaction cost economics stands to benefit from more fully dynamic constructions. But whereas saying dynamics is easy, doing dynamics is hard'. This is quite an admission, after saying that inter-temporality is central to TCE.
Let me return to the issue of assessing trustworthiness. Williamson (1985: 59) argued as follows:

> Inasmuch as a great deal of the relevant information about trustworthiness or its absence that is generated during the course of bilateral trading is essentially private information - in that it cannot be fully communicated to and shared with others (Williamson 1975: 31-37) - knowledge about behavioural uncertainties is very uneven.

This may be so. But the argument yields insufficient reason to ignore trust. Why should it be easy to incorporate trust? Even if it is difficult, disregarding it may be worse. I admit that 'private information .. cannot be fully communicated', but I will use sociological and social psychological literature to show that it can to a reasonable extent be inferred from observable behaviour (e.g. Deutsch 1973). As the transaction relation unfolds in time, one can accumulate more or less reliable information about trustworthiness. Did the partner act not only according to the letter but also to the spirit of the

agreement? Did he give timely warnings about unforeseen changes or problems? Was he open about mistakes, weaknesses, relevant contingencies. Was he truthful about his dealings with others that might constitute a threat? Did he defect to more attractive alternatives at the earliest opportunity? Or, to use Hirschman's (1970) notions of 'voice' and 'exit', how much voice rather than exit did he exhibit? When Williamson argues for the assumption of opportunism, as a basis for governance, he does not seem to be aware of the price one pays for that. It leads to possibly costly contracting, hierarchical supervision, or incentive mechanisms, with costs and difficulties of monitoring. What is worse, such forms of control might seriously constrain the freedom, ambiguity and open-endedness of action that is crucial especially when collaboration is aimed at innovation. And perhaps worse than that, an expression of distrust, based on the assumption of opportunism, is likely to destroy the basis for building up trust as the relation unfolds. There is much evidence in the sociological and social-psychological trust literature that distrust breeds distrust and may even elicit opportunism. Then the assumption of opportunism may become self-fulfilling, with considerable costs of contracting and loss of perspective for a fruitful relationship.

The point here is that if we really appreciate the time dimension, in the development of a transaction relation, then we have to analyse how trustworthiness or opportunism evolves in time and how their extent may be observed or inferred. Related to this, I propose that if one takes inter-temporality seriously, there are compelling reasons to see the transaction relation as the unit of analysis, rather than transactions, as TCE proposes.

As indicated, TCE neglects innovation and learning. It does so by Williamson's own admission (1985: 144-145, 1999). That neglect is unacceptable at a time when innovation and learning seem to form the very core of what is going on in economies, markets and organizations. To accommodate this, I need a theory of knowledge. That is not the focus of this book, but I will summarize the theory in a following section. It is important to take a dynamic view, including innovation and learning, because there trust is especially important, due to the importance of uncertainty in innovation, and the resulting limitations of contracts and monitoring in the governance of relations. Thus, there is a two-sided relation between trust and learning: one can develop trust in a learning process, and under the uncertainty of innovation trust is especially needed.

Williamson's excuse for not taking a dynamic process approach is that it is easier said than done. That is true. The main attraction of economic analysis of equilibrium outcomes is that it is analytically tractable and relatively simple. However, it is possible to analyse how trust emerges or is broken down, on the basis of experience in processes of interaction. Here, it is not only a matter of assessing the degree of opportunism, as if that were a stable entity. Opportunism and trustworthiness are themselves subject to change as a function of how a relationship develops, in what Zucker (1986) called 'process based trust'.

**Bounded rationality**

Another related, fundamental point of criticism against classical TCE concerns its treatment of bounded rationality and uncertainty. Even in recent work, Williamson (1999) maintains that he fully accepts bounded rationality: there is fundamental uncertainty concerning future contingencies. However, he claims that there is foresight: one can take such uncertainty into account, infer the hazards following from it, and conduct governance accordingly (in a 'discriminating alignment') and 'efficiently', i.e. in an optimal fashion (to yield an 'economizing result'). We are not myopic, Williamson claims: we are not so stupid as not to take uncertainties into account when we design governance. And indeed, we can to some extent take risks and uncertainty into account. Firms can spread risks by participating in different markets, in the same way that investors can spread risks in a portfolio of investments. Beyond that, to deal with real or radical uncertainty, we can construct scenarios of possible futures, prepare contingency plans for them, and identify the robustness of strategies across different scenarios.

However, the question of course is what the implications of bounded rationality are for the correct identification of relevant hazards and scenarios. Doesn't bounded rationality imply that we might be mistaken about them? Williamson (1999: 1103) admits that TCE 'makes only limited contact with the

subject of learning', and indicates that we may be mistaken about hazards and may learn about them as events unfold (1999: 1104). And apart from hazards I add: how about new options? In spite of great imagination and ingenuity, the scenarios we invented may not include what actually arises. And how about shifts in our preferences? Is it reasonable to assume learning without shifts in preferences? And if new insights in hazards arise, new scenarios, or new options or goals, are we then able to shift from the governance structure engaged upon to an adapted, optimal form? That would always be possible only if there is no path-dependence or lock-in in governance, and that is a strong claim to make. Can one consistently accept, on the one hand, lock-in as a fundamental principle, raising the problem of hold-up, and yet assume perfect flexibility to shift to novel governance as new insights in contingencies arise?

This issue is related to the issue of 'efficient', optimal outcomes. Williamson claims that efficient outcomes are achieved because 'dysfunctional consequences and other long run propensities will not be mindlessly repeated or ignored' (Williamson 1999: 1105). But this begs a number of questions. It implies that dysfunctionality and long run propensities are stable, so that experience in the past is indicative of the future, and it implies that we know which are stable and which are not. How can we know that? And if we did know, how can one be sure that the firm survives to implement the lesson in time?

Perhaps Williamson is falling back on the notion of selection: 'the market' will select inefficient forms of organization out? That is the usual assumption behind the economist's assumption of efficient outcomes, going back to Alchian (1950). I note that if Williamson's argument is indeed evolutionary, he is deviating from the perspective of the firm strategist, who is talking about the survival of the firm. As noted by Chiles and McMackin (1996), there are two perspectives in transaction cost economics. The first is the long-term evolutionary perspective, where 'objective' transaction costs determine the survival of the fittest governance forms. The second is a short-term managerial choice perspective, where managers act on subjective costs that are based on varying perceptions and evaluations of risk. The latter explains why firms in similar circumstances may make different trade-offs. Such variety in cognition is crucial, in a study of learning and innovation. The selection argument was already shown to be weak by Winter (1964). In selection it is not the best possible but the best available in the population that survives. In the presence of economy of scale inefficient large firms may push out efficient small firms, and in this way inefficiency may survive. Furthermore, the argument assumes efficient selection, but that cannot be taken for granted in view of possible monopolies, entry barriers and transaction costs.

## THEORY OF TRUST, KNOWLEDGE, LEARNING, PSYCHOLOGY, AND COGNITIVE DISTANCE

### Trust

Trust is too large and complex a subject to fully discuss here. For an integrated survey of the literature, see Nooteboom (2002a). There, the following propositions are argued:

- Trust is a four-place predicate: the trustor (1) trusts a trustee (2), in some aspect (3), under some conditions (4).
- Trust can have several trustees: things, people, organizations, institutions. For people and some institutions, one can have trust in different aspects: competence, intentions (commitment, limits to opportunism), available resources, vulnerability to outside events.
- Trustworthiness and trust have limits. Unconditional trust is indeed (as suggested by TCE) not wise. It operates within tolerance limits, which depend on experience and outside contingencies (e.g. under strong competitive pressure, firms can afford loyalty less).
- Trust entails the acceptance of relational risk. Trust is never certain. It operates as a default: trustworthiness is assumed, up to a limit, until evidence of violation is perceived (in which case limits of trust are narrowed).

