

**DYNAMIC EFFECTS OF TRUST AND COGNITIVE SOCIAL  
STRUCTURES ON INFORMATION TRANSFER RELATIONSHIPS**  
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# **Dynamic Effects of Trust and Cognitive Social Structures on Information Transfer Relationships**

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January 16, 2002

## ***Abstract***

Changes in relationships are due to human actions. We assume that these human actions are functions of perceptions of a focal individual, but also the perceptions of other individuals who are part of the organizational and social environment. We hypothesize that perceptions based trust and perceptions of the structural environment individuals operate in affect relationship change more than the "actual" environment in which individuals operate. An empirically analysis shows the dynamic effects of perceptions on changes in two types of relationships, which are believed to be important in account management. We explore, 1, whether the levels of perceptions, and, 2, whether changes in perceptions affect relationship changes. For example, we consider the effects of the amount of trust as well as the change in the amount of trust one individual puts in another individual. We find that perceptions have more impact on relationship change than "actual" network variables have. Furthermore, the results show that it is useful to distinguish between level and change effects of perceptions.

# 1 Introduction

Information transfer relationships are crucial for organizations that root their competitive advantages in knowledge (re-) combinations (Grant 1996; Hargadon & Sutton 1997). Organizations give individuals more autonomy to develop, maintain and dissolve information transfer relationships (Galbraith 1994; Volberda 1998). However, little is yet known about what drives individuals to change relationships (Burt 2000b; Tsai 2000). We assume that relationships change as a function of perception-based evaluations that individuals make about these relationships (cf. Barry & Crant 2000; Heider 1958). In a qualitative study, Andrews & Delahaye (2000) find that not only self-perceptions, but also perceptions of others may influence information transfers. In our study we empirically explore effects of self-perceptions and perceptions of others on changes in information requests.

Andrews & Delahaye (2000) find that perceptions such as, trustworthiness and credibility influence information transfers. We suggest these are two perception-based dimensions of interpersonal trust (cf. Deutsch 1960; Dooley & Fryxell 1999). Interpersonal trust can be seen as an attitude of one individual towards another based on perceptions, beliefs, and attributions to that other (Whitener, Brodt, Korsgaard & Werner 1998). Trust has been found to increase the quality and quantity of information transfers (O'Reilly & Roberts 1976; Zand 1972). However, trust is a multidimensional concept that may affect relationship evaluation in different ways (e.g. Mayer, Schoorman & Davis 1995; McAllister 1995). Indeed, a perceptions-based distinction between trust in intentions and trust in abilities has been made (Deutsch 1960; Dooley & Fryxell 1999). Trust in intentions is what Andrews & Delahaye (2000) would call trustworthiness. It is the trust that others will not harm your interests, for example, by using information you have given to your disadvantage. On the other hand, trust in abilities is reflected in the credibility of individuals. Andrews & Delahaye (2000) find that individuals attribute the quality of information they might receive to the quality of the individual from who they receive it. In the present study we explore the effects of these two dimensions, both the perception of an ego that requests information as well as the perception of alter that gives information.

Theories suggest that the organizational and social environment influences individuals motivation for action (Heider 1958; March & Simon 1958). The main elements in this environment are individuals and the relationships between them, which taken together form a

network of relationships. Andrews and Delahaye (2000) suggest that perceptions of network structures may influence information transfers. Cognitive social structures capture the perceptions that individuals have of networks structures (Krackhardt 1987). Indeed, cognitive social structures have been shown to influence for example, individual's beliefs (Kilduff & Krackhardt 1994), performance (Krackhardt 1990) and friendships (Carley & Krackhardt 1996).

If we consider the cognitive social structure of a focal individual, let us call him/her ego, we have to realize that the organizational and social environment also consists of other perceiving individuals. In case such individuals have a direct relationship with ego we will call them alter. Alter's cognitive social structure might lead him/her to be more or less accessible for information requests from ego. Hence, whether ego finds it easier or harder to get information from alter depends on alter's perceptions. For similar reasons we also consider the perceptions of those individuals that are not directly part of a relationship but have a relationship with both alter and ego (we call them third parties). We assume that perceptions of network structures have an effect on the evaluation individuals make of the relationships in which they are involved.

The context in which information is used may be the decisive factor in an individual's evaluation of a relationship. The literature on information transfer has mainly focussed on the context of R&D (e.g. Hansen 1999; Ancona & Caldwell 1992). However, other contexts such as account management are also heavily dependent on information transfers. In account management the focus is on the creation of tailor-made products and services for important customers. Such processes often require the combination of different knowledge bases (Grant 1996; cf. Henderson & Clark 1989). In this paper we limit the discussion to the context of account management in service industries.

In the following section, we discuss the context of our study in greater detail. Subsequently, we discuss our hypotheses in section 3 and the method we use to test these hypotheses in section 4. In section 5 we present the results of our analyses, and, in section 6 we discuss these results and present our conclusions.

## 2 Account Management In Service Industries

We define account management as the set of processes involving activities that develop and maintain beneficial relationships with important customers. In order to meet the needs of different important customers, many organizations have introduced account management (Cespedes 1992; Shapiro & Moriarty 1984b). For many service providing organizations, like banks, management consultant firms, software engineering companies and advertising agencies, it is essential to continuously produce new and tailor-made services. Services that these firms offer are often easily replicated or have short life cycles.

Processes that lead to tailor-made outcomes can be characterized as innovative processes, as each customer requires a unique bundle of service attributes. These processes are often accompanied by the (re-)combination of different knowledge bases (Grant 1996; Kogut & Zander 1995). To create tailor-made services, account managers in service industries are often responsible for both the *specification* of services, and for the *delivery* of these services (Cespedes 1991, p.348; Zeithaml, Berry & Parasuraman 1988). A *service specification* task aims to develop a service proposal that optimally fits and/or anticipates customer needs. A *service delivery* task aims to "produce" and deliver services according to the specification that was accepted by a customer.

The *specification* and *delivery* tasks require distinct types of knowledge (Nelson & Winter 1982; Ruekert & Walker 1987; Ryle 1949; Simon 1997). In *service specification* tasks, the primary aim is to determine which offering would sufficiently satisfy a customer. This task requires knowledge about *which* bundle of service attributes would best fit a customer's needs. Moreover, this task encompasses the search for information. For example, *service specification* tasks would benefit from "new" knowledge that results from the combination of knowledge about different currently available services. On the other hand, in *service delivery* tasks the primary aim is to 'produce' an accepted specification. A central aspect is the transfer of knowledge about *how to* implement bundles of service attributes and it requires the integration of specialized skills and routines that provide different service attributes (Lawrence & Lorsch 1967; Nelson & Winter 1982). To accomplish both *service specification* and *service delivery* tasks, individuals usually require the knowledge of others. Especially, to generate tailor-made services, knowledge of others is needed. Relationships facilitate the search and transfer of information that holds this knowledge (cf. Hansen 1999). Therefore any changes in these relationships are a salient issue in account management.

### 3 Relationship Changes

#### 3.1 The Process of Changing Relationships

We define the change in a relationship as a change in the strength of a relationship. The strength of a relationship is defined as the degree of substantive and affective interaction between two individuals (cf. Granovetter 1973; Krackhardt 1992). In this study we focus on the change in strength of task-specific information transfer relationships. We assume that changes in a relationship are a function of the perceptions ego holds about alters and the perceptions of those that form the network of which the relationship between ego and alter is a part. This includes alters perceptions as well as perceptions of third parties.

This view on relationship change is a constructual perspective that entails that *"social structure through interaction affects cognition, and cognition motivates interaction and hence changes social structure"* (Carley & Krackhardt 1996). We especially focus on the effects of cognition of social structure on relationship change (and thus social structure change). We do not explicitly model the process of cognition, but rather we use Heider's (1958) balance theory to assess how different perceptions would affect ego's evaluation of alter as a useful source for information. A positive (negative) evaluation of alter as a source of information implies that ego likes (dislikes) the information alter can provide (cf. Heider 1958, p.140, p.174). Based on such evaluations, ego strengthens (weakens) the relationship with alter.

