Governance Structures, Cultural Distance, and Socialization Dynamics: Further Challenges for the Modern Corporation

Christian Cordes, Sarianna M. Lundan, Stephan Müller, and Georg Schwesinger*

December 2015

Abstract

This paper relates cultural distance and governance structures. We suggest a model of cultural evolution that captures the idiosyncratic socialization dynamics taking place in groups of communicating and interacting agents. Based on these processes, cultural distance within and between groups or organizational units develops. Transaction cost theorists associate higher cultural distance with higher transaction costs. Therefore, one problem of economic organization is assessing alternative governance structures in terms of the socialization dynamics they enable that entail different intraorganizational transaction costs. We assume that transaction can be organized within governance structures that allow transaction cost economizing socialization processes.

Keywords: Cultural Distance – Governance Structures – Corporate Culture – Cultural Evolution – Firm Performance

JEL Codes: D21, D23, L25, M14, C61

* Cordes (corresponding author), Lundan, and Schwesinger: University of Bremen, Hochschulring 4, 28359 Bremen, Germany (e-mail: c.cordes@uni-bremen.de, s.lundan@uni-bremen.de, and schwesinger@uni-bremen.de); Müller: University of Göttingen, Platz der Göttinger Sieben 3, 37073 Göttingen, Germany (e-mail: Stephan.Mueller@wiwi.uni-goettingen.de).

1. Introduction

This paper relates cultural distance (CD), as a further attribute of transactions, and governance structures. Standing in the tradition of Oliver E. Williamson (e.g., 1979, 1981, 2002), we suggest an additional problem of economic organization: assessing alternative governance structures in terms of the socialization dynamics they enable, which entail different intraorganizational transaction costs due to CD. We assume that transactions in organizations can be assigned to and organized within governance structures that allow transaction cost economizing socialization processes.

Moreover, our socialization governance approach appeals to behavioral theory and cultural evolution. We suggest an innovative model of cultural evolution that captures socialization processes and the development of CD within and between groups or organizational units. It describes the idiosyncratic learning and socialization dynamics taking place in groups of communicating and interacting agents and explains important aspects of governance structures, firm cultures, and related transaction costs (Commons, 1934; Coase, 1937).

CD has been used as a key variable in many areas of organizational behavior (e.g., Kogut and Zander, 1993; Shenkar, 2001; Buckley and Carter, 2004) and firms have been interpreted as multi-cultural teams (e.g., Lazear, 1999). We suggest that given certain socialization dynamics that occur in groups, processes of convergence and divergence in CD within and between organizational units take place. Furthermore, CD between parties is an important attribute of transactions. Transaction cost theorists associate higher CD with higher costs of transaction due to communication and information costs or less efficient intraorganisational transfer of knowledge and skills (e.g., Kogut and Zander, 1993; Nooteboom, 2000; Buckley and Carter, 2004). Employees who have different cultures impose costs on an organization that would be absent were cultures homogeneous (Lazear, 1999). An organization can, however, react to this challenge by choosing suited socialization governance structures that close CD between individuals or organizational entities.

We examine governance structures such as the firm by incorporating several behavioral-related variables of organizational development in our model of cultural evolution, such as a role model bias in cultural transmission and group-based learning. In this context, humans' constrained psychological resources are a fundamental part of cultural evolution. Imitating and learning from others, i.e., relying on purely social influences, are a means by which agents finesse these bounds of rationality (e.g., Boyd and Richerson, 1985; Bernheim, 1994; Manski, 2000; Richerson and Boyd, 2005). Therefore, socialization processes within groups that are based on mechanisms of cultural transmission and their implications matter a lot to organizations and their efforts to craft governance structures that mitigate the problem of increasing CD.