- Trust is based on both rational reasons, in an assessment of possible sources of trustworthiness, and psychological causes (see the later section on social psychology), for judging someone (or something) to be trustworthy
- Trustworthiness can have many sources. Some constitute 'control', or 'deterrence' (Shapiro et. al. 1992, Maguire et. al. 2001), with an appeal to calculative self-interest, on the basis of contracts, hierarchy, dependence, use of hostages, reputation mechanisms, and the institutional environment (thus trust in people or organizations can be institution-based). That includes the instruments of governance from TCE. However, other sources go beyond calculative self-interest, with more intrinsic motivation, such as ethics of behaviour, empathy or identification, or routinized behaviour. The second type I call 'real' trust, or trust 'in the strong sense'. This accommodates the insight from TCE that if trust does not go beyond calculative self-interest it is not a meaningful concept. In contrast with TCE, I argue that trust does indeed go beyond calculative self-interest and can yet be viable, within limits, in markets.
- When trust is not present prior to a relation, it can be built up, in prolonged interaction. A first stage is the building of empathy, whereby people learn about a partner's cognitive and other characteristics, which enables a more reliable assessment of the limits of trustworthiness. A further stage is the development of identification, in the sharing of perceptions, evaluations, norms, aims, and the like (McAllister 1995, Lewicki and Bunker 1996).
- Disappointment of expectations, in interaction, does not necessarily yield a break-down of trust. Conflict of insight is a source of learning. While conflict may yield a breakdown of trust, the joint solution of conflict may deepen trust.

**Knowledge and learning**

I take the notions of knowledge and cognition in a wide sense, including perception, interpretation and evaluation, which include emotion-laden value judgements. In other words, I see cognition and emotion (such as fear, suspicion, grief, excitement) as linked (Simon 1983, Nussbaum 2001). The Cartesian separation of mind and body is dropped (Merleau-Ponty 1962, Damasio 1995). Note the difference between urges (such as hunger, sex) and emotions. In contrast with urges, emotions are directed not at generalized but at specific objects. Also, emotions are informed by cognition in more detail than urges. For example, fear of something is informed by its perception, attribution of characteristics, interpretation of events, and causal inferences of threat.
As argued by Herbert Simon, due to bounded rationality, much behaviour is routinized, and 'automatic', in the sense of unreflected, and largely based on tacit knowledge, in 'subsidiary' rather than 'focal' awareness (Polanyi 1962, 1966, 1969). Routinized behaviour is rational in the sense of being 'adaptive': it helps us to function and survive in a world of uncertainty and bounded rationality. Here, I distinguish two meanings of 'rational conduct'. One refers to the use of reason for deliberative evaluation, in 'calculative behaviour', and the second refers to the adaptiveness of conduct, contributing to survival under uncertainty (which constrains deliberative evaluation). Activity becomes routinized when it has proven to be consistently adequate, or 'satisficing'. The routine is relegated to subsidiary awareness. The downside of routines is that they may become dysfunctional in new circumstances. When this yields a perceived threat, due to malfunction, routinized behaviour may be shifted from subsidiary to focal awareness, for critical, deliberative reflection. As argued by Simon (1983) emotions, such as fear, caused by malfunction, serve to trigger such a shift. This is one reason why emotions are part of rationality, in the sense of adaptiveness.
It is a truism to say that information is not the same as knowledge: to become knowledge, information needs to be interpreted and understood in a cognitive framework. Similarly to most researchers in this area, I employ a 'constructivist' theory of knowledge, and language, that descends from 'symbolic interactionism' in sociology (G.H. Mead), and the view, taken from cognitive psychology, that intelligence is internalized action (Piaget 1970, 1974, Vygotsky 1962, Bruner 1979). That is why it has also been called an 'activity theory' of cognition (Blackler 1995). Our view is related to other 'constructivist', 'interpretative' or 'hermeneutic' views (cf. Weick 1979, 1995). In contrast with the dominant 'computational representational' view in cognitive science, this leads to the view of

knowledge in terms of ‘situated action’. Knowledge and the meaning of words are not independent from context. They lie partly in the context of use, and they shift from one context to another. One may still speak of mental ‘representations’, but only on the understanding that they are mentally constructed, in an embedding in existing cognitive structures, and are not ‘given’ as any ‘mirror image’ of reality. Even ‘recall’ from ‘memory’ is not simple retrieval, but reconstruction, affected by the context at hand. For a more detailed recent analysis, see Nooteboom (2000a).

Mental categories or schemata are more or less routinized and tacit. This applies, for example, to pattern recognition. That arises in many areas, such as shapes of objects or drawings, physiognomy, practices, conditions and motives of behaviour. In discussions of tacit knowledge there is a tendency to see tacit and codified knowledge as substitutes, as when tacit knowledge is ‘externalized’ (Nonaka and Takeuchi 1995) into codified knowledge. However, there is also complementarity: underlying, tacit categories are needed to interpret information (externalized knowledge) transmitted in communication. People properly understand each other only if they sufficiently share underlying categories. When those are tacit and incongruent, there is a problem. They may then first have to develop shared categories, by interaction in a ‘community of practice’ (Brown and Duguid 1996), to establish what Lissoni and Pagani (2001) called an ‘epistemic community’. Once they have established that, they may disband, at least temporarily, and communicate at a distance in ways that outsiders would not understand for lack of a cognitive basis, or lack of proper absorptive capacity. Alternatively, it may be possible to make implicit, tacit categories explicit, but those, in turn, would need to be interpreted on the basis of underlying categories. At some level, the preconditions for cognition are inevitably tacit: one must take basic notions and meanings in language for granted; one cannot go on defining the terms of a definition. To some limited extent it is possible to make one’s tacit categories explicit, but this is not always possible or easy.

There is a difference between declarative and procedural memory (Cohen and Bacdayan 1996), which is related, but not identical, to the distinction between tacit and codified knowledge. Declarative memory is supposed to have a locational identification in the brain: it can be ‘declared’ (as one has to do in the basic coding for a computer programme) and ‘retrieved’. It typically relates to information on identity, abstractions and formal explanation, disembedded from specific context. Procedural memory, on the other hand, has more to do with practical know-how, relational knowledge of how to combine elements of knowledge in practical procedures. This latter knowledge is more embedded in practice and specific conditions of application. Procedural knowledge tends to be more tacit. For codification it needs to be disembedded from practical procedure, which can be difficult, and entails a loss in abstraction. That is why sharing it may require interaction in a community of practice.

Procedural knowledge may derive from declarative knowledge, as when formal training is applied in practice and then develops into a routine. This generally entails that to yield procedural knowledge, declarative knowledge is embedded in a specific context of use. That is how one may first learn a language on the basis of formal grammar, then apply it, and after a while be able to identify proper and faulty constructions, without any longer being able to specify why, on the basis of what grammatical rules. In this way, knowledge that was once explicit can develop into tacit, routinized knowledge. Practical knowledge does not have to develop in this way. Procedural knowledge may be transferred, by socialization in a community of practice, without first having been formalized into codified knowledge. This is what happens in an artisanal master-apprentice relation, and in the learning of one’s mother tongue.

In the literature on organizational learning, two levels of learning are proposed. One is learning to do existing things better, and the other is learning to do new things. The first has variously been called first order, single loop learning or learning for exploitation, and the second has been called second order, double loop or exploratory learning (Argyris and Schön 1978, Hedberg et. al. 1976, Fiol and Lyles 1985, Holland 1975, March 1991). Efficient exploitation of resources is needed to survive in the short term, and exploration of new resources is needed to survive in the long term. While we can make this conceptual distinction, in the process of learning the two kinds of learning do not stand apart from each other. Exploitation is based on exploration, and vice versa. We exploit what we have explored, and it is on the basis of exploitation that we explore. According to our activity theory of knowledge, learning forms the bridge between practice and innovation. A central task of organizations is to find ways of combining the two. Arguably, this is the central challenge for management. The combination

of exploitation and exploration is not easy. Exploitation generally entails stable standards and meanings of terms, and stable relations in division of labour. Exploration typically requires the reverse: the loosening and change of standards, meanings, organizational structures.
For an extensive discussion, see Nooteboom (2000a).