We further assume that the effects of perceptions on relationship changes are twofold. We expect that the 'level of perceptions' influence relationship changes. For example, the amounts of trust ego puts in alter at a given moment can make ego to change the relationship strength. Additionally, we postulate an effect of the 'change in the level of perception'. This effect occurs when ego updates his/her perceptions. For example, Meyerson, Weick & Kramer (1996) emphasize that trust can be "swift" trust such as that of the crew of a commercial airplane. This crew might never have met, but may need to take-off within an hour. This requires the swift development of trust. It is the change in the level of trust which makes the crew to take action.

It should be mentioned that we would expect relationship changes only for ego's perceptions, and not for those of alter or third parties. Heider (1958) suggests that alter's

perceptions become apparent to ego through alter's actions. Therefore, we do not expect a short-term effect of alter's perceptions on ego-induced relationship changes. In fact, actions are events that happen in the short-term and we would need to consider an even shorter term to measure ego's response to these actions. Although we do not exclude the possibility of short-term relationship change based on alter's perceptions, we do not expect it.

## 3.2 Trust

Interpersonal trust has been found to enhance the quality of information transfer (O'Reilly & Roberts 1976), increase the frequency of information transfer (Zand 1972), and in work situations is suggested to be a necessary condition for cooperation (Arrow 1974; Brockner, Siegel, Daly, Tyler & Martin 1997). McAllister (1995) defines interpersonal trust as the extent to which a person is confident in, and willing to act on the basis of, the words, actions, and decisions of another. Interpersonal trust can be seen as an attitude of one individual towards another based on perceptions, beliefs, and attributions to that other (Whitener, Brodt, Korsgaard & Werner 1998). Hence, trust as an attitude is an aggregate measure of how individuals perceive each other.

We have emphasized in the introduction that we consider two relevant dimensions of trust in this study to be perceived abilities and perceived intentions (Deutsch 1960). As we mentioned the distinction between these dimensions reflect the perceived trustworthiness and credibility that Andrews & Delahaye (2000) found to affect information transfers. Even a greater similarity exists with the dimensions Dooley & Fryxell (1999) discern. They emphasize the distinction between loyalty and ability as two dimensions of trust, which concurs with trust in intentions and trust in abilities. In the following we suggest that trust of ego in alter and the trust of alter in ego might influence information requests. Also we suggest that the effects of the dimensions of trust are dependent on the type of information transferred.

### 3.2.1 Ego's Trust in Alter

In accordance with earlier studies we expect a positive effect of trust on information requests. However, we also expect that the "ability" and "intention" dimensions of trust, both have a strong influence on *service specification* or *service delivery* relationships. When ego works on *service specification* tasks he/she is less vulnerable to adverse intentions of alter who provides



*service specification* information. Trust in the abilities of alter suggests that ego perceives alter to have the ability to do the right things right. Ego's evaluation of alter as provider of *service specification* information would be positive in this case, because according to ego, alter is likely to know what to do. Therefore,

*H1a*: The increase in, and the amount of, trust that ego has in alter's abilities are positively related with ego's change in the strength of the *service specification* relationship with alter.

For *service delivery* information transfer we expect trust in intentions to be more relevant. As mentioned above, *service delivery* tasks aim to implement services. More explicit goals can be formulated for these tasks. This also requires explicit commitment of time and energy from those participating in the implementation.

Especially when the services to be delivered are new, it is hard to assess whether skills and capabilities of alter are sufficient (Nelson & Winter 1982). Therefore, trust in ability is hard to generate and it is less likely that ego initiates actions due to trust in ability. A necessary condition for ego to request more *service delivery* information is that ego trusts alter to do his/her best to attain task goals. Ego's trust in alter's intentions has a positive effect on ego's evaluation whether alter is a good source for *service delivery* information. Hence,

*H1b*: The increase in, and the amount of, trust ego has in alter's intentions are positively related with ego's change in the strength of the *service delivery* relationship with alter.

### 3.2.2 Alters' Trust in Ego

Trust in ego's abilities indicates that alter perceives ego to be able to accomplish his/her job successfully. Alter may perceive that ego might contribute to his/her knowledge and hence be more open to information transfers with ego. However, we may derive from attribution theory (Heider 1958) that as trust in abilities rises, the more likely it becomes that alter perceives himself/herself to be a less useful source for *service specification* information to ego.

According to Heider (1958), the abilities of ego to perform tasks are evaluated against, for example, performances of others who do similar tasks. High amounts of trust in an ego's

abilities might mean that alter attributes to ego higher abilities than to third parties. Now assume that ego and alter operate in an similar environment on similar tasks. The more alter trusts ego's abilities, the smaller alter perceives the difference between alter and ego's abilities to be<sup>1</sup>. Therefore, the more alter trusts ego's abilities, the less likely it is that he/she will consider himself/herself to be a useful source of information for ego. Alter would then be less focused on providing ego with information, which negatively affects ego's evaluation about whether alter is a good source for information. This would be especially eminent for *service specification* tasks where the decisions of what to do are made. On the other hand in *service delivery* tasks trust in abilities can be interpreted as a willingness to cooperate in the "production" of services. An ego whose abilities are trusted by a specific alter may use this alter in the execution of what ego suggests should be done. We therefore hypothesize,

*H2a*: The increase in, and the amount of, trust alter has in ego's abilities are negatively and positively related with ego's change in the strength of (1) the *service specification* relationship, and (2) of the *service delivery* relationship with alter, respectively.

When alter trusts ego's intentions, alter perceives that ego's goals or ways to reach a goal are congruent with that of him/herself. In order to accomplish such goals, alter is willing to share information with ego, that is, both *service specification* information and *service delivery* information. From ego's perspective the more effort it takes to access alter's information, the less positive ego will evaluate alter as a source for information. For both *service specification* information requests and *service delivery* information requests we hypothesize,

*H2b*: The increase in, and amount of, trust alter has in ego's intentions are positively related with ego's change in the strength of (1) the *service specification* relationship, and (2) of the *service delivery* relationship with alter.

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<sup>1</sup> Assuming that alter takes his own abilities as benchmark and subtracts ego's abilities from his/her own abilities.

### 3.3 Cognitive Social Structure

As mentioned earlier, perceptions of network structure may affect relationship changes. However, most studies on the effect of network structure do not consider these perceptions, but only consider "actual" networks. Such studies show that relationships that are embedded in dense network structures are more stable than relationships that are not embedded in dense networks (Feld 1997; Burt, 2000). Individuals in broker positions maintain relationships with two or more unconnected others (e.g. Burt 1992; Fernandez & Gould 1994). As, these relationships are not embedded we would expect that these relationships are more prone to change.

Furthermore, the literature on "actual" networks shows that broker positions affect individuals' opportunities to accomplish different tasks (e.g. Burt 1992; Gargiulo & Benassi 2000). For example, broker positions enhance the ability of individuals to combine information for product innovations (Tsai & Ghoshal 1998), which offers them "new" information (Hargadon & Sutton 1997). However, brokered relationships are often weaker and hence decrease individuals' ability to transfer complex information (Granovetter 1973; Hansen 1999). Also brokers could experience higher information ambiguity, because they receive information from unrelated sources (Burt 1997a).

In our empirical analyses we will control for "actual" broker positions, but we do focus on the effects that perceived broker positions have on relationship change. We will consider the effects of perceptions that ego, alter and third parties hold of the network structure. Again, hypotheses are specified on whether a relationship change concerns a change in *service specification* or *service delivery* information requests. For similar reasons as we have discussed above, we consider change and level effects.

#### 3.3.1 Ego's Perception of Broker Positions

In *service specification* tasks, the aim is to develop services that uniquely satisfy customer needs. Information that enhances the scope of possible solutions to be considered might contribute to the accomplishment of these tasks. Brokers especially may be a source for such information, because they have opportunities to (re-) combine different knowledge bases, which stimulates the development of "new" information (Hargadon & Sutton 1997; Tsai & Ghoshal 1998). However, as brokers combine unrelated information they are more prone to

ambiguous information (Burt 1997a). It has been suggested that the use of specific information will decrease when that information leads to ambiguity (O'Reilly 1983; Hackman 1990). Therefore,

*H3*: The increase in, and the number of times that ego perceives to broker the relationship with alter, are negatively related with ego's change in strength of the (a) *service specification* relationship, and (b) of the *service delivery* relationship with alter.