Given this perspective, our work is a contribution to social interaction theory. This literature links social interactions with economic theory and includes several earlier works, such as Schelling (1972), Banerjee (1992), Kirman (1993), Ellison and Fudenberg (1993, 1995), Frank (1997), Bikhchandani et al. (1998), DeMarzo et al. (2003), and Brock and Durlauf (2007). Moreover, sociology investigates the important place of socialization in the evolution of cultures (e.g., French Jr., 1956; Parsons, 1967; Bandura, 1977). In line with these contributions, our model assumes an agent's cultural traits to be dependent on the cultural traits exhibited by other actors. Agents are boundedly rational and subject to social influence via socialization. Cultural traits are transmitted by processes of cultural learning – the basis of socialization – that require extended series of personal interaction. In this context, a cultural trait is defined as an idea, norm, belief, attitude, habit, or value that is acquired by social learning and that influences an individual's behavior (e.g., Henrich et al., 2008). Cultural traits have long been used in anthropology as units of transmission that reflect behavioral characteristics of individuals or groups (see O'Brian et al., 2010).

The paper is organized as follows. In Section 2, a model of the evolution of CD within and between groups or organizational units is specified. In Section 3, implications of socialization processes for intra- and intergroup CD are developed. Section 4 relates the governance of socialization and internal transaction costs and derives some principles of governance of socialization in organizations. Section 5 concludes.

2. The basic model of intragroup socialization processes

Our model depicts the development of CD within and between groups of communicating and interacting agents. It draws on ideas originating from cultural evolution theory and opinion formation models as proposed by Feldman and Cavalli-Sforza (1975) and DeGroot (1974; also DeMarzo et al., 2003). Let there be $i = 1, \dots, N$ members of a group. The value of a cultural trait j ($j = 1, \dots, M$) of the ith individual at time t is $x_{ij,t}$. All cultural traits considered in our model are continuous in nature and treated independently. For a single cultural trait j, vector $\boldsymbol{x}_{j,t}$

captures the state of the group, where $\boldsymbol{x}_{j,t} = \left(x_{1j,t}, \dots, x_{Nj,t}\right)^T$. $\overline{\boldsymbol{x}}_{j,t}$ is the group mean value of cultural trait j at time t.

A cultural trait j of an individual i is assumed to depend on the values of the same trait in all N members of the group and these members' weights, w_{ik}, in socialization. Each coefficient w_{ik} measures the dependence of the trait of the ith employee on the trait exhibited by the kth group member. Hence, employee i's value of a cultural trait j develops according to

$$x_{ij,t+1} = \sum_{k=1}^{N} w_{ik}\, x_{kj,t}. \tag{1}$$

Agents acquire their traits by learning from one another, i.e., an interdependent process of socialization takes place within groups. Cultural transmission within a group can then be represented by a stochastic $N \times N$ matrix W that has as its elements the proportional contributions of each member of the group to the value of an individual's trait as captured by the weights, w_{ik}: $W = \|w_{ik}\|$ $(0 \le w_{ik} \le 1,\ i = 1, \dots, N,\ k = 1, \dots, N,$ and $\sum_{k=1}^{N} w_{ik} = 1\ \forall i)$. For one cultural trait j, the change in a group's state is modeled as:

$$\boldsymbol{x}_{j,t+1} = W\boldsymbol{x}_{j,t} + \boldsymbol{\varepsilon}, \tag{2}$$

where $\boldsymbol{\varepsilon} = (\varepsilon_1, \varepsilon_2, \dots, \varepsilon_N)^T$ is a random component for each agent that represents individual learning (with mean zero and variance σ^2).[1] We assume ε_i and ε_k to be independent in a given generation and that errors independent between generations and across traits. Thus, the cultural trait of the ith employee at $t+1$ can be considered as the weighted influences of the traits of all group members at t including herself, apart from the random error term ε_i. Means and variances of cultural traits within and between groups of N individuals will be subject to change in the course of ongoing socialization processes.

From (2) we have $(t \to \tau)$

$$E\left(\boldsymbol{x}_{j,t+1}\right) = W^{t+1}\boldsymbol{x}_{j,0} \tag{3}$$

so that the expected value of $\boldsymbol{x}_{j,t+1}$ is determined by its initial values and the spectral properties of W. Equations (2) and (3) describe the development for a single cultural trait. For more than one cultural trait, we can aggregate the group's state by a matrix X_t with $X_t = \left(x_{ij,t}\right)$.