**Evolutionary psychology**

My thesis that cognitive or mental categories develop in interaction with the physical and social environment does not entail the claim that at birth the mind is a 'tabula rasa', without any innate mental structures. Evolutionary psychologists claim that certain psychological features or mechanisms are 'in our genes' as a result of evolution (Barkow et. al. 1992). They emerged as features that gave selective or reproductive advantage, over the millions of years that the human species evolved in hunter-gatherer societies. These form a shared heritage, in the form of common basic psychological and cognitive mechanisms. These are plausible to the extent that they were conducive to survival and procreation in ancient times. For example, survival required the basic ability to identify objects and movement, to categorize natural kinds (plants, animals), distinguish the animate from the inanimate, natural kinds from artefacts (Tooby and Cosmides 1992: 71). On top of that it requires the ability to recognize objects, judge speed and distance, to avoid predators and to catch prey (Tooby and Cosmides 1992: 110). Survival also requires mother-infant emotion communication signals (Tooby and Cosmides 1992: 39).
Of importance for the discussion of trust is the claim that survival in hunter-gatherer societies was also furthered by sociality. The variance of yields, in gathering edible plants, roots, nuts, etc., and even more in hunting, together with problems of durable storage, entails an evolutionary advantage of the willingness to surrender part of one's yield to others in need, in the expectation to receive from them when they are successful (Cosmides and Tooby 1992: 212). This is enhanced by the ability to assess such willingness among others and to signal a credible threat to sanction lack of reciprocity. As explained by Frank (1988), an emotionally based commitment towards retaliation or revenge, and the ability to signal this, would help to make such threats credible when revenge would carry a cost that is disproportional to its economic gain and would hence be implausible on the basis or rational choice. It also entails an ability to 'read' facial expressions of emotion (Tooby and Cosmides 1992: 70), and to attribute, with some validity, motives to people on the basis of observed behaviour and verbal and other expression. All this may yield an evolutionary basis for social reciprocity and trust. Of course, if this evolutionary argument is true, we also have to take the bad with the good: the adverse effects of a drive towards emotion-laden retaliation or revenge.
However, less basic, 'higher level' cognitive categories of perception, interpretation and evaluation have to be geared to a world that is unrecognizably different from ancient hunter-gatherer societies. This requires a plasticity in the formation of cognitive structures, tacked on to deeper level ones derived from evolution, that are apt for the world one is in. In fact, this is based on an evolutionary argument as well: without such plasticity we would not have been able to evolve as we have. In other words, while underlying cognitive abilities, urges and inclinations may be instinctive, inherited from a shared evolution, the superstructure of cognitive categories is developed in interaction with one's current, more individual environment.

**Social psychology**

Next to cognitive considerations in the narrow sense, there are also more emotion-laden and instinct-based considerations from social psychology. Such instincts are inherited, emerging, at least in part, from evolution. We infer causes of behaviour and we attribute characteristics and motives to people according to mental categories or schemata. We can identify with people, to the extent that there is similarity of such behavioural schemata. Empathy entails knowledge of other people's cognition, without sharing it. Empathy helps to attribute motives and capabilities correctly, and thereby arrive at a more reliable assessment of trustworthiness. Identification leads to sympathize with them and

perhaps tolerate disappointments. We entertain more or less tacit categories of justice, and trust depends on the extent that others share them. Absorptive capacity may be limited by cognitive dissonance: we may subconsciously resist information that is in conflict with established and cherished views or convictions, particularly if it would require and admission of mistaken choices in the past. Past acts have to be justified to oneself and to others, even at the cost of distorting facts or construing artificial arguments.
Social psychology offers a number of insights into instinct-related decision heuristics that people use. In a survey, Bazerman (1998) mentions the following heuristics:

- Availability heuristic: people assess the probability and likely causes of an event by the degree to which instances of it are 'readily available' in memory, i.e. are vivid, laden with emotion, recent and recognizable. Less available events and causes are neglected.
- Representativeness heuristic: the likelihood of an event is assessed by its similarity to stereotypes of similar occurrences. This is related to the role of defaults and prototypes discussed in Chapter 1. We recognize something according to the likeness of some focal features to those of a prototype, which may be a stereotype, and on the basis of that attribute other features from the stereotype that are not in fact present. This can easily yield prejudice.
- Anchoring and adjustment. Judgement is based on some initial or base value ('anchor') from previous experience or social comparison, plus incremental adjustment from that value. People have been shown to stay close even to random anchors that bear no systematic relation to the issue at hand. First impressions can influence the development of a relation for a long time.

These heuristics are non-rational in the sense that they are not (fully) based on calculative evaluation. However, they are rational in the adaptive sense of contributing to survival under uncertainty and bounded rationality. Concerning the availability heuristic, in the above analysis of routines I noted the importance of an emotional identification of a suspicious event to trigger awareness of the routine and subject it to scrutiny. Perhaps this is connected with the availability heuristic: we pay attention only when triggers are emotion laden. If we did not apply such filters our consciousness would likely be overloaded.
Concerning the representativeness heuristic, I note the role of prototypes or 'exemplars' in language and categorization (Rosch 1978, Nooteboom 2000a). Since definitions can seldom offer necessary and sufficient conditions for categorization, and meaning is context-dependent and open-ended, allowing for variation and change, we need prototypes. Prototypes are salient exemplars of a class that guide categorization by assessing similarity to the prototype. The notion also appears in science: the case of Adam Smith's pin factory, mentioned before, constitutes a classic exemplar of economy of scale by division of labour. The root meaning of a 'paradigm', in science' is 'exemplar'. This also explains the role of cultural features such as myths and role models. The mechanism of attributing unobserved characteristics upon recognition of observed ones enables pattern recognition, which is conducive to survival.
Concerning anchoring and adjustment, under uncertainty cognition does need such an anchor, and taking the most recent value of a variable, or a value observed in behaviour of people in similar conditions, with whom one can empathize, may well be rational. The notion of a default entails that one adapts past guidelines for behaviour on the basis of new evidence. Incremental adjustment can be inadequate, but so can fast adjustment. Studies of learning and adjustment have shown that hasty and large departures from existing practices can yield chaotic behaviour (March 1991, Lounamaa and March 1987).
The relevance of these heuristics to trust is clear, because they affect attribution of characteristics and expectations of trustworthiness. According to the heuristics, one would develop expectations, explain broken expectations, and attribute trustworthiness according to what is 'available' in the mind, stereotypes, existing norms or recent experience. Note, however, that although these heuristics are rational in the adaptive sense, they can yield errors of myopia, prejudice, and inertia. As a result, while trust is feasible, it can go wrong.
Another psychological phenomenon is that people are found to have difficulty to choose between immediate gratification and long-term benefit, yielding a problem of 'the weakness of the will'. This has been explained in terms of people having multiple selves that are at odds with each other, or as a visceral

drive competing with a rational inclination. Another interpretation follows the availability heuristic: immediate gratification is more 'available'. Studies of behaviour under uncertainty have shown that people may assess delay in gratification differently when it is near than when it is far ahead, and that sometimes discounting seems to take place not according to an exponential but according to a hyperbolic function. According to that function, the negative utility of a delay of gratification increases as the decision moves to the present. As a result, preferences may reverse at some point in time. The relevance of this phenomenon to collaborative relations is also clear, in the trade-off between loyalty to a partner, which may be in one's long-term interest, and the temptation to defect to another partner who offers more advantage in the short term. One may honestly think one is able to withstand that temptation in the future, and succumb to it when it nears. Again, we cannot unequivocally judge that this psychological mechanism is maladaptive. As noted also by Bazerman (1998), the impulse of temptation may also entail the vision of entrepreneurial opportunity, and too much repression of it may suppress innovation.
'Prospect theory' has demonstrated that people are not risk-neutral, but can be risk-taking when a decision is framed in terms of loss, and risk-averse when it is framed in terms of gain. This 'framing' entails, among other things, that in a relation people will accept a greater risk of conflict when they stand to incur a loss than when they stand to obtain a benefit. Related to this effect is the 'endowment effect': people often demand more money to sell what they have than they would be prepared to pay to get it. In the first case one wants to cover for loss. This may contribute to loyalty and stable relations, as follows. Relations typically end when one of the partners encounters a more attractive alternative, while the other partner wants to continue the relation. The first partner is confronted with a gain frame, the second with a loss frame. This may cause the second partner to engage in more aggressive, risky behaviour, to maintain the relation, than the first partner, who may be more willing to forego his profit and run less risk of a harmful separation procedure. One wonders what the adaptive rationale of this difference between a gain- and a loss-frame is, if any. Perhaps it lies precisely in the effect just mentioned: it reduces defection and thereby stabilizes relationships.[1]
Earlier, I noted the importance of identification on the basis of shared categories concerning the motives and conditions of behaviour. This is clearly related to the availability heuristic: behaviour that one can identify with is more 'available'. This affects both one's own trustworthiness, in the willingness to make sacrifices for others, and one's trust, in the tolerance of behaviour that deviates from expectations. One will more easily help someone when one can identify with his need. One can more easily forgive someone's breach of trust or reliance when one can identify with the lack of competence or the motive that caused it. One can more easily accept the blame for oneself. Since one can identify with him, one may sympathise with his action, seeing, perhaps, that his action was in fact a just response to one's own previous actions.
Another reason to attribute blame to oneself when someone else is in fact to blame, is to reduce uncertainty or establish a sense of control. This works as follows. If it is perceived to be impossible or very difficult to influence someone's behaviour in order to prevent or redress damage from broken expectations, one may attribute blame to oneself. By doing that, one relieves the stress of feeling subjected to the power of others. For people with little self-confidence or a low self-image, this is a move of desperation, and self-blame fits with the preconception one had of oneself. For people with self-confidence, self-blame may yield a sense of control: if the cause lies with oneself, one can more easily deal with it. Of course, that may be an illusion, due to overconfidence in oneself.
Another mechanism is that of a belief in a just world, which gives reassurance. By enacting justice, even anonymously, one confirms its existence by contributing to it, and thereby maintains a sense of security. However, when the sacrifice for another would be too high to accept, in the view of self-interest, then to avoid a self-perception of callousness one may convince oneself that his hardship is his own fault.