If alter brokers the relationship with ego, this could be advantageous for the *service specification* tasks that ego has to accomplish. Recall that *service specification* aims to develop a service that uniquely fits a specific customer's needs and that "new" information might be beneficial to this task. As brokers are expected to have more "new" information available we hypothesize,

*H4a*: The increase in, and the number of times that ego perceives alter to broker the relationship with ego, are positively related with ego's change in strength of the *service specification* relationship with alter.

If ego has to deal with a broker to accomplish a *service delivery* task, this might be harmful. A broker position violates optimal conditions for *service delivery* tasks, which require focus and mutual understanding that allow transfer of more complex knowledge (Ancona & Caldwell 1992; Hansen 1999). By definition, brokers' attentions are scattered over unconnected alters, which reduces his/her focus and deep mutual understanding. Hence,

*H4b*: The increase, in and the number of times that ego perceives alter to broker the relationship with ego, are negatively related with ego's change in strength of the *service delivery* relationship with alter.

When ego perceives third parties to broker the relationship between him/her and alter, he/she perceives to have a weak relationship with alter. Hansen (1999) suggests that weak relationships may obstruct information transfers. Hence,

*H5*: The increase in, and the number of times that ego perceives third parties to broker the relationship between ego and alter, are negatively related with ego's change in the strength of the (a) *service specification* relationship, and, (b) *service delivery* relationship with alter.

### 3.3.2 Alters' Perception of Broker Positions

How would ego respond to alter's perception that alter brokers the relationship? The perception of alter that he/she is a broker signals that he/she might have "new" information available. This would have a positive influence on ego's evaluation of alter's suitability to be a source for *service specification* information. However, it would have a negative effect on ego's assessment of alter as a source for *service delivery* information. Because alter has perceived to be a broker he/she will have no incentive to strengthen the relationship with ego. To accomplish a service delivery task that ego and alter are both engaged in, ego has to compete with third parties for the attention of alter. We therefore hypothesize,

*H6*: The number of times that alter perceives to broker the relationship with ego, is positively related with ego's change in strength of (a) the *service specification* relationship, and, is negatively related with ego's change in the strength of (b) the *service delivery* relationship with alter.

When alter perceives ego to broker the relationship ego is perceived to be a potential source of "new" information for alter. However, it also implies that alter is a source of ambiguous information to ego. Given that ego dislikes ambiguous information as suggested by O'Reilly (1983), he/she will negatively evaluate alter as a source for information. Hence,

*H7*: The number of times, that alter perceives to broker the relationship with ego, is negatively related with ego's change in strength of (a) the *service specification* relationship, and, (b) of the *service delivery* relationship with alter.

Alter's perception that many third parties' broker the relationship between alter and ego might indicate that alter perceives the relationship with ego to be weak. Furthermore, it may lead

alter to anticipate a decrease in the relationship strength between the third parties and alter. Therefore, ego might want to increase the strength of both relationships with alter to secure the valuable information alter has to offer.

*H8*: The number of third parties that alter perceives to broker the relationship between ego and alter, is positively related with ego's change in strength of (a) the *service specification* relationship, and, (b) of the *service delivery* relationship with alter.

### 3.3.3 Perceived Brokered Relationships

In the case of third party perceptions, the perceptions of those who perceive to broker a relationship are of special interest. These self-perceived brokers will attribute the ambiguity they have to deal with to both individuals in the brokered relationship. To reduce this ambiguity, third parties might want to stimulate direct information transfer between ego and alter. However, those third parties provide ego with "new" information, which ego will only perceive to be useful if it concerns *service specification* information. If ego attributes the "newness" of information that third parties provide to alter, ego will evaluate alter as a good source for *service specification* information, but a bad source for *service delivery* information. This third party effect becomes more likely if more third parties perceive to broker the relationship between ego and alter. Hence,

*H9*: The number of third parties that perceive to broker the relationship between ego and alter, is (a) positively related with ego's change in strength of the *service specification* relationship, and, (b) negatively related with ego's change in strength of the *service delivery* relationship with alter.

In the next section we describe the methods we used to test these hypotheses.

## 4 Method

### 4.1 Sample

Over three periods we collected data on relationship changes in an account managers unit in an IT consulting firm. The unit was installed 6 months before our first measurement. We were allowed to do two subsequent measurements 12 and 16 months after the installation. This unit focuses on the telecom industry and each account manager is responsible for one or a few accounts in this industry. To receive full cooperation, subjects were approached on an individual bases. Further, management promoted cooperation with the study in plenary meetings. Each time, data collection took 5 weeks.

We observed 146 relationship changes. The unit consisted of 10 account managers. Before the second measurement two subjects left the unit. Their replacements were also willing to cooperate in the study and the group did not change before the third measurement. Hence, instead of 180 relationship changes we measured 146 relationship changes. (Three measurements in a group of 10 individuals are two times 90 relationship changes. Since two individuals left after the first period the number of relationship changes we could measure were 56 between period 1 and 2, and 90 between period 2 and 3, which sums to 146 relationship changes.)

The average age of the participants was 36.4 years and average company tenure was 5.6 years. All participants had finished higher education. The group of respondents consisted of 11 males and 1 female. Most of the account managers (11) in the unit were stationed at the same base. However, the daily time spend at the base is relatively low and infrequent as the nature of the job forces account managers to travel between different projects at customer sites. Most account managers have supervision over a group of consultants who are assigned to projects for their customers. Plenary meetings are held regularly to facilitate knowledge updates and initiate contacts. Furthermore, individuals are free to start up bilateral contacts with other account managers as they see fit.

## 4.2 Measurement

To measure the dependent and independent variables, we developed networks questions (see table 1). As measure for relationship strength we used the frequency with which ego requests information from alter (Feld 1997; Wasserman & Faust 1997). Questions 1 and 2 measure the dependent variables, that is the frequency with which respondents request respectively *service specification* information and *service delivery* information in the six months prior to the questionnaire. As indicated in table 1 (questions 1 and 2), we labeled both types of information as respectively ‘product’ and ‘process’ information, which better suited to the vocabulary of the respondents. We present respondents a scale with two anchors (very little to very much) and ask them to indicate on a line between those anchor's the frequency of information requests. We categorized these responses in seven categories of equal distance. In contrast, 5-point Likert like scales were presented to measure the different types of trust (questions 4 and 5 in table 1). We choose to use different scales to counter respondents’ fatigue.

<b>Table 1: Network Measures</b>	
<b>Network</b>	<b>Measure</b>
<i>Service specification</i> Information Transfer	Product information is information concerning the fit of product combinations in an advice, proposal and/or offer. How often on average do you ask the persons in the list for product information?
<i>Service delivery</i> Information Transfer	Process information is information concerning the 'production' of accepted advises, proposals and / or offers. How often on average do you ask the persons in the list for process information?
Perceived Cooperation	Please indicate in the schedule below, who do you think works together with whom in the acquisition of customers and the implementation of projects?
Trust in Intentions	In working together trust plays a role. To what extent do you trust that those listed below take into account your interests?
Trust in Ability	In working together trust plays a role. To what extent do you trust upon the knowledge, experience and the capabilities of those listed below?