We define a group x's cultural endowment by a vector $\boldsymbol{c}$:

[1] Due to this random term, CD between agents will never completely vanish for individuals' environments not being exactly identical and continuous idiosyncratic learning experiences.

$$\boldsymbol{c}_x = (\overline{\boldsymbol{x}}_{1,t}, \dots, \overline{\boldsymbol{x}}_{M,t}), \quad (4)$$

which is composed of the group's mean values of cultural traits j ($j = 1, \dots, M$) at time t. A group's cultural endowment may also summarize more organization-specific cultural traits, such as organizational stories and shared experiences, rituals and rites, symbolic manifestations, and solutions to problems in an external environment and to internal integration (see Schein, 1990). Moreover, within-group CD is measured by VAR_t^{WIG}, the intragroup variance in cultural trait values at time t (for a definition, see below). Employees constituting a group or organizational unit may have different cultural backgrounds and have experienced idiosyncratic socialization histories prior to entering the organization. This fact gives rise to significant intragroup CD, i.e., we expect a considerable degree of initial intragroup variance in cultural trait values. This measure of cultural distance will then change in the course of time depending on individual learning and the socialization dynamics captured by the cultural transmission matrix W. CD between organizational units is captured by VAR_t^{BTG}, the variance in the difference of groups' mean values of cultural traits (also defined below).

The cultural transmission matrix, W, captures learning biases taking effect in socialization. Cultural learning biases can be viewed as frugal, boundedly rational heuristics (e.g., Ellison and Fudenberg, 1993; DeMarzo et al., 2003). Copying the cultural traits shown by other members of one's reference group is such a simple, general rule (Asch, 1955; Kirman, 1993; Sacerdote, 2001). A more specific learning bias is based on prominent or prestigious role models in an individual's social environment. These play an important role in socialization (e.g., French Jr., 1956; Labov, 2006). Indeed, evidence from social psychology and anthropology suggests that human agents are prone to adopt cultural traits that are shown by role models in their social environment (Harrington Jr., 1999; Henrich and Gil-White, 2001; Labov, 2001; Atkisson et al., 2012; Chudek et al., 2012). Therefore, a cognitive disposition to imitate successful or prestigious agents takes effect in cultural transmission, i.e., there is a model-based bias in socialization. To account for such a role model bias, we allow some individuals to exert relatively greater influence in shaping group members' cultural traits. Single individuals, such as (corporate) entrepreneurs or business leaders, often play outstanding roles in the socialization of employees (e.g., Schein, 1992; Van den Steen, 2010).

To guide our analysis of intragroup socialization below, we specify the transmission weights included in W. Let us assume the following matrix to illustrate some important effects of cultural transmission in groups:

$$W=\begin{bmatrix} r+p-\frac{N}{\alpha} & \frac{1-\left(p+r-\frac{N}{\alpha}\right)}{N-1} & \frac{1-\left(p+r-\frac{N}{\alpha}\right)}{N-1} & \cdots & \frac{1-\left(p+r-\frac{N}{\alpha}\right)}{N-1} \\ r+\frac{1-p}{N-1}-\frac{N}{\alpha} & p & \frac{1-\left(p+r-\frac{N}{\alpha}+\frac{1-p}{N-1}\right)}{N-2} & \cdots & \frac{1-\left(p+r-\frac{N}{\alpha}+\frac{1-p}{N-1}\right)}{N-2} \\ r+\frac{1-p}{N-1}-\frac{N}{\alpha} & \frac{1-\left(p+r-\frac{N}{\alpha}+\frac{1-p}{N-1}\right)}{N-2} & p & \cdots & \frac{1-\left(p+r-\frac{N}{\alpha}+\frac{1-p}{N-1}\right)}{N-2} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ r+\frac{1-p}{N-1}-\frac{N}{\alpha} & \frac{1-\left(p+r-\frac{N}{\alpha}+\frac{1-p}{N-1}\right)}{N-2} & \frac{1-\left(p+r-\frac{N}{\alpha}+\frac{1-p}{N-1}\right)}{N-2} & \cdots & p \end{bmatrix}. \tag{5}$$

In this matrix, the role model bias is reflected by the parameter r: agent $i = 1$ takes on the position of a prominent role model. Ceteris paribus, high values of r lead to relatively large elements in the first column and relatively small elements elsewhere, which is a prerequisite for this agent to be influential. Different values of r reflect the fact that individuals differ in their ability to exert influence in the socialization of other agents. This can be due to differences in charismatic potential, social skills, authority, prestige, personal work ethic, etc. (e.g., Milgram, 1974; Hodgson, 1996; Langlois, 1998).