[1] I do not wish to imply that stability of relations is always a good thing economically, in the sense that it is always conducive to efficiency and welfare. A certain amount of stability may be needed to recoup specific investments, which may in turn be needed to achieve high added value and innovativeness. However, relations can become too stable and exclusive and thereby yield rigidities. The question therefore is how to develop relations that have optimal duration: neither too short nor too long.

Yet another psychological mechanism is that in violation of rational behaviour sunk costs, such as sacrifices made in a relationship, are not seen as bygones that should be ignored in an assessment of future costs and benefits. They are seen as sacrifices that would be seen as in vain if one pulls out after having incurred them. This yields what is known as 'non-rational escalation of commitment'. It is associated with cognitive dissonance: cutting one's losses and pulling out would entail an admission of failure, of having made a bad decision in the past. The phenomenon is confirmed in empirical research, which shows that when the decision is made by someone not involved in the initial decision, or when the threat of an admission of failure is removed, the rational decision to pull out is made. Again, one cannot say that this mechanism is always bad, because it also demonstrates perseverance in the face of setbacks, which can be a good thing, and is in fact a trait of many a successful innovating entrepreneur. This phenomenon can also be connected with the effect of a loss frame versus a gain frame, proposed in prospect theory. The person, or group, that made the initial decision experiences a loss frame, with the inclination to accept further risk in order to prevent acceptance of the loss. The decision maker who enters fresh experiences a gain frame, to make a decision that will offer profit in the future, regardless of past sunk costs, and will be less inclined to accept the high risk of continuing losses from sticking to past decisions. The mechanism of non-rational escalation can contribute to the continuation of a relationship where it is not beneficial.

**Cognitive distance**

The process of knowledge construction, summarized above, precludes objective knowledge (or at least any certain knowledge whether or to what extent knowledge is objective, which pragmatically amounts to the same). We cannot 'descend from our mind to check how our knowledge is hooked on to the world'. Personal knowledge is embedded in a system of largely tacit, routinized mental categories that constitute absorptive capacity (Cohen and Levinthal 1990). Since mental categories have developed on the basis of interaction with others, in a string of contexts that make up experience, knowledge is path-dependent, and there will be 'cognitive distance' (Nooteboom 1992, 1999) between people with different experience, and cognitive similarity to the extent that people have interacted, in shared experience. I do not wish to imply that cognitive distance is any simple, linear, one-dimensional metric. In Nooteboom (2000a) I elaborate the notion of cognitive distance in terms of overlap of, and mappings between, ranges and domains of perception and cognitive construction. Note the difference between cognitive distance and cognitive variety. Variety refers to the number of people with different cognitive capabilities, while distance refers to the 'distance' between them.
Cognitive variety and distance yield both an opportunity and a problem. As shown in evolutionary economics, variety yields opportunities for innovation. The opportunity of cognitive distance is that contact with others gives us a possibility to escape from the myopia of our personal cognitive construction, by profiting from the different insights of others, based on different experience. In the absence of claims of objective knowledge, interaction with others is the only path we have to correct our errors. A problem, however, is that the greater the cognitive distance, the more difficult it is to cross it, i.e. to understand the actions and expressions of a partner. Thus there is an optimal cognitive distance: large enough for partners to tell each other something new, and small enough for comprehension. This is an important point, since in my theory optimal distance is the main determinant of the boundaries of firms.
Absorptive capacity is part of our ability to cross cognitive distance. The other part is communicative capacity, or the ability to help others understand what we do or say. Here, the use of metaphor is important (for examples, see Nonaka and Takeuchi 1005). Here metaphor can be paraphrased as A trying to tell what he knows to B, in terms of B's knowledge. Note the difference between (partly) understanding what others know, and how they think, and having the same knowledge, sharing cognitive categories. The first entails the crossing of cognitive distance, and is known as 'empathy'. The second entails the reduction of cognitive distance, and is known as 'identification'.
Absorptive capacity is not fixed. When the knowledge involved is codified, absorptive capacity can be increased and maintained by more formal, declarative forms of learning, such as R&D. Often, when firms outsource certain activities, they maintain R&D in that area in order to maintain absorptive

capacity (Granstrand et. al. 1997). When knowledge is more tacit, I propose that absorptive capacity depends on cumulative experience in absorbing tacit knowledge from a variety of sources. Then communicative capacity also matters more, to help partners to absorb tacit knowledge.
In knowledge transfer, a widely recognized problem is that it may be difficult to codify or 'externalize' tacit knowledge. There is a second problem that has not yet been widely recognized. On the end of the receiver tacit knowledge can also create a problem, as follows. Tacit knowledge is taken for granted because it is tacit. It is hard to criticize something that one is not aware of. Thus, tacit knowledge may create an obstacle for the adoption of new technology. To eliminate this, one may first have to make the tacit procedures and underlying assumptions explicit.

> There is less need to formalize and externalize tacit, procedural knowledge in a smaller firm than in a large one. In a small firm, with a team of people in direct contact on a shop floor, there can be co-ordination by direct supervision (Mintzberg 1983). In a large firm, aimed at economies of scale by specialization, formalization is needed to co-ordinate over larger spatial and organizational distance, by the specification of work processes or skills. This yields advantages and disadvantages for the smaller firm. An advantage is that the lesser degree of bureaucratic regulation allows for greater flexibility, for adapting a product to idiosyncratic demand. A disadvantage is that tacit, undocumented knowledge is vulnerable to loss. If the carrier has an accident or leaves the firm, the knowledge may be lost. A second disadvantage follows from the obstacle to absorption due to unreflective practices and assumptions indicated above. These phenomena explain why it can be difficult or costly to transfer new technology to small firms: there are firm size effects in transaction costs (Nooteboom 1999, 2002b).

## A COGNITIVE THEORY OF THE FIRM

### The firm as a focusing device

The theory of knowledge set out above leads to the notion of a firm as a focusing device (Nooteboom 1992). An important function of a firm is to create sufficient focus, that is alignment of mental categories, in a reduction of cognitive distance, or at least sufficient mutual absorptive and communicative capacity to cross cognitive distance, for people to achieve a common purpose. This seems related to the term 'epistemic community'. It is also similar to the earlier notions of an organization as a sensemaking system (Weick 1979, 1995), system of shared meanings (Smircich 1983), interpretation system (Choo 1998), and the need for 'shared beliefs' (Haas 1992). Note also that the notion of 'focus' appears related to the notion of 'core competencies' of the firm, in the management literature (Prahalad and Hamel 1990). A difficult question, in that literature, has been how, precisely, core competence is defined. I suggest that perhaps the notion of cognitive focus may help to give a more fundamental, cognition based view to support and clarify that notion.
Note that a cognitive focus is needed for reasons of both competence and governance. Competence refers to the need for people in the firm to align their causal beliefs, and beliefs concerning the location of knowledge in the organizations, organizational structure (architecture) and organizational strategy. Governance refers to the need to motivate people and generate trust, as basis for coordination and collaboration. Here, the focus includes basic cultural categories concerning the cognitive and ethical characteristics of man, the relation between man and nature, the nature of knowledge, justice, responsibility, the relation between people, competition, autonomy, authority, collaboration, initiative, responsibility, openness, honesty, and trust. Here, on the basis of the previous discussion of trust and social psychology, I deviate from economic perspectives that focus only on extrinsic, material incentives, on the basis of only calculative self-interest. While I recognize that those are relevant, cognitive focus serves to align motives more intrinsically, on the basis of mutual empathy and identification with a joint purpose and style of doing things. In terms of social psychology, discussed above, the focus serves to enable and constraint the working of decision heuristics. Thus, it affects 'availability to the mind', offers stereotypes for categorization (myths, role models), 'anchors' from which to adjust, weakness of the will, the framing of decisions, and conceptions of justice.