We measure perceived cooperation networks similar to Casciaro (1998), but we enforced symmetry to limit the duration of questionnaire (table 1, question 3). Responses to this question are part of the cognitive social structure matrix  $x_{ijq}$ . This is a data cube representing the cognitive social structure of a network with  $q$  individuals. The value of  $x_{ijq}$  is 1 if  $q$  perceives a relationship between  $i$  and  $j$  and 0 otherwise. With  $x_{ijq}$  we derive the following



measures for perceived broker positions and perceived brokered relationships. Measure  $A_{ij}$  represents ego's perception of how often ego brokers the relationship,  $A_{ij} = \sum_q x_{iji} x_{iqi} (1 - x_{jqj}), \forall x_{iji}, x_{iqi} > 0$ . Measure  $B_{ij}$  represents ego's perceptions of how often alter brokers the relationship,  $B_{ij} = \sum_q x_{iji} x_{jqj} (1 - x_{iqi}), \forall x_{iji}, x_{jqj} > 0$ . Measure  $C_{ij}$  represents ego's perceptions of how often third parties broker the relationship between ego and alter,  $C_{ij} = \sum_q x_{iqi} x_{jqj} (1 - x_{iji}), \forall x_{iqi}, x_{jqj} > 0$ . The transposes  $A_{ij}^T$ ,  $B_{ij}^T$  and  $C_{ij}^T$  represent alters' perceptions of respectively how often alter and ego and how many third parties broker the relationship. Finally, the measure,  $D_{ij} = \sum_q x_{iqq} x_{jqj} (1 - x_{ijq}), \forall x_{iqq}, x_{jqj} > 0$ , represents the sum of how often third parties perceive to broker the relationship between ego and alter.

### 4.3 Control variables

Following other studies that use social cognitive structures we control for effects of the "actual" network structure (Kilduff & Krackhardt 1994; Krackhardt 1992). We use the local aggregated structure (LAS) as proxy for the "actual" network structure (Krackhardt 1987). In the LAS a relationship is present when both actors indicate that the relationship exists (Krackhardt 1987 1990). We use the LAS as the basis for the "actual" broker measures of ego, alter and third parties, regarding the relationship between ego and alter.

### 4.4 Models

We will consider three statistical models for both our dependent variables. The first model is a model in which we include perceptions (trust and cognitive social structures) as well as the "actual" network structure. To check how much perceptions and the "actual" network structure contribute to the explanatory power of this model, we consider two other models, that is, one that contains only perception variables, and the other that contains only "actual" network data.

The general specification of the models we consider is an equilibrium-correction (EC) specification (Greene 2000),

$$(Y_{ij,t} - Y_{ij,t-1}) = \alpha + \beta(X_{ij,t} - X_{ij,t-1}) + (\rho - 1)(Y_{ij,t-1} - \gamma X_{ij,t-1}) + \varepsilon_{ij} \quad (1)$$

where  $Y_{ij,t} - Y_{ij,t-1}$  is a vector of  $(n(n-1)(t-1)) \times 1$  elements that represents the change in frequency with which  $i$  requests information from  $j$  between time  $t-1$  and  $t$ . Furthermore,  $X_{ij,t} - X_{ij,t-1}$  is a matrix that contains the changes in  $k$  explanatory variables. Thus  $Y_{ij,t-1}$  and  $X_{ij,t-1}$  are the frequencies of information requests at time  $t-1$  and the level of the explanatory variables at time  $t-1$  respectively. Equation (1) states that the change in information request frequency ( $Y_{ij,t} - Y_{ij,t-1}$ ) is a function of the change in the explanatory variables ( $X_{ij,t} - X_{ij,t-1}$ ) as well as the equilibrium relation between the frequency of information requests and the level of explanatory variables ( $Y_{ij,t-1} - \gamma X_{ij,t-1}$ ). In equation (1),  $\beta$  and  $\gamma$  represent the vectors of coefficients that respectively represent the effects of "change" and "level" of the explanatory variables on change in the dependent variable.

The error-correction model is often used in econometric time series analyses, because it has various nice features. For example, it explicitly estimates a coefficient  $\rho - 1$  which is the short-term adjustment of  $Y_{ij,t} - Y_{ij,t-1}$  to the deviation of the equilibrium relation. Furthermore, it specifies explicitly the effects of change in explanatory variables ( $\beta$ ) as well as the effects of the level of explanatory variables ( $\gamma$ ). These latter features are especially useful to test our hypotheses.

A problem that might arise however, is that network data are prone to structural autocorrelation. Structural autocorrelation may occur, for example, because individuals have answering bias, meaning that the statements made by an individual are dependent. Or, a specific individual may have a certain unobserved trait, which causes dependency between statements of others about relationships with that particular individual.

To take care of structural autocorrelation Krackhardt (1988) proposes the MRQAP analysis, which is robust against structural autocorrelation. Though it has not been shown to be generally consistent, elsewhere we show that the MRQAP analysis is also useful for the EC model (Dekker, Franses & Krackhardt, 2001). The MRQAP analysis is based on simulations with random data that have a similar structural autocorrelation structure as the data on which the model parameters are estimated. Using the simulation results, an assessment can be made whether model parameter estimates are truly significantly different

from zero or whether they are spurious results that may have been caused by structural autocorrelation.

A common way to compare nested regression models is to statistically test whether the increase in explained variance, usually measured as the increase in  $R^2$ , differs from zero. Because we use the MRQAP approach, and thus assume that certain assumptions of ordinary least squares (OLS) do not hold, we cannot straightforwardly test the changes in the  $R^2$ -statistic. However, we may use the adjusted- $R^2$  as a qualitative measure to compare models. The adjusted  $R^2$  is not sensitive to the number of variables included in the regression and therefore a nice measure to compare different regression models. Although we cannot interpret the size of the adjusted  $R^2$ , we may use it to make qualitative statements about the differences between adjusted  $R^2$ 's of nested models.

## 5 Results

Table 2 shows descriptive statistics of the levels of the variables. Table 3 and 4 describe the results of our analysis. Let us emphasize that we adopt a lenient  $\alpha=0.10$  level of significance to test the hypotheses in this explorative study. In table 5, we summarize our results and the hypotheses we have formulated in section 3. In this section we will first report on our qualitative assessment of the adjusted  $R^2$ 's of the different nested models. Subsequently, we report the results concerning our hypotheses based on the 'best' models.

Table 5 shows that most of our hypotheses are supported by our estimation results, and that the distinction between change and level effects thus seems useful. In table 3 and 4 we distinguish between change and level parameters respectively by the  $\Delta$  and  $t-l$  indices attached to the variable names. Indeed, no change effects are found for alter's and third parties' perceptions. However, most effects of the perceptions that ego holds are distinguishable in level and change effects.

The adjusted  $R^2$ 's in table 3 shows that adding the "actual" network variables do not add explanatory power to the model that describes changes in frequency of *service specification* information. The "actual" network variables do have explanatory power (all level variables are significant in model 1c). However the adjusted  $R^2$  of model 1c is considerably lower than that of model 1a that contains both "actual" network variables as well as perception variables. Furthermore, when dropping the "actual" network variables, the

adjusted  $R^2$  increases to .58 (model 1b). With regard to changes in the frequency of *service specification* requests the results suggest that we can disregard the "actual" network variables. Hence, we use model 1b to discuss the support for our hypotheses on change in *service specification* relationship strength.

The adjusted  $R^2$ 's in table 4 suggest that adding "actual" network variables may add some explanatory power to the model for *service delivery* relationships. Especially, we see that the effect of alter's "actual" broker position ("# of times Alter brokers  $R_{\Delta}$  (LAS)") remains present in model 2a. Table 4 also shows that the short-term adjustment parameter ( $\rho$ - $I$ ) in model 2b is not significant at  $\alpha < .10$  ( $-.85$ ,  $p = 0.10$ ), which implies that model 2b that incorporates only perception variables is invalid. Therefore we use model 2a for inference on our hypotheses concerning *service delivery* relationship strength.

The results partly support hypothesis 1a, on the effects of "Ego's Trust in Alter's Abilities" on change in frequency with which alter requests *service specification* information ( $\Delta$ : .33,  $p = .08$  and  $t$ - $I$ : .53,  $p = .15$ , see table 3 model 1b). Full support is found in model 2a for hypothesis 1b on the effects of "Ego's Trust in Alter's Intentions" on change in frequency of *service delivery* information requests ( $\Delta$ : .51,  $p = .01$  and  $t$ - $I$ : .96,  $p = .00$ ). Hence, both models 1b and 2a suggests the existence of a "swift" trust effect, since the change parameters are significant.