Whether to preferentially follow other group members or to mainly rely on one's own cultural trait values also represents a bias in cultural transmission. Parameter p in matrix W measures this tradeoff in socialization governance: if it takes on relatively high values, then the diagonal elements imply that each individual strongly determines her own cultural trait values, while other group members have a relatively small effect in that process. On the other hand, if the p values are low relative to the matrix's other elements, the group has a stronger influence on the value of a single individual's cultural trait, i.e., conformity and compliance exert a relatively strong effect (see Asch, 1955; Bernheim, 1994; Cialdini and Goldstein, 2004). Hofstede (1989) offers support for the existence of these effects in socialization in different cultural environments. One of his cultural dimensions used in country comparisons is "individualism", the degree to which people learn to act as individuals rather than collectivistic as members of a cohesive group (also Bond and Smith, 1996). Similarly, Greif (1994) differentiates between collectivist and individualist cultures to explain differences in institutional structures between societies. p values also differ among organizations due to different corporate cultures in which agents either focus on their personal agendas or subscribe to (collective) firm goals. Finally, parameter α is a normalization factor.

3. Implications of socialization processes for intra- and intergroup cultural distance

Besides cultural transmission in a group context, individual learning, as captured by the random component ε, is considered as a determinant of the development of agents' various cultural trait values. Since this component is assumed to be independent among individuals, the following propositions apply to each of the M cultural traits in our model. Therefore, for ease of notation, the subscript j denoting a particular trait is suppressed in the following analysis.

3.1. Convergence and stabilization of cultural trait values within groups

Let $V_t = E[(x_t - \bar{x}_t)'(x_t - \bar{x}_t)]$ denote the variance-covariance matrix for a given trait j, evolving according to the stochastic process characterized by W. Then, the intragroup variance at time t is given by the sum of the diagonal elements of V_t divided by $N-1$, i.e.,

$$VAR_t^{WIG} = \frac{1}{N-1} tr(V_t). \tag{6}$$

Our model demonstrates that CD within groups is reduced by shared socialization experiences among individual employees. For a regular Markov matrix, it can be shown that intragroup variance in cultural traits, VAR_t^{WIG}, decreases and stabilizes at a finite value in the course of group-bound socialization. Let us first assume a simplified cultural transmission table, W^s, in which no individual takes on the position of a particularly influential role model:

$$W^s = \begin{bmatrix} p & \frac{1-p}{N-1} & \frac{1-p}{N-1} & \cdots & \frac{1-p}{N-1} \\ \frac{1-p}{N-1} & p & \frac{1-p}{N-1} & \cdots & \frac{1-p}{N-1} \\ \frac{1-p}{N-1} & \frac{1-p}{N-1} & p & \cdots & \frac{1-p}{N-1} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \frac{1-p}{N-1} & \frac{1-p}{N-1} & \frac{1-p}{N-1} & \cdots & p \end{bmatrix}. \tag{7}$$

If no cultural transmission between group members takes place, W^s equals the Identity matrix and each agent's trait values follow a random walk driven by uncorrelated individual learning. In that case, within-group variance diverges. However, in the presence of joint socialization based on mutual cultural learning, the expected long-run intragroup variance is given by:

$$VAR^{WIG,S} = \lim_{t\to\infty} VAR_t^{WIG,S} = \sigma^2 \left(1 + \frac{\lambda^2}{1-\lambda^2}\right),^{2} \tag{8}$$

[2] $VAR_t^{WIG,S} = \sigma^2 \left(1 + \lambda^2 \frac{1-\lambda^{2t}}{1-\lambda^2}\right) + \sigma_0^2 \lambda^{2(t+1)}$, where σ_0^2 measures the unbiased initial group variance.