There are two arguments for this theoretical turn. One is, simply, that this reflects how people really behave, as elaborated in the section on social psychology. This is important to me because of my preference for a realist theory of the firm. The second argument is that it enables a better understanding of the coordination of activities, which has shown to be extremely problematic in the economic governance theories of the firm, with their neglect of trust and the assumption of rational, calculative, purely self-interested behaviour. A key problem there lies in problems of monitoring opportunistic behaviour. That problem is of increasing importance in our new 'knowledge society', where knowledge work is, almost by definition, difficult to monitor. Rather than monitoring the outcome of behaviour, the principle of the firm as a focusing device considers the formation of perceptions, attributions, directions and motives underlying behaviour.

**Myopia and sharpness of the focus**

Now, it is important to recognize that the cognitive focussing in firms yields a problem of myopia, by which organizations may fail to see or adequately interpret potential opportunities and threats to its existence. Ongoing, intense collaboration, especially when it is closed off from outside contacts, tends to reduce cognitive distance, leading to 'group think' (Janis 1981). From a perspective of governance, the positive side of this is that it yields empathy and identification as a basis for trust. From a perspective of competence, the negative side of this is that it reduces the differences needed for learning. To compensate for that, organizations need outside partners for complementary cognition, or 'external economy of cognitive scope' (Nooteboom 1992). Next to all the familiar arguments for the advantages of alliances of firms over integration in mergers and acquisitions, this yields a cognitive argument. Such outside relations serve to complement myopic cognition in the firm. For that it is essential to maintain cognitive distance, with partners independently tapping into their own sources of learning. Integration in one firm, in a merger or acquisition, requires an integration of cultures, i.e. a shared cognitive focus, which is not only difficult, and often results in failure, but also eliminates sources of learning. Here, my theory of the firm develops into a theory of the 'network economy'. This yields a prediction that runs counter to TCE. TCE predicts that under high uncertainty, which precludes a sufficiently closed contingent contract, and high dependence due to specific investments, there is an incentive to integrate in the firm. My theory predicts the opposite: under high uncertainty, in terms of a rapid change of technology and markets, there is a greater need to engage in outside relations, for the sake of flexibility and cognitive distance, rather than integration in mergers or acquisitions. The latter prediction has been confirmed empirically by Colombo and Garrone (1998).
An important question now is, how sharp or narrow the focus of a firm should be. My theory of knowledge precludes the notion of people having identical knowledge. Having had different experiences, being engaged in different activities, and importing cognitive experience from outside the firm, people will never have identical knowledge. Within firms some internal cognitive distance is inevitable, and also beneficial. Such distance can yield misunderstanding and error, but it is also a source of learning.
The optimal sharpness of the focus of a firm depends on whether the organization chooses to concentrate more on efficient exploitation (utilization of existing resources and competencies, including cognitive competencies), or on exploration (development of new competencies). The former requires a sharper focus, with more unity of perception and interpretation for the sake of efficient co-ordination, while the latter requires more diversity and volatility of linkages for the sake of finding Schumpeterian 'novel combinations'. A narrow focus of behavioural norms may also be needed to establish and maintain trust. In other words, a trade-off is needed between cognitive distance (wide focus), to enable innovation and learning, and cognitive proximity (in a narrow focus, with many 'shared beliefs'), to achieve efficient production, coordination and collaboration. This, I propose, defines the function of a firm, and determines its boundaries (questions 2 and 3). The legal identity of the firm serves to give a legal basis for the coordination of resources to achieve this. Here, my theory connects with the governance view of the firm. Legal identity is needed to establish ownership rights, to control resources, and a generalized labour contract to coordinate resources, according to the chosen focus. What lies outside the focus requires collaboration with outside firms and other organizations.

The trade-off depends on a number of contingencies. Some refer to competence, and others to governance. As already indicated, on the competence side it depends on whether the focus of the firm lies on exploration or exploitation. Exploitation requires a narrow focus, with limited cognitive distance, in stable structures and ties between people. Exploration requires a wider focus, with ample cognitive distance and variety, in flexible structures and not too strong and durable ties. Where the emphasis lies depends on where in an innovation life cycle one's products and technologies lie. In the early stage of the emergence of novelty, the emphasis lies on exploration. Later, after the emergence of a 'dominant design', the widening of demand, and entry of competitors, the priority shifts to efficient exploitation  One way to combine the two is to specialize in one and acquire the other from outside partners. Thus, in an industry, some firms may specialize in exploration, and other in the efficient utilization of what comes out. A striking example is the dual structure, in Western countries (not Japan, for example, cf. Kneller 2002) of small, flexible, volatile biotech companies, and large, stable pharmaceutical companies. The latter is needed for scale intensive and durable linkages, for the lengthy process of acquiring regulatory approval of drugs, spreading risks across drugs (with occasional 'blockbusters' cross-subsidizing failures), large-scale production, large scale distribution and the build-up and maintenance of a brand name.
This is not, however, the only solution. There are ways to combine the two within a single firm (Nooteboom 2000a). The possibility of doing this depends on how 'systemic' versus 'stand-alone' activities within the firm are (Langlois and Robertson 1995). In highly systemic tasks, there are many linkages between elements (individual actions), with tight and durable constraints on them, to ensure mutual fit. An example would be a refinery. Here, there is little scope for varying local practice (in separate elements), needed for exploration, without breaking down the integrity of the total system, needed for exploitation. In stand-alone activities, there is scope for local change. An example is a consultancy, with highly autonomous professionals who can vary their practice without disrupting that of others. Of course, there the question is how they can share their knowledge, to avoid the re-invention of wheels, for the sake of efficient exploitation. An intermediate form is a 'modular system'. Here, elements are linked, but flexibly, with generic rather than specific standards on linkages, allowing for switches between components. An example would be the building of computers. To the extent that exploitation is more stand-alone, or modular, it allows more for simultaneous exploration.
The question how narrow the focus must be also concerns the governance side. Some contingences here are the following. When monitoring activities is more difficult, intrinsic motivation and trust are more needed, and the focus must provide the basis for it. This happens when work is based on professional knowledge and deep, tacit practical experience. More or less durable, intensive ties may be needed, for building empathy and identification. When the focus is on innovation, the ensuing uncertainty also obstructs the drawing up and monitoring of formal agreements, and requires an emphasis on trust. The problem here is, of course, that on the other hand for innovation one needs a wide scope, with cognitive distance and variety. The solution is that the scope must be wide concerning competence, and sufficiently narrow concerning governance. In other words, one needs a strong culture of trust, in combination with diversity of knowledge.

**Coordination**

Now I turn to further questions of coordination (question 4). Coordination of activities is another subject that is too large to fully deal with here. I restrict the presentation to considerations that contribute to a determination of the boundaries of a firm.
As admitted from the start of this paper, we cannot deny or ignore risks of opportunism, and resulting problems of relational risk, even if we accept that trust is real and relevant. It was argued above how important it is, from a perspective of learning by interaction, to invest in mutual understanding between diverse perspectives, to utilise complementary cognition, at a cognitive distance. Such investment is often relation-specific, and thus creates the problem of hold-up identified by TCE. Also, the building of trust, in empathy and identification, also constitutes a specific investment. Here, the argument links up with TCE. Within the firm, the new forms of specific investments proposed here, to limit cognitive distance, build mutual absorptive capacity and 'shared beliefs' are especially high.