Table 3 and 4 also show support for hypotheses 2a1 and 2a2. The level of "Alter's Trust in Ego's Abilities", affects ego's change in the frequency with which he/she requests information. As expected a negative effect was found for change in *service specification* information ( $t$ - $I$ :  $-.61$ ,  $p = .09$ , see table 3, model 1b), and a positive effect was found for *service delivery* information ( $t$ - $I$ :  $.70$ ,  $p = .01$ , see table 4, model 2a). Also, model 1b in table 3 shows support for hypothesis 2b1 since in this model the level of "Alter's Trust in Ego's Intentions" is significantly positive ( $t$ - $I$ :  $.69$ ,  $p = .05$ ). On the other hand hypothesis 2b2 is not supported, since the parameter for the level of "Alter's Trust in Ego's Intentions" is not significant in model 2a in table 4 ( $t$ - $I$ :  $-.11$ ,  $p = .33$ ).

Broker positions in ego's social cognitive structures do have different effects on change in frequency of *service specification* and *service delivery* requests. *Service specification* is only affected by "the number of times Ego brokers " the relationship, while *service delivery* is only affected by "the number of times Alter brokers " the relationship, both from ego's perception (EP). These findings partly support hypothesis H3a ( $\Delta$ :  $-.27$ ,  $p = .11$  and

*t*-1: -.62, *p*= .06 see model 1b in table 3) and hypothesis H4b (-.17, *p*=.17 and -.85, *p*=.00 see model 2a in table 4). Ego's perceptions of "the number of Third Parties that Broker" the relationship between ego and alter have an effect only on the change in *service delivery* requests. These results support hypothesis H5b ( $\Delta$ : -.39, *p*= .02 and *t*-1: -.65, *p*= .02, see model 2a in table 4) and do not support hypothesis H5a ( $\Delta$ : -.10, *p*= .24 and *t*-1: -.49, *p*= .12, see model 1b in table 3).

As mentioned, our expectations to only find level effects and no change effects of alter's perceptions are supported. However, the support about alter's perceptions is limited to alter's perceived broker position. The "number of times that Alter perceives to broker" the relationship between ego and alter is positively associated with both ego's change in *service specification* and *service delivery* information requests. These results support hypothesis H6a and H6b (*t*-1: .51, *p*= .09 and *t*-1: .54, *p*= .05; in respectively table 3 model 1b and table 4 model 2a). No effects were found of alter's perceptions concerning the number of times ego brokers the relationship or third parties broker the relationship. Hence, no support was found for hypotheses H7a, H7b, H8a and H8b. Finally, the number of third parties' that perceive to broker the relationship between ego and alter have no effect on the change in information requests. No support was found for either hypothesis H9a or for hypothesis H9b.

**Table 2: Correlations Between All Variables At  $t$  And  $t-1$** 

<i>No. Variable Name</i>	<i>Mean</i>	<i>S.D.</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
1 Freq. Serv. Delivery Info. Request <sub>t</sub>	1.98	2.28																
2 Freq. Serv. Delivery Info. Request <sub>t-1</sub>	2.08	2.12	.47															
3 Freq. Serv. Specification Info. Request <sub>t</sub>	2.15	2.28	.39	.16														
4 Freq. Serv. Specification Info. Request <sub>t-1</sub>	2.60	2.28	.42	.62	.28													
5 Ego's Trust In Alter's Intentions <sub>t</sub>	3.10	1.32	.47	.40	.31	.42												
6 Ego's Trust In Alter's Intentions <sub>t-1</sub>	3.26	1.29	.42	.39	.46	.45	.48											
7 Ego's Trust In Alter's Abilities <sub>t</sub>	3.09	1.32	.32	.50	.33	.55	.64	.28										
8 Ego's Trust In Alter's Abilities <sub>t-1</sub>	3.49	1.04	.29	.41	.39	.52	.46	.46	.54									
9 Alter's Trust In Ego's Intentions <sub>t</sub>	3.10	1.32	.30	.35	.26	.28	.20	.26	.14	.24								
10 Alter's Trust In Ego's Intentions <sub>t-1</sub>	3.26	1.29	.26	.26	.17	.23	.26	.31	.21	.18	.48							
11 Alter's Trust In Ego's Abilities <sub>t</sub>	3.09	1.32	.32	.21	.27	.27	.14	.21	.08	.10	.64	.28						
12 Alter's Trust In Ego's Abilities <sub>t-1</sub>	3.49	1.04	.34	.08	.22	.18	.24	.18	.10	.08	.46	.46	.54					
13 # of times Ego brokers R <sub>t</sub> (EP)	.71	1.24	.14	.06	.42	.27	.14	.17	.24	.20	.09	.09	.18	.10				
14 # of times Ego brokers R <sub>t-1</sub> (EP)	.93	1.28	.15	.17	.27	.31	.15	.16	.29	.22	.13	.21	.20	.13	.40			
15 # of times Alter brokers R <sub>t</sub> (EP)	.61	1.28	-.03	-.05	.07	-.04	.00	-.02	.06	-.01	-.02	-.06	.13	.04	.16	.08		
16 # of times Alter brokers R <sub>t-1</sub> (EP)	.68	1.12	-.09	.07	-.02	.07	.13	.08	.08	.05	.06	.03	.14	.08	-.03	.09	.18	
17 # of Third Parties that broker R <sub>t</sub> (EP)	.57	1.15	-.19	-.11	.04	-.16	-.08	-.08	-.06	-.05	-.03	-.21	.02	-.05	-.29	-.10	-.24	-.07
18 # of Third Parties that broker R <sub>t-1</sub> (EP)	.65	1.27	-.17	-.24	-.26	-.14	-.21	-.20	-.23	-.27	-.24	-.08	-.14	-.06	-.12	-.37	-.08	-.31
19 # of times Alter brokers R <sub>t</sub> (AP)	.71	1.24	.22	.20	.16	.29	.09	.09	.18	.10	.14	.17	.24	.20	.07	.17	.20	.17
20 # of times Alter brokers R <sub>t-1</sub> (AP)	.93	1.28	.32	.38	.32	.27	.13	.21	.20	.13	.15	.16	.29	.22	.17	.15	.16	.11
21 # of times Ego brokers R <sub>t</sub> (AP)	.61	1.28	.00	.12	.07	.22	-.02	-.06	.13	.04	.00	-.02	.06	-.01	.20	.16	.07	.15
22 # of times Ego brokers R <sub>t-1</sub> (AP)	.68	1.12	.08	.10	.04	.12	.06	.03	.14	.08	.13	.08	.08	.05	.17	.11	.15	.01
23 # of times Third Parties broker R <sub>t</sub> (AP)	.57	1.15	-.14	-.06	-.21	-.08	-.03	-.21	.02	-.05	-.08	-.08	-.06	-.05	-.10	-.15	-.03	-.20
24 # of times Third Parties broker R <sub>t-1</sub> (AP)	.65	1.27	-.17	-.20	-.22	-.18	-.24	-.08	-.14	-.06	-.21	-.20	-.23	-.27	-.15	-.08	-.14	-.05
25 # of Third Parties that broker R <sub>t</sub> (TPP)	.70	.74	-.08	.08	-.11	-.08	.04	-.16	.01	-.07	.04	-.16	.01	-.07	-.13	-.07	.01	-.15
26 # of Third Parties that broker R <sub>t-1</sub> (TPP)	1.01	1.04	-.08	-.03	-.05	.03	-.01	-.07	.06	.00	-.01	-.07	.06	.00	-.10	-.17	.06	-.12
27 # of times Ego brokers R <sub>t</sub> (LAS)	.34	.77	.15	.13	.27	.24	.11	.13	.22	.12	.13	.13	.24	.10	.60	.33	.17	.13
28 # of times Ego brokers R <sub>t</sub> (LAS)	.52	.96	.07	.14	.24	.10	.12	.20	.18	.14	.23	.18	.20	.18	.26	.54	.06	.22
29 # of times Alter brokers R <sub>t</sub> (LAS)	.34	.77	.17	.24	.22	.21	.13	.13	.24	.10	.11	.13	.22	.12	.29	.14	.37	.11
30 # of times Alter brokers R <sub>t-1</sub> (LAS)	.52	.96	.24	.26	.14	.16	.23	.18	.20	.18	.12	.20	.18	.14	.07	.26	.19	.42
31 # of Third Parties that Broker R <sub>t</sub> (LAS)	.32	.60	-.09	.08	.04	.05	.06	-.10	.08	-.01	.06	-.10	.08	-.01	-.08	.06	-.05	-.10
32 # of Third Parties that Broker R <sub>t-1</sub> (LAS)	.51	.76	-.08	-.22	-.18	-.06	-.09	-.11	-.11	-.12	-.09	-.11	-.11	-.12	-.18	-.33	-.12	-.24