where λ refers to the $(N-1)$-fold non-unit eigenvalue of W^s, given by $\lambda = \frac{Np-1}{N-1}$. Inserting that into Equation (8) yields:

$$VAR^{WIG,S} = \sigma^2 \left(\frac{N-1}{N(1-p)\left(1+\frac{Np-1}{N-1}\right)} \right). \tag{9}$$

For p approaching unity, the case of absent cultural learning can be interpreted as the limit case of Equation (9). While $p = 1$ implies agents who fully determine their own cultural trait values, $p = 0$ leads to individuals who are exclusively subject to group influences. Hence, our first proposition says:

Proposition 1 $VAR^{WIG,S} \underset{p\to 1}{\longrightarrow} \infty$, i.e., socialization reduces intragroup variance in trait values.

If we take into account an influential business leader in socialization characterized by a higher weight in cultural learning, as compared to an ordinary group member and measured by the relative size of r, we can capture the corresponding effects by analyzing a cultural transmission matrix, W, as described by (5) above. In this case, intragroup variance, VAR_t^{WIG}, converges and stabilizes at a finite value and – under certain conditions – also decreases in the course of socialization. To establish these results, the following Lemma provides a compact expression for VAR_t^{WIG}. Let $\sigma_{1,0}^2 = \frac{1}{N}\left(x_{1,0} - \bar{x}_{-1,0}\right)^2$ and $\sigma_{-1,0}^2 = \frac{1}{N-1}\sum_{k=2}^{N}\left(x_{k,0} - \bar{x}_{-1,0}\right)^2$, where the former measures the initial distance of the model's trait to the average of all other group members and the latter the unbiased initial trait variance for all non-role models.

Lemma

$$VAR_t^{WIG} = \sigma^2 \left(1 + \frac{1}{N-1}\lambda_2^2 \frac{1-\lambda_2^{2t}}{1-\lambda_2^2} + \left(1 - \frac{1}{N-1}\right)\lambda_{N-2}^2 \frac{1-\lambda_{N-2}^{2t}}{1-\lambda_{N-2}^2}\right) + \sigma_1^2 \lambda_2^{2(t+1)} + \sigma_{-1}^2 \lambda_{N-2}^{2(t+1)},$$

where $\lambda_2 = \frac{Np-1}{N-1}$ and $\lambda_{N-2} = \frac{Np-1}{N-1} + \frac{r-\frac{N}{\alpha}}{N-2}$ are the non-unit eigenvalues of W.

Proof

Following Feldman and Cavalli-Sforza's (1975) analysis of the properties of within-group variance, we know that

$$V_{t+1} = (I-P)W^{t+1}V_0 W'^{t+1}(I-P) + \sigma^2(I-P) + \sigma^2(I-P)\left[\sum_{k=1}^{t} W^k W'^k\right](I-P),$$

where P is a matrix all of whose rows are equal to $(1/N, \dots, 1/N)$.

$$VAR_t^{WIG} = \frac{1}{N-1} tr\left((I-P)W^{t+1}V_0 W'^{t+1}(I-P) + \sigma^2(I-P) + \sigma^2(I-P)\left[\sum_{k=1}^{t} W^k W'^k\right](I-P) \right)$$

$$= \sigma^2 + \frac{1}{N-1}\underbrace{tr\big((I-P)W^{t+1}V_0W'^{t+1}(I-P)\big)}_{\geq 0,\text{ for } t\to\infty, tr\to 0} + \frac{1}{N-1} tr\underbrace{\left(\sigma^2(I-P)[\textstyle\sum_{k=1}^{t} W^k W'^k](I-P)\right)}_{\text{increasing and converging}}$$

$$= \sigma^2 + \frac{1}{N-1} tr\big((I-P)W^{t+1}V_0W'^{t+1}(I-P)\big) + \frac{1}{N-1}\left[\textstyle\sum_{k=1}^{t} tr\left(\sigma^2(I-P)W^kW'^k(I-P)\right)\right]$$