TCE arguments for the need to integrate under high specific investments here merge with the role of the firm in providing a focus.
Between firms, at a larger cognitive distance, adequate mutual absorptive capacity, to cross the distance, and to a greater or lesser extent trust, are also needed. Thus, between firms also, some cognitive focus, but a wider one, is needed. As indicated before, counter to TCE, this does not necessarily yield an argument for integration in one firm, in view of the need to maintain cognitive distance. Between firms, specific investment in mutual absorptive capacity is not necessarily symmetrical. A larger absorptive capacity, resulting from specialised staff, R&D, and a greater fund of experience in crossing cognitive distance, can yield understanding with lower specific investment. This is an issue, for example, in collaboration in R&D between large and small firms. The large firm tends to have greater absorptive capacity than the small one, and thus the latter is more vulnerable to spillover.
In governance, we have to systematically incorporate the spillover problem. Spillover risk and the notion of hostages are connected. For example, information provided to the partner may be used as a hostage, in the sense used in TCE. In fact, that can be used deliberately as an instrument in a governance package. For example, when specific investments are one-sided, and there are drawbacks in making the hold-up risk more even by sharing ownership, compensation may take place by the less dependent party surrendering sensitive information as a hostage. That may be the preferred solution if such information transfer is useful also for other reasons, such as helping the other side in improving his competence. Take the case of small and large firm collaboration. Lesser absorptive capacity of the smaller firm not only increases his relative hold-up risk (due to higher specific investment in understanding) but also his spillover risk. A balance of dependence may be struck if the larger partner surrenders sensitive knowledge as a hostage. That may yield three benefits at once: balance of hold-up risk (by the hostage mechanism), balance of the spillover risk, and improvement of the small firm's competence.
A small firm can also protect its knowledge from spillover by keeping it more tacit. For a large firm this is more difficult, because under division of labour, with many specialists interacting with each other, knowledge has to be more documented in procedures, for the purpose of co-ordination. In a small firm, with direct supervision of the whole of a firm process such need is less.
If spillover cannot be protected by internalisation within the firm, because of the need for collaboration with outsiders, to profit from their complementary cognition, one can try to maintain exclusiveness, and demand that partners do not interact with one's competitors, in the area of activity under consideration. However, such exclusiveness of relations constrains the sources of learning one's partner has access to. In other words, it constrains the variety of knowledge that is a source of innovation. This is exacerbated by the fact that durable relations with exclusive, more or less isolated partners will in due course reduce cognitive distance. An interesting option arises under 'radical' speed of change, defined as change of products or technology that is faster than the time it takes for knowledge to spill over (Nooteboom 1998). Note that what is relevant here is not just the time needed for the 'information' to 'reach' a competitor. In fact 'spillover' is a misleading term, because it suggests the naïve view of knowledge as a commodity shipped across a communication channel. A crucial question is whether a competitor is able to absorb, imitate and implement the knowledge, and how long that takes. Under the condition of radical speed, the spillover problem drops out: one has become a moving target.

**Boundaries of the firm**

I proposed that the cognitive focus of a firm is a fundamental principle for establishing the boundaries of the firm, and that the trade-off between a narrow and a wide focus depends on a number of contingencies, which may vary in time. As a result, the boundaries of a firm are subject to shifts. I also incorporate governance perspectives, in the control of relational risk of hold-up and spillover.
As in the control of hold-up risk (as argued by TCE), spillover also can be better controlled within the firm, where one can demand insight in transfers of knowledge, and create guarantees against spillover better than one could demand from an independent outside partner. Knowledge spills over less easily

when it is tacit, rather than documented. Even then, it can still spill over by poaching of the staff in which the knowledge is embodied. However, spillover can be further obstructed when competencies are embodied not in single people but in teams, organisational structure or culture. Another argument, from the competence perspective, for integration is that by outsourcing one may surrender the capability to assess the value of the offering of suppliers (Beije, 1998). Also, one may drop a capability that later turns out to be crucial in order to utilise or replace elements of core competence, or cognitive focus of the firm. Teece (1986) proposed that the appropriation of returns on core competencies may require access to 'complementary assets'. Even if those are not part of core competence, they may have to be integrated in the firm. One may therefore have to see such complementary assets as attached to core competence.

From the perspective of the cognitive theory of the firm, arguments for disintegration, in outside relations, are: cognitive scope and flexibility of Schumpeterian novel combinations. These come in addition to TCE considerations of economies of scale in specialised outside producers (if the corresponding productive assets are not too specific), and the 'powerful incentives' of an independent producer responsible for his own survival.

Concerning loss of crucial capabilities, mentioned before, there are ways to deal with these problems also in alliances. One is to make use of a benchmarking service, so that one can compare a supplier's offering with best practice. A second is to maintain sufficient R&D in the outsourced activity to maintain absorptive capacity, i.e. the ability to judge developments in the field. This may also help to retain the option of re-entry later, to retain options for future core competencies, perhaps as a second mover, but still fast enough to be a serious player. As noted before, this is reflected in empirical evidence that firms retain an R&D capability in activities that were outsourced (Granstrand et. al. 1997). However, such R&D can perhaps be done in collaboration with others, in an R&D consortium. One may also try to retain the required openings in distribution channels, perhaps by means of alliances. In other words, outside collaboration may also be used to retain options for the utilisation or modification of core competencies. Here, the flexibility of outside collaboration returns: one may use it to maintain more flexibility also in options for future core competence. Also, the cognitive argument returns: outside collaboration R&D may be better, in order to maintain cognitive distance for the sake of a wider scope for learning.

Overall, the argument for an alliance is that it gives more focus of core competence, more flexibility of configuration, and more variety of cognition, as discussed before. Another great advantage of an alliance is that it entails fewer problems of clashes between different cultures, structures and procedures, in management, decision making, remuneration, labour conditions, information and communication, which often turn out to be the biggest obstacles for a successful MA. These problems are systematically underestimated in practice. The depth of the problem becomes clearer from the notion of a firm as a focusing device. There are not only practical obstacles, as in different organizational structures, decision procedures and incentive structures, but also, beyond those, deep problems of different ways of looking at the world, in different organizational foci. Of course such problems can also occur in alliances, but less integration still entails fewer problems of integration.

The take-over of a young, dynamic, innovative firm may serve to rejuvenate an old firm (Vermeulen and Barkema, 2001). In a growing new firm, the entrepreneur often has to turn himself around to the role of an administrator, or hire one, to delegate work and institute formal structures and procedures for the coordination of division of labour, in larger scale production. He may not be able or willing to do that, and it may be to the benefit of the firm when it is taken over by a firm with a better managerial capability. However, it may be more likely that the entrepreneurial dynamic of the small firm gets stifled in the bureaucracy of the acquirer, in which case it should stay separate. In cognitive terms: its cognitive scope dissolves in that of the larger firm.

There is an argument of scale for both integration and disintegration. In production, many economies of scale have been reduced, e.g. in computing. However, there is still economy of scale in, for instance, distribution channels, communication networks, network externalities, and brand name. For integration, the argument of scale is that one pools volume in activities in which one specialises. For outsourcing, the argument is that for activities that one does not specialise in, an outside, specialised producer can collect more volume, producing for multiple users. That may also offer more opportunities for professional development and career to staff that are specialised in that activity.

From the perspective of brand image there are also arguments for both integration and separation. In an alliance there may be too great a risk that the image or quality of a brand allotted to partners will not be maintained sufficiently scrupulously. On the other hand, it may be better to maintain an independent, outside brand, to preserve its local identity.
An equity joint venture is an intermediate form. It yields advantages of control without full integration of all activities of the parents. Thereby, it allows for more focus on core competencies and limits integration problems. It can separate off and protect a new, entrepreneurial activity from established bureaucracy. By separating activities off from the parents one can also better control spillover problems for existing partners. If an existing partner of one of the parents is suspicious that his knowledge may spill over to parts of the other parent that compete with him, in a joint venture that can be shielded off. The new venture may also offer new opportunities for financing.