**Table 2: Correlations (Continued)**

<i>No. Variable Name</i>	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)
18 # of times Third Parties broker $R_{t-1}$ (EP)	.05														
19 # of times Alter brokers $R_t$ (AP)	-.10	-.15													
20 # of times Alter brokers $R_{t-1}$ (AP)	-.15	-.08	.40												
21 # of times Ego brokers $R_t$ (AP)	-.03	-.14	.16	.08											
22 # of times Ego brokers $R_{t-1}$ (AP)	-.20	-.05	-.03	.09	.18										
23 # of times Third Parties broker $R_t$ (AP)	.12	.08	-.29	-.10	-.24	-.07									
24 # of times Third Parties broker $R_{t-1}$ (AP)	.08	-.01	-.12	-.37	-.08	-.31	.05								
25 # of Third Parties that broker $R_t$ (TPP)	.25	.09	-.13	-.07	.01	-.15	.25	.09							
26 # of Third Parties that broker $R_{t-1}$ (TPP)	.25	.12	-.10	-.17	.06	-.12	.25	.12	.38						
27 # of times Ego brokers $R_t$ (LAS)	-.22	-.19	.29	.14	.37	.11	-.22	-.16	-.12	-.20					
28 # of times Ego brokers $R_t$ (LAS)	-.17	-.28	.07	.26	.19	.42	-.19	-.28	-.11	-.25	.36				
29 # of times Alter brokers $R_t$ (LAS)	-.22	-.16	.60	.33	.17	.13	-.22	-.19	-.12	-.20	.60	.19			
30 # of times Alter brokers $R_{t-1}$ (LAS)	-.19	-.28	.26	.54	.06	.22	-.17	-.28	-.11	-.25	.19	.46	.36		
31 # of Third Parties that Broker $R_t$ (LAS)	.28	-.06	-.08	.06	-.05	-.10	.28	-.06	.37	.30	-.24	-.12	-.24	-.12	
32 # of Third Parties that Broker $R_{t-1}$ (LAS)	.21	.25	-.18	-.33	-.12	-.24	.21	.25	.08	.34	-.23	-.36	-.23	-.36	.01

Abbreviations:  $R_t$ =Relationship between Alter and Ego at time  $t$ ; EP=Ego's Perception ; AP=Alter's Perception ; TPP=Third Parties Perceptions ; LAS= Local Aggregated Structure

**Table 3: Change in Frequency Service Specification Information Requests**

Independent Variables	Model 1a			Model 1b			Model 1c		
	I	II	III	I	II	III	I	II	III
Constant	<b>-.03</b>	<b>.91</b>	<b>.09</b>	<b>-.29</b>	<b>.94</b>	<b>.06</b>	<b>.64</b>	<b>1.00</b>	<b>.00</b>
Short-Term Adjustment Parameter ( $\rho-1$ )	<b>-.58</b>	<b>.00</b>	<b>1.00</b>	<b>-.60</b>	<b>.00</b>	<b>1.00</b>	<b>-.45</b>	<b>.00</b>	<b>1.00</b>
Ego's Trust In Alter's Intentions $\Delta$	.04	.48	.52	.01	.52	.48			
Ego's Trust In Alter's Intentions $_{t-1}$	.23	.29	.71	.21	.29	.71			
Ego's Trust In Alter's Abilities $\Delta$	.28	.12	.88	<b>.33</b>	<b>.08</b>	<b>.92</b>			
Ego's Trust In Alter's Abilities $_{t-1}$	.45	.20	.80	.53	.15	.85			
Alter's Trust In Ego's Intentions $\Delta$	<b>.31</b>	<b>.09</b>	<b>.91</b>	.29	.10	.90			
Alter's Trust In Ego's Intentions $_{t-1}$	<b>.76</b>	<b>.04</b>	<b>.96</b>	<b>.69</b>	<b>.05</b>	<b>.95</b>			
Alter's Trust In Ego's Abilities $\Delta$	-.04	.58	.42	-.02	.56	.44			
Alter's Trust In Ego's Abilities $_{t-1}$	<b>-.67</b>	<b>.93</b>	<b>.08</b>	<b>-.61</b>	<b>.91</b>	<b>.09</b>			
# of times Ego brokers $R_{\Delta}$ (EP)	-.31	.87	.13	-.27	.89	.11			
# of times Ego brokers $R_{t-1}$ (EP)	-.64	.89	.11	<b>-.62</b>	<b>.94</b>	<b>.06</b>			
# of times Alter brokers $R_{\Delta}$ (EP)	-.13	.79	.21	-.07	.72	.28			
# of times Alter brokers $R_{t-1}$ (EP)	-.27	.71	.29	-.19	.66	.34			
# of times Third Parties broker $R_{\Delta}$ (EP)	-.07	.66	.34	-.10	.74	.26			
# of times Third Parties broker $R_{t-1}$ (EP)	-.40	.82	.18	-.49	.88	.12			
# of times Alter brokers $R_{\Delta}$ (AP)	-.27	.89	.11	-.11	.75	.25			
# of times Alter brokers $R_{t-1}$ (AP)	.25	.28	.72	<b>.51</b>	<b>.09</b>	<b>.91</b>			
# of times Ego brokers $R_{\Delta}$ (AP)	.02	.47	.53	.02	.49	.51			
# of times Ego brokers $R_{t-1}$ (AP)	-.04	.50	.50	.02	.44	.56			
# of times Third Parties broker $R_{\Delta}$ (AP)	-.03	.61	.39	-.06	.68	.32			
# of times Third Parties broker $R_{t-1}$ (AP)	-.12	.63	.37	-.20	.70	.30			
# of Third Parties that broker $R_{\Delta}$ (TPP)	.38	.15	.85	.44	.11	.89			
# of Third Parties that broker $R_{t-1}$ (TPP)	.68	.19	.81	.57	.22	.78			
<b>“Actual” -variables</b>									
# of times Ego brokers $R_{\Delta}$ (LAS)	-.10	.68	.32				<b>-.39</b>	<b>.92</b>	<b>.08</b>
# of times Ego brokers $R_{t-1}$ (LAS)	-.26	.68	.32				-.77	.86	.14
# of times Alter brokers $R_{\Delta}$ (LAS)	.50	.16	.84				.40	.16	.84
# of times Alter brokers $R_{t-1}$ (LAS)	.71	.22	.78				<b>1.32</b>	<b>.06</b>	<b>.94</b>
# of Third Parties that Broker $R_{\Delta}$ (LAS)	-.07	.65	.35				.22	.47	.53
# of Third Parties that Broker $R_{t-1}$ (LAS)	-.73	.80	.20				-.40	.76	.24
Adj. R <sup>2</sup>		.57			.58			.39	

*I* are parameter estimates; *II* are proportion of simulated parameters larger than given parameter; *III* are proportion of simulated parameters smaller than given parameter. MRQAP analysis based on 10000 simulations.

Results in **Bold** are significant at 10% level in MRQAP-analysis.