The last term can be simplified: with eigenvalues $\lambda_1 = 1$, $\lambda_2 = \frac{Np-1}{N-1}$ and $\lambda_3 = \cdots = \lambda_N = \frac{Np-1}{N-1} + \frac{r-\frac{N}{\alpha}}{N-2} \equiv \lambda_{N-2}$, it follows that

$$tr\Big(\sigma^2(I-P)W^kW'^k(I-P)\Big) = \sigma^2((\lambda_2)^{2k} + (N-2)(\lambda_{N-2})^{2k}). \quad (10)$$

Equation (10) derives from $W^k = (Q\Lambda Q^{-1})^k = Q\Lambda^k Q^{-1}$ and, accordingly, $W'^k = (Q\Lambda^k Q^{-1})'$, where the columns of Q correspond to the set of eigenvectors of W. More precisely, let $Q = (\nu_1^T, \nu_2^T, \dots, \nu_N^T)$ with ν_i being the eigenvector associated with λ_i. Eigenvectors are given by

$$\nu_1 = (1, \dots, 1), \nu_2 = \left(r - \frac{N}{\alpha} - (1-p)/r - \frac{N}{\alpha} + \frac{1-p}{(N-1)}, 1 \dots, 1\right), \nu_k = -e_2 + e_k, k = 3, \dots N.$$

Hence,

$$\frac{1}{N-1}\left[\textstyle\sum_{k=1}^{t} tr\left(\sigma^2(I-P)W^kW'^k(I-P)\right)\right] = \frac{\sigma^2}{N-1}\textstyle\sum_{k=1}^{t}\big((\lambda_2)^{2k} + (N-2)(\lambda_{N-2})^{2k}\big)$$

$$= \frac{\sigma^2}{N-1}\left((\lambda_2)^2\frac{1-(\lambda_2)^{2t}}{1-(\lambda_2)^2} + (N-2)(\lambda_{N-2})^2\frac{1-(\lambda_{N-2})^{2t}}{1-(\lambda_{N-2})^2}\right). \quad (11)$$

For the middle term, we have:

$$\frac{1}{N-1} tr\left((I-P)W^iV_0W'^i(I-P)\right) = \frac{1}{N}(x_1 - \bar{x}_{-1})^2(\lambda_2)^{2i} + \frac{1}{N-1}\left(\textstyle\sum_{k>1}(x_k - \bar{x}_{-1})^2\right)(\lambda_{N-2})^{2i}. \quad (12)$$

The first term in parenthesis on the right-hand side of Equation (12) is the initial variance between the role model's trait value and the average of all other employees. It is decreasing geometrically. The second term describes the initial variance among all ordinary employees excluding the role model. Combining (11) and (12) yields:

$$VAR_t^{WIG} = \sigma^2 + \frac{(x_1-\bar{x}_{-1})^2}{N}(\lambda_2)^{2(t+1)} + \frac{\sum_{k>1}(x_k-\bar{x}_{-1})^2}{N-1}(\lambda_{N-2})^{2(t+1)} + \frac{\sigma^2}{N-1}\left((\lambda_2)^2\frac{1-(\lambda_2)^{2t}}{1-(\lambda_2)^2} + (N-2)(\lambda_{N-2})^2\frac{1-(\lambda_{N-2})^{2t}}{1-(\lambda_{N-2})^2}\right). \quad (13)$$

QED

Given the expression for the within-group variance provided by the Lemma above, Proposition 2 states the condition under which VAR_s^{WIG} decreases from generation $t-1$ to the next when a role model takes effect in cultural transmission:

Proposition 2 $VAR_t^{WIG} - VAR_{t-1}^{WIG} < 0$ if and only if $\lambda_2^{2t}\left(\frac{\sigma^2}{N-1} - \frac{\sigma_1^2}{N}(1-\lambda_2^2)\right) + \lambda_{N-2}^{2t}\left((N-2)\frac{\sigma^2}{N-1} - \sigma_{-1}^2(1-\lambda_{N-2}^2)\right) < 0.$