**Other organizational forms**

Finally, I turn to the last question (n2. 5): what other organizational forms, beside the firm, are there, and in what respects are they different from the firm? There has been much talk of 'forms of organization between market and hierarchy'. These constitute a variety of network structures of firms and other (e.g public) organizations, with a variety of structures and strengths of ties. One crucial difference with a firm is that generally these forms do not have a similar legal identity as the firm (with the exception of e.g. associations, foundations, and the like). There is a wide variety of such network forms, depending on the number of participants, the density of relations, and the strength of ties. I will not give an analysis of this variety of forms here, and mention only that in such networks we again meet considerations of systemic, modular and stand-alone structures that were discussed before. As I argued before, such structures often serve to distribute tasks of exploitation and exploration. Network relations can be coordinated on the basis of control, by contract, dependence, hostages, reputation mechanisms, and other institutions, or by means of 'real' trust, based on ethics, empathy, identification or routinized behaviour. Usually, combinations of these will be used, depending on a range of contingencies, in institutional environments, technology, type of knowledge, and stage along innovation cycles (Nooteboom 1999).
When we combine the governance and competence perspectives, an important issue for both science and policy is the following. How do we make the trade-off between on the one hand durability and exclusiveness and on the other hand flexibility of network relations? Sufficient durability, and perhaps also some exclusiveness, are needed to recoup the specific investment needed for mutual understanding and collaboration, for the sake of innovative novel combinations, and to control spillover risk. On the other hand, if relations become too durable and exclusive they induce rigidity and constrain innovation. This has implications for the debate on national innovation systems (Nooteboom 2000b).

**Conclusion**

The cognitive theory proposed in this paper offers a new view on the firm, its functions, its boundaries and new forms of organization, in network relations between firms. It focuses on learning and innovation, and incorporates trust. Trust is related to learning in two ways. Trust can emerge from learning by interaction, in the building of empathy and identification. Vice versa, trust is needed especially in innovation, in view of the uncertainty involved in it, which obstructs governance by hierarchical control and control by material incentives for performance, in both their design and in the monitoring involved. The paper proposes the notion of cognitive distance, based on a constructivist, interactionist theory of knowledge. On the basis of that, it proposes the notion of the firm as a focusing device, to establish optimal cognitive distance. A focus of cognition and shared beliefs is needed for reasons of competence, to connect diverse knowledge, and for reasons of governance, to enable coordination on the basis of collaboration. Using insights from evolutionary and social psychology, the theory propose a view of the firm not mainly as a device to engineer controls to limit

‘opportunities’ for opportunism, or material incentives to limit ‘incentives for opportunism’, although, admittedly, those are part of the story, with a great deal of variation between firms, but primarily as a cultural device to reduce ‘inclination’ towards opportunism, on the basis of ‘shared beliefs’ (Nooteboom 1996).

The focusing of a firm requires a trade-off between a narrow focus, for the purpose of efficient exploitation, and a wide focus, for the purpose of exploration. The choice is a strategic one, related, among other things, to the stage of the innovation cycle in which the firm positions itself. Opportunities for combining exploitation and exploration within the firm depend on whether the activities are systemic, modular or stand-alone, which is primarily related to the technologies involved. Whatever cognitive distance remains within the firm, depending on the chosen focus, there is a need to invest in mutual absorptive capacity, to cross cognitive distance. There is also a greater or lesser need to invest in the building of trust, by building empathy or identification. The need for this depends on the professional nature of knowledge, the tacitness of knowledge, and the degree of uncertainty, as arises especially in innovation, which all limit possibilities for formal agreements and incentives, and the monitoring required for that. The investment in mutual absorptive capacity and trust yield new forms of specific investments. Here, the cognitive theory touches upon transaction cost economics (TCE). Such specific investments require sufficient durability of relations to recoup them, and may yield a problem of hold-up. However, the building of trust itself mitigates the inclinations for opportunism that cause the risk. Another risk that is incorporated in problems of governance is spillover risk. Like hold-up risk, spillover risk, if it obtains, can better be controlled within a firm. The notion of the firm as a focusing device may help to further develop the notion of ‘core competence’ from the management literature.

Division of the tasks of exploitation and exploration can also be achieved in relations between firms. An example is the dual structure of biotechnology firms and pharmaceutical firms, in the (Western) drug industry. According to the cognitive theory, large uncertainty in the firm’s environment, in terms of technological and market change, yields an argument for disintegration of activities, in relations between firms, counter to the prediction of integration within a firm from TCE. The prediction from cognitive theory has been confirmed in empirical research. The argument does not deny the argument from TCE that under uncertainty it is more difficult to draft adequate contingent contracts. The argument is that there is an overriding argument to use outside firms for the sake of ‘external economy of cognitive scope’, i.e. the need, particularly in innovation, to maintain cognitive variety and distance, and flexibility of configurations, for Schumpeterian ‘novel combinations’. The notion of focus yields additional insight in the problems of integration, in a merger or acquisition. Then, two foci need to be integrated, which is difficult, not only from a technical perspective of integrating different systems of coordination, but also from a cultural perspective of aligning different systems of ‘shared beliefs’, and from a strategic perspective of dissolving the focus of the firm. In this way, the cognitive theory also yields a new view on inter-firm relations, in the ‘networked learning economy’.

This paper suffers from several shortcomings. First, there is much more to say on the implications of the theory for more detailed analysis of inter-firm relations (Nooteboom 1999), and relations within firms, within and between ‘communities of practice’ (Brown and Duguid 1996, Wenger and Snyder 2000, Bogenrieder and Nooteboom 2002), and the change of organizational routines (Nooteboom 2002c). That goes beyond the scope of this paper.

While some of the predictions from the theory have been corroborated empirically, there is need for more empirical research, and that is the main priority.

**References**


Alchian, A. (1950). 'Uncertainty, evolution and economic theory', The Journal of Political Economy, 43, february 1950, 1, 211 - 21.

Argyris, Chris, Donald Schön (1978). *Organizational learning*. Reading, MA: Addison - Wesley.

Barkow, J., L. Cosmides and J. Tooby (1992). *The adapted mind: Evolutionary psychology and the generation of culture*, Oxford: Oxford University Press.

Bazerman, M. (1998). *Judgement in managerial decision making*, New York: Wiley.

Beije P. 1998. *Technological cooperation between customer and subcontractors*, ERASM research report 98-39, Rotterdam School of management, Erasmus University Rotterdam.

Blackler, F. (1995). 'Knowledge, knowledge work and organizations: An overview and interpretation'. *Organization Studies*, 16/6, 1021-1046.

Bogenrieder, I. and Nooteboom, B. (2002). *Learning groups: what types are there? A theoretical analysis and an empirical study in a consultancy firm*, Research paper, Rotterdam School of Management, Erasmus University Rotterdam.

Brown, John S., Paul Duguid (1996). 'Organizational learning and communities of practice'. In M. D. Cohen and L. S. Sproull (eds.) *Organizational learning*, London: Sage: 58-82.

Bruner, Jerome (1979). *On knowing; essays for the left hand.* Cambridge MA: The Belknap Press. (first published 1962).

Burt, Ronald (1992). *Structural holes: The social structure of competition.* Cambridge MA: Harvard University Press.

Chiles, T.H. and J.F. McMackin (1996), 'Integrating variable risk preferences, trust and transacton cost economics', *Academy of Management Review*, 21/7: 73-99.

Choo, C. W. (1998), *The knowing organization*, Oxford: Oxford University Press.

Cohen, M. D., P. Bacdayan (1996). 'Organizational routines are stored as procedural memory', in M. D. Cohen and L. S. Sproull (eds.), *Organizational learning*, London: Sage, 403-430.

Cohen, M. D. and D. A. Levinthal (1990). 'Absorptive capacity: a new perspective on learning and innovation'. *Administrative Science Quarterly* 35, 128 - 52

Colombo, M.G. and P. Garrone (1998). 'Common carriers entry into multimedia services', *Information Economics and Policy*, 10, 77-105.

Damasio, A. R. (1995). *Descartes' error: Emotion, reason and the human brain*, London: Picador.

Dasgupta, P. and J. Stiglitz (1980). 'Uncertainty, industrial structure and the speed of R&D', *Bell Journal of Economics*, 90/1, 1-28.

Dasgupta, P. and J. Stiglitz (1981). 'Entry, innovation, exit', *European Economic Review*, 15, 137-158.

Fiol, C. M. and M. A. Lyles (1985). 'Organizational learning', *Academy of Management Review*, 10/4, 803 - 13.