Abbreviations: R=Relationship between Alter and Ego; t-1 indicates level effect;  $\Delta$  indicates change effects; EP=Ego's Perception ; AP=Alter's Perception ; TPP=Third Parties Perceptions ; LAS= Local Aggregated Structure



**Table 4:** Change in Frequency Service Delivery Information Requests

Independent Variables	Model 2a			Model 2b			Model 2c		
	I	II	III	I	II	III	I	II	III
Constant	<b>-1.66</b>	<b>.99</b>	<b>.01</b>	<b>-1.68</b>	<b>.99</b>	<b>.01</b>	<b>1.04</b>	<b>.96</b>	<b>.04</b>
Short-Term Adjustment Parameter ( $\rho-1$ )	<b>-.80</b>	<b>.05</b>	<b>.95</b>	-.85	.13	.87	<b>-.60</b>	<b>.00</b>	<b>1.00</b>
Ego's Trust In Alter's Intentions $\Delta$	<b>.51</b>	<b>.01</b>	<b>.99</b>	<b>.59</b>	<b>.01</b>	<b>.99</b>			
Ego's Trust In Alter's Intentions $_{t-1}$	<b>.96</b>	<b>.00</b>	<b>1.00</b>	<b>.94</b>	<b>.00</b>	<b>1.00</b>			
Ego's Trust In Alter's Abilities $\Delta$	.07	.37	.63	.02	.47	.53			
Ego's Trust In Alter's Abilities $_{t-1}$	-.08	.61	.39	-.04	.54	.46			
Alter's Trust In Ego's Intentions $\Delta$	.10	.33	.67	.02	.47	.53			
Alter's Trust In Ego's Intentions $_{t-1}$	-.11	.67	.33	-.11	.62	.38			
Alter's Trust In Ego's Abilities $\Delta$	.24	.16	.84	<b>.30</b>	<b>.09</b>	<b>.91</b>			
Alter's Trust In Ego's Abilities $_{t-1}$	<b>.70</b>	<b>.01</b>	<b>.99</b>	<b>.66</b>	<b>.04</b>	<b>.96</b>			
# of times Ego brokers $R_{\Delta}$ (EP)	-.30	.89	.11	-.21	.80	.20			
# of times Ego brokers $R_{t-1}$ (EP)	-.16	.70	.30	-.28	.79	.21			
# of times Alter brokers $R_{\Delta}$ (EP)	-.17	.83	.17	-.17	.81	.19			
# of times Alter brokers $R_{t-1}$ (EP)	<b>-.85</b>	<b>1.00</b>	<b>.00</b>	<b>-.76</b>	<b>1.00</b>	<b>.00</b>			
# of times Third Parties broker $R_{\Delta}$ (EP)	<b>-.39</b>	<b>.98</b>	<b>.02</b>	<b>-.38</b>	<b>.98</b>	<b>.02</b>			
# of times Third Parties broker $R_{t-1}$ (EP)	<b>-.65</b>	<b>.99</b>	<b>.01</b>	<b>-.60</b>	<b>.97</b>	<b>.03</b>			
# of times Alter brokers $R_{\Delta}$ (AP)	.17	.27	.73	.12	.28	.72			
# of times Alter brokers $R_{t-1}$ (AP)	<b>.54</b>	<b>.05</b>	<b>.95</b>	<b>.47</b>	<b>.06</b>	<b>.94</b>			
# of times Ego brokers $R_{\Delta}$ (AP)	.00	.49	.51	.01	.46	.54			
# of times Ego brokers $R_{t-1}$ (AP)	.27	.14	.86	.09	.36	.64			
# of times Third Parties broker $R_{\Delta}$ (AP)	-.07	.63	.37	-.11	.72	.28			
# of times Third Parties broker $R_{t-1}$ (AP)	-.02	.53	.47	.02	.48	.52			
# of Third Parties that broker $R_{\Delta}$ (TPP)	.05	.44	.56	-.09	.60	.40			
# of Third Parties that broker $R_{t-1}$ (TPP)	.04	.46	.54	-.12	.62	.38			
<b>“Actual”-variables</b>									
# of times Ego brokers $R_{\Delta}$ (LAS)	.46	.11	.89				.16	.36	.64
# of times Ego brokers $R_{t-1}$ (LAS)	-.27	.70	.30				-.39	.72	.28
# of times Alter brokers $R_{\Delta}$ (LAS)	<b>-.53</b>	<b>.92</b>	<b>.08</b>				-.08	.60	.40
# of times Alter brokers $R_{t-1}$ (LAS)	-.09	.58	.42				<b>.91</b>	<b>.08</b>	<b>.92</b>
# of Third Parties that Broker $R_{\Delta}$ (LAS)	-.48	.87	.13				-.34	.81	.19
# of Third Parties that Broker $R_{t-1}$ (LAS)	-.37	.69	.31				-.42	.68	.32
Adj. $R^2$		.42			.39			.22	

*I* are parameter estimates; *II* are proportion of simulated parameters larger than given parameter; *III* are proportion of simulated parameters smaller than given parameter. MRQAP analysis based on 10000 simulations.

Results in **Bold** are significant at 10% level in MRQAP-analysis.

Abbreviations: R=Relationship between Alter and Ego; t-1 indicates level effect;  $\Delta$  indicates change effects;

EP=Ego's Perception ; AP=Alter's Perception ; TPP=Third Parties Perceptions ; LAS= Local Aggregated Structure

**Table 5:** Hypotheses and Results based on Model 1b and Model 2a

Hypotheses	Support for Change Effect	Support for Level Effect
<u>Ego's trust</u>		
H1a: The increase in, and the amount of, trust that ego has in alter's abilities are positively related with ego's change in the strength of the <i>service specification</i> relationship with alter.	H1a: Yes	H1a: No
H1b: The increase in, and the amount of, trust ego has in alter's intentions are positively related with ego's change in the strength of the <i>service delivery</i> relationship with alter.	H1b: Yes	H1b: Yes
<u>Alter's trust</u>		
H2a: The increase in, and the amount of, trust alter has in ego's abilities are negatively related with ego's change in the strength of (1) the <i>service specification</i> relationship, and (2) of the <i>service delivery</i> relationship with alter.	—	H2a1: Yes H2a2: Yes
H2b: The increase in, and amount of, trust alter has in ego's intentions are positively related with ego's change in the strength of (1) the <i>service specification</i> relationship, and (2) of the <i>service delivery</i> relationship with alter.	—	H2b1: Yes H2b2: No
<u>Ego's Perceptions of Broker Positions</u>		
H3: The increase in, and the number of times that ego perceives to broker the relationship with alter, are negatively related with ego's change in strength of the (a) <i>service specification</i> relationship, and (b) of the <i>service delivery</i> relationship with alter.	H3a: No H3b: No	H3a: Yes H3b: No
H4a: The increase in, and the number of times that ego perceives alter to broker the relationship with ego, are positively related with ego's change in strength of the <i>service specification</i> relationship with alter.	H4a: No	H4a: No
H4b: The increase, in and the number of times that ego perceives alter to broker the relationship with ego, are negatively related with ego's change in strength of the <i>service delivery</i> relationship with alter.	H4b: No	H4b: Yes
H5: The increase in, and the number of times that ego perceives third parties to broker the relationship between ego and alter, are negatively related with ego's change in the strength of the (a) <i>service specification</i> relationship, and, (b) <i>service delivery</i> relationship with alter.	H5a: No H5b: No	H5a: Yes H5b: Yes
<u>Alter's Perceptions of Broker Positions</u>		
H6: The number of times that alter perceives to broker the relationship with ego, is positively related with ego's change in strength of (a) the <i>service specification</i> relationship, and, (b) of the <i>service delivery</i> relationship with alter.	—	H6a: Yes H6b: Yes
H7: The number of times, that alter perceives to broker the relationship with ego, is negatively related with ego's change in strength of (a) the <i>service specification</i> relationship, and, (b) of the <i>service delivery</i> relationship with alter.	—	H7a: No H7b: No
<u>Third Parties Perceptions of Broker Positions</u>		
H8: The number of third parties that alter perceives to broker the relationship between ego and alter, is positively related with ego's change in strength of (a) the <i>service specification</i> relationship, and, (b) of the <i>service delivery</i> relationship with alter.	—	H8a: No H8b: No
H9: The number of third parties that perceive to broker the relationship between ego and alter, is (a) positively related with ego's change in strength of the <i>service specification</i> relationship, and, (b) negatively related with ego's change in strength of the <i>service delivery</i> relationship with alter.	—	H9a: No H9b: No
— indicates that no hypothesis is formulated for this effect.		