Proof

$$VAR_t^{WIG} = \sigma^2 + \sigma_1^2\lambda_2^{2(t+1)} + \sigma_{-1}^2\lambda_{N-2}^{2(t+1)} + \frac{\sigma^2}{N-1}\left(\lambda_2^2\frac{1-\lambda_2^{2t}}{1-\lambda_2^2} + (N-2)\lambda_{N-2}^2\frac{1-\lambda_{N-2}^{2t}}{1-\lambda_{N-2}^2}\right)$$

$$VAR_{t-1}^{WIG} = \sigma^2 + \sigma_1^2\lambda_2^{2t} + \sigma_{-1}^2\lambda_{N-2}^{2t} + \frac{\sigma^2}{N-1}\left(\lambda_2^2\frac{1-\lambda_2^{2(t-1)}}{1-\lambda_2^2} + (N-2)\lambda_{N-2}^2\frac{1-\lambda_{N-2}^{2(t-1)}}{1-\lambda_{N-2}^2}\right)$$

$$VAR_t^{WIG} - VAR_{t-1}^{WIG} < 0 \Leftrightarrow$$

$$\sigma_1^2\lambda_2^{2(t+1)} + \sigma_{-1}^2\lambda_{N-2}^{2(t+1)} + \frac{\sigma^2}{N-1}\left(\lambda_2^2\frac{1-\lambda_2^{2t}}{1-\lambda_2^2} + (N-2)\lambda_{N-2}^2\frac{1-\lambda_{N-2}^{2t}}{1-\lambda_{N-2}^2}\right) - \sigma_1^2\lambda_2^{2t} + \sigma_{-1}^2\lambda_{N-2}^{2t} + \frac{\sigma^2}{N-1}\left(\lambda_2^2\frac{1-\lambda_2^{2(t-1)}}{1-\lambda_2^2} + (N-2)\lambda_{N-2}^2\frac{1-\lambda_{N-2}^{2(t-1)}}{1-\lambda_{N-2}^2}\right) \Leftrightarrow \sigma_1^2\lambda_2^{2t}(\lambda_2^2-1) + \sigma_{-1}^2\lambda_{N-2}^{2t}(\lambda_{N-2}^2-1) + \frac{\sigma^2}{N-1}(\lambda_2^{2t} + (N-2)\lambda_{N-2}^{2t}) < 0 \Leftrightarrow \lambda_2^{2t}\left(\frac{\sigma^2}{N-1} - \sigma_1^2(1-\lambda_2^2)\right) + \lambda_{N-2}^{2t}\left((N-2)\frac{\sigma^2}{N-1} - \sigma_{-1}^2(1-\lambda_{N-2}^2)\right) < 0$$

QED

Based on Proposition 2, the following Corollary provides the sufficient conditions for VAR_t^{WIG} to monotonically decrease or increase in the presence of a role model:

Corollary

1. If the variance introduced by individual learning, as measured by σ^2, is sufficiently small, VAR_t^{WIG} decreases monotonically.
2. If initially the role model and all non-role models have identical trait values, VAR_t^{WIG} increases monotonically.
3. If the net role model bias $(r - \frac{N}{\alpha})$ is sufficiently small and p sufficiently large, VAR_t^{WIG} increases monotonically.
4. For any given level of individual learning σ^2: if the initial intragroup variance among non-role models and the initial cultural distance of the role model to the group's average trait value are sufficiently high, VAR_t^{WIG} decreases monotonically.

Proof

1. For $\sigma \to 0: VAR_t^{WIG} - VAR_{t-1}^{WIG} < 0, \forall t.$
2. Note that $\frac{\sigma^2}{N-1} - \sigma_1^2(1-\lambda_2^2) < 0 \Leftrightarrow \frac{\sigma^2}{(N-1)(1-\lambda_2^2)} < \sigma_1^2$ and $(N-2)\frac{\sigma^2}{N-1} - \sigma_{-1}^2(1-\lambda_{N-2}^2) < 0 \Leftrightarrow \frac{(N-2)\sigma^2}{(N-1)(1-\lambda_{N-2}^2)} < \sigma_{-1}^2$.
3. $\sigma_1^2 = \sigma_{-1}^2 = 0 \Longrightarrow \lambda_2^{2t}\left(\frac{\sigma^2}{N-1}\right) + \lambda_{N-2}^{2t}\left((N-2)\frac{\sigma^2}{N-1}\right) > 0.$
4. Under these conditions, both eigenvalues are close to one. Note that $\lambda_2^{2t}\left(\frac{\sigma^2}{N-1} - \sigma_1^2(1-\lambda_2^2)\right) + \lambda_{N-2}^{2t}\left((N-2)\frac{\sigma^2}{N-1} - \sigma_{-1}^2(1-\lambda_{N-2}^2)\right) \xrightarrow{\lambda_2, \lambda_{N-2} \to 1} \sigma^2 > 0.$