Granstrand, O., P. Patel and K. Pavitt (1997). 'Multi - technology corporations: Why they have distributed rather than distinctive core competencies', California Management Review, 39/4, 8 - 25.

Haas, P.M. (1992). 'Introduction: Epistemic Communities and International Policy Coordination.' *International Organization*, vol 46/1, 1-35

Hedberg, B. L. T. , P. C. Nystrom and W. H. Starbuck (1976). 'Camping on seesaws: Prescriptions for a self - designing organization', *Administrative Science Quarterly*, 21, 41 - 65

Hirschman, A. O. (1970). *Exit, voice and loyalty: Responses to decline in firms, organisations and states,* Cambridge MA: Harvard University Press

Holland, J. H. (1975). *Adaptation in natural and artificial systems*, Ann Arbor: University of Michigan.

Janis, Irving (1981). *Groupthink*. Boston: Houghton Mifflin

Kneller, R. (2002), ……., paper at the EGOS conference, Barcelona, july.

Langlois, R.N.and P. L. Robertson (1995). *Firms, markets and economic change*, London: Routledge.

Lee, T. and L. L. Wilde (1980). 'Market structure and innovation: A reformulation', Quarterly *Journal of Economics*,94, 429-436.

Lewicki, R.J. and B.B. Bunker (1996), 'Developing and maintaining trust in work relationships', in R.M. Kramer and T.R. Tyler (eds), Trust in organizations: Frontiers of theory and research, Thousand Oaks: Sage Publications: 114-139.

Lindenberg, S. (2000), 'It takes both trust and lack of mistrust: The workings of cooperation and relational signalling in contractual relationships', *Journal of Management and Governance*, 4: 11-33.

Lounamaa, P. H. and J. G. March (1987). 'Adaptive coordination of a learning team', Management Science, 33, 107 - 23.

Loury, G. C. (1979). 'Market structure and innovation', *Quarterly Journal of Economics*, 93, 395-410.

Lissoni, F. and Pagani, M. (2001). *How many Networks in a Local Cluster? Textile Machine Production and Innovation in Brescia*. Paper for the workshop on 'The influence of cooperation, networks and institutions on Regional Innovation Systems, Max Planck Institute Jena, 8-10 February.

Maguire, S., N. Philips and C. Hardy (2001), 'When "silence=death", keep talking: Trust, control and the discursive construction of identity in the Canadian HIV/AIDS treatment domain', *Organization Studies*, 22/2: 285-310.

March, J. (1991). 'Exploration and exploitation in organizational learning', *Organization Science*, vol. 2, no.1.

McAllister, D.J. (1995), 'Affect- and cognition based trust as foundations for interpersonal cooperation in organizations', Academy of Management Journal, 38/1: 24--59.

Merleau - Ponty, M. (1964). *Le visible et l'invisible*, Paris: Gallimard.

Mintzberg, H. (1983). *Structure in fives: Designing effective organizations*, Englewood Cliffs NJ: Prentice - Hall.

Nelson R. R. and S. Winter (1982). *An evolutionary theory of economic change*, Cambridge: University Press.

Nonaka, I. and H. Takeuchi (1995). *The knowledge creating company*, Oxford: Oxford University Press.

Nooteboom, B. (1982). A New Theory of Retailing Costs, *European Economic Review*, 17, 163 186.

Nooteboom, B. (1987). Threshold Costs in Service Industries, *Service Industries Journal*, 7, 65 76.

Nooteboom, B. (1991). 'Entry, spending and firm size in a stochastic R&D race', *Small Business Economics*, 3, 103-120.

Nooteboom, B. (1992). Towards a Dynamic Theory of Transactions, *Journal of Evolutionary Economics*, 2:281-99

Nooteboom, B. (1996), 'Trust, opportunism and governance: A process and control model', *Organization Studies*, 17/6: 985-1010.

Nooteboom, B. (1998). 'Cost, quality and learning based governance of transactions', in: M. Colombo (ed.): *The Changing Boundaries of the Firm*, London: Routledge, 187-208.

Nooteboom, B. (1999). *Inter-firm alliances; analysis and design.* London: Routledge.

Nooteboom, B. (2000a). *Learning and innovation in organizations and economies*. Oxford: Oxford University Press.

Nooteboom, B. (2000b). 'Institutions and forms of co-ordination in innovation systems', *Organization Studies*, 21/5, 915-939.

Nooteboom, B. (2002a). *Trust: forms, foundations, functions, failures and figures*. Cheltenham UK: Edward Elgar.

Nooteboom, B. (2002b). 'Problems and solutions in knowledge transfer', in: T. Brenner and D. Fornahl (eds.), *Cooperation, networks and institutions in regional innovation systems*, Cheltenham: Edward Elgar, forthcoming.

Nooteboom, B. (2002c). *The change of routines: A multi-level analysis*, Paper for a workshop on routines, Roskilde, Denmark, November.

Nussbaum, M.C. (2001). *Upheavals of thought, The intelligence of emotions*, Cambridge UK: Cambridge University Press.

Piaget, J. (1970). *Psychologie et epistémologie*. Paris: Denoël.

Piaget, J. (1974). *Introduction a l'épistémologie génétique.* Paris: Presses Universitaires de France.

Polanyi, M. (1962*). Personal knowledge*, London: Routledge.

Polanyi, M. (1966). *The tacit dimension*, London: Routledge.

Polanyi, M. (1969). *Knowing and being*, London: Routledge.

Prahalad, C. and G. Hamel (1990) 'The core competences of the corporation', *Harvard Business Review*, May - June.

Rosch, E. (1978). 'Principles of categorization', in E. Rosch and B. B. Lloyd (eds.), *Cognition and categorization*, Hillsdale, NJ: Erlbaum.

Shapiro, D.L., B.H. Sheppard and L. Cheraskin (1992). 'Business on a handshake', *Negotiation Journal*, 8/4, 365-377.

Simon, H. A. (1983). *Reason in human affairs*, Oxford: Basil Blackwell.

Six, F. (2002). 'Trust and trouble in organizations', in B. Nooteboom and F. Six (eds.), *The trust process in organizations,* Cheltenham UK: Edward Elgar, forthcoming

Smircich, L. (1983). 'Organization as shared meaning', in L. R. Pondy, P. J. Frost, G. Morgan and T. C. Dandridge (eds.), *Organizational symbolism*, Greenwich Conn: JAI Press, 55 - 65.

Thompson, J. D. (1967). *Organizations in action*, New York: McGraw-Hill.

Tooby, j. and l. Cosmides (1992), 'The psychlogical foundations of culture' in J.H. Barkow, L. Cosmides and J. Tooby, *The adapted mind*, Oxford: Oxford University Press: 19-136.

Vermeulen, F. and H. Barkema (2001). 'Learning through acquisitions', *Academy of Management Journal*, 44/3: 457-476.

Vygotsky Lef S. (1962). *Thought and language*. Edited and translated by E. Hanfmann and G. Varkar. Cambridge MA: MIT Press.

Weick, K. F. (1979). *The social psychology of organizing*, Reading, MA: Addison - Wesley

Weick, K.E. (1991). 'The nontraditional quality of organizational learning.' *Organization Science*, Vol.2, no.1 February 1991, 163-174

Weick, K.F. (1995). *Sensemaking in organisations*, Thousand Oaks CA: Sage

Wenger, E. C. and W. M.Snyder (2000).'Communities of practice: The organizational frontier' *Harvard Business Review*, jan-feb: 139-145

Williamson, O.E. (1975), *Markets and hierarchies*, New York: Free Press.

Williamson, O.E. (1985), *The economic institutions of capitalism; Firms markets, relational contracting*, New York: The Free Press.

Williamson, O.E. (1993), 'Calculativeness, trust, and economic organization', *Journal of Law & Economics* 36: 453-486.

Williamson. O. E. (1999). 'Strategy research: Governance and competence perspectives', *Strategic Management Journal*, 20: 1087-1108.

Winter, S. G. (1964), 'Economic "natural selection" and the theory of the firm', *Yale Economic Essays*, 4 (spring): 225 - 72.

Zucker, L.G. (1986), ‘Production of trust: Institutional sources of economic structure’, in Barry, Staw and Cummings, *Research in organisational behaviour*, vol. 8: 53-111.