## 6 Discussion and Conclusions

Two findings stand out in this explorative study. First, the results suggest that perceptions do matter more than "actual" structure in explaining autonomous relationship development. These results support the qualitative findings of Andrews & Delahaye (2000) that emphasize the importance of perceptions for relationship development. Indeed, changes in *service delivery* information requests are affected by the "actual" structure when perception variables are introduced, but the contribution to the adjusted  $R^2$  is relatively small compared to that of the perception variables. Furthermore, the effects of "actual" variables on change in *service specification* information requests disappear after adding the perception variables. These findings stress the importance of social cognitive structures (Krackhardt 1987; Carley & Krackhardt 1996). As we argue, it is not only ego's perception of the organizational and social environment that affects ego's behavior, also the perceptions of alters influence ego's behavior. We could not find support for the notion that third parties influence ego's behavior, though this might well be due to the relatively small data set.

An initially puzzling result is that we see an effect of alter's "actual" broker position on change in *service delivery* information requests and not on *service specification* information request. A possible explanation could be that the results of *service delivery* are immediate and more objective. The consequences of "actual" positions are more easily associated with this performance, while this link is harder to make with *service specification*. This idea is supported by the fact that the effect of "actual" broker positions is a change effect. When an alter increases the number of relations which he/she brokers, this is a signal for ego to diminish *service delivery* information request. Either alter is spending less time on ego or offers more "new" information, both negative for accomplishing a *service delivery* task.

A second important finding is that the effects of perceptions may not be entirely positive. Change in perceptions and the level of perceptions are found to have different effects. These latter findings are consistent with ideas about 'swift' trust (Meyerson et al. 1996). Interesting is also that individuals do only respond to the level of perceptions of alter. We have to assume that this is because we would need more time periods to observe change effects. Another explanation is that others are able to hide their change in perceptions or that ego is not able to detect these changes in others perceptions.

In this section we subsequently discuss our results in greater detail. First, we focus on the outcomes regarding trust. Second, we discuss the concerning cognitive social structures. Finally, we discuss some shortcomings of this study and opportunities for further research.

### 6.1 Trust

Our results indicate that it makes good sense to distinguish between trust in abilities and trust in intentions as two separate dimensions of trust. Each enhances different types of information requests in different ways. The fact that usually *service specification* tasks precede *service delivery* tasks suggests that working relationships first need trust in abilities to start, and subsequently need trust in intentions to be finished. However it is not the amount of trust in abilities that strengthens the *service specification* information requests, rather it is the change in this amount. Only when trust in alter's abilities rises will ego request more *service specification* information.

Also, contrary to standard beliefs about trust we found that trust indeed may diminish information transfers. When alter trusts ego's abilities, ego will decrease the frequency of *service specification* information requests. Together with the relationship enhancement effect of ego's trust in alter, there seems to be a process driven by trust that could lead to broker positions in a network. When ego receives more trust this apparently implies two things. First, ego diminishes his/her relationship strength with others and hence has resources left to engage in relationships with others. And, second, as alter trusts ego, alter increases relationship strength with ego and hence has less resources to spend on others. These two effects of trust in ego may force ego in a broker position. Further research is needed to investigate this idea, but it could be a trust-based explanation for the rise of broker positions (see for example, Burt 1992, 1999 for discussions on this topic).

Another result is that alter's level of trust affect ego's behavior (relationship changes), while change in alter's trust has no effect. Of course the time lag could be the cause of this result and we would need shorter time periods to see ego's reaction to changes in alter's trust. Another reasoning could be that ego is capable of detecting alter's levels of trust, though not the change in trust. Ego could take alter's trust in him/her as a given and act on it only to later find out that the level of trust has changed. This is a point that needs further research.

## 6.2 Cognitive Social Structure

We find that the cognitive social structure affects whether individuals strengthen or weaken their relationships. Again remarkable differences between *service specification* and *service delivery* relationships become apparent. We discuss these effects and differences from two perspectives, ego as broker and alter as broker.

### 6.2.1 Ego as Broker

The results suggest that individuals do not like to be brokers, even when a broker position means that ego is better able to accomplish certain tasks, such as *service specification* tasks. Apparently the (psychological) costs of information ambiguity cannot be retrieved by the advantages broker positions offer. This could be because within a cooperative setting, such as within organizations, broker positions cannot be exploited. Especially, when costs are relatively hard to share (e.g. understanding tacit *service delivery* information) and advantages are relatively easy to share (e.g. transferring "new" *service specification* information). Especially, when imputation of organizational outcome is not directly related to the individual in the broker position.

In our case, *service specification* tasks are necessary to execute *service delivery* tasks, but only the latter directly generate financial results. In cooperative settings a common norm is that it is expected of individuals to help colleagues. For example, in our study account managers are stimulated to share ideas for new products. However, although brokers may provide great input for knowledge creation they might be less involved in implementing these ideas. Hence, it is not unlikely that credits for the results are assigned relatively less to those that father the idea, than those that mother the idea. Broker positions in cooperative settings do bring costs, but it might be hard to get credits for the value added due to this position.

### 6.2.2 Alter as Broker

Although individuals seem not to like broker positions, under some conditions they recognize the value of others in a broker position. With regard to *service delivery* we find a contradictory effect between ego's perceptions, alter's perceptions and the "actual" network. For *service delivery* tasks

it seems that enhancing relationships with a broker is detrimental. "New" information does not speed up *service delivery*. Ego's perception level of alter holding a broker position negatively affects the development of relationship strength. Also, alter's "actual" increase in his/her broker position is negatively related to change in relationship strength. However, alter's perceptions of his/her broker position affects change in *service delivery* strength positively.

This finding may be related to the finding that when alter perceives to be a broker he/she is a good source for *service specification* information. Though this result is not significant. Again, notice that *service specification* only generates revenues after a correct *service delivery* task. These tasks depend on strong relationships that allow the transfer of more tacit knowledge (cf. Hansen 1999; Nelson & Winter 1982). Hence, because alter's perception to broker the relationship is valuable to ego in *service specification* it also forces ego to strengthen the *service delivery* relationship with alter to overcome what is known as "the knowing-doing gap" (Pfeffer & Sutton 2000). This would explain the increase of ego's effort to strengthen his/her relationship with alter, when alter perceives to hold a broker position.

### *6.3 Limitations and Further Research*

There are obvious limitations to this study. First, the results are evaluated at  $\alpha=.10$ . We are confident that this is fine for an explorative study as presented here, but we should be cautious not to over-generalize the results. Results could be more significant if data would be collected over a larger number of periods and/or in a larger number of units with perhaps more individuals. Also other contexts could be considered.

Also many of our results could form bases for new hypotheses that include antecedents of perceptions. Especially, structural antecedents would be of interest because then the dynamics of the social system could be made more transparent. Simulation studies could be especially valuable, for example to analyze the effects of different begin states of networks. These studies could enable managers to use tools like empowerment in a more detailed way. Also, these studies could make a link between impression management and the evolution of network structures.

## 6.5 Conclusion

In this paper we showed that perceptions have an important impact on the development of relationships. Although "actual" network structures may drive relationship change, trust and social cognitive structures seem to have a more important impact on relationship change. The use of trust and social cognitive structures (especially cognitive broker positions) make clear two things. First, a distinction between trust in intentions and trust in abilities is necessary when we analyze changes in different types of information transfers. Second, for both trust and social cognitive structures it is important to distinguish between effects of perceived levels as well as change in perception. The amount of trust has a different effect than the change in the amount of trust that individuals hold. Through structural antecedents of perceptions, future research could explicitly link individuals positions and perceptions to network structure evolution.

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