QED

Finally, Proposition 3 shows that VAR_t^{WIG} stabilizes at a finite value:

Proposition 3 VAR_t^{WIG} converges to $VAR^{WIG} = \sigma^2\left(1 + \frac{1}{N-1}\frac{{\lambda_2}^2}{1-{\lambda_2}^2} + \left(1 - \frac{1}{N-1}\right)\frac{{\lambda_{N-2}}^2}{1-{\lambda_{N-2}}^2}\right).$

Proof

Taking the limit of VAR_t^{WIG} w.r.t. time yields the above result. QED

Proposition 3 reveals that in large groups VAR^{WIG} is essentially determined by λ_{N-2}.

3.2. Divergence of cultural endowments between groups

The model also shows that each group of interacting and communicating agents will develop an idiosyncratic cultural endowment in the course of time. As a consequence, cultural endowments of two separated groups, $\boldsymbol{c}_x$ and $\boldsymbol{c}_y$, will diverge during their specific socialization processes. The variance in the difference of groups' mean values of cultural traits, VAR_t^{BTG}, increases as a linear function of time. Accordingly, CD between groups or organizational units necessarily grows proportionately to time if the groups' members do not (or rarely) interact and communicate with members of the other groups. We capture this argument formally in Proposition 4.

Proposition 4 VAR_t^{BTG} increases (asymptotically) as a linear function of time.

Proof

Let $y_{j,t+1} = W_y y_{j,t} + \eta_t$ and N_x and N_y the numbers of members of two separated groups. Furthermore, we assume η and ε to be independent within and across cultural transmission steps. Iteration of Equation (1) gives us:

$$x_{t+1} = {W_x}^{t+1} x_0 + \sum_{k=0}^{t} W_x^k \, \varepsilon_{t-k}. \tag{14}$$

Hence,

$$\bar{x}_{t+1} = \overline{{W_x}^{t+1} x_0} + \sum_{k=0}^{t} \overline{W_x^k \varepsilon_{t-k}} \tag{15}$$

$$\overline{W_x^{t+1} x_0} = \overline{Q \Lambda^{t+1} Q^{-1} x_0} = \frac{1}{N_x(N_x-1)(b_x-1)} \left(N_x b_x - (N_x - 1 + b_x)\lambda_2^{t+1}\right) \sum_{i\geq 2} x_i - (N_x - 1)\left(N_x - (N_x - 1 + b_x)\lambda_2^{t+1}\right) x_1 = \sum_{i=1}^{N_x} \varphi_{x,i}^{t+1} x_i \tag{15a}$$

$$\varphi_{x,1}^{t+1} = -\frac{(N_x-1)\left(N_x-(N_x-1+b_x)\lambda_2^{t+1}\right)1}{N_x(N_x-1)(b_x-1)} \xrightarrow[t\to\infty]{} \frac{1}{1-b_x}$$

$$\varphi_{x,i\geq 2}^{t+1} = \frac{\left(N_x b_x-(N_x-1+b_x)\lambda_2^{t+1}\right)}{N_x(N_x-1)(b_x-1)} \xrightarrow[t\to\infty]{} \frac{b_x}{(N_x-1)(b_x-1)},$$

where

$$b_x = \frac{r_x - \frac{N_x}{\alpha_x} - (1-p_x)}{r_x - \frac{N_x}{\alpha_x} + \frac{(1-p_x)}{N_x - 1}}.$$

Analogously, we derive expressions for $\overline{W_x^k \varepsilon_{t-k}}$, $\overline{W_y^{t+1} y_0}$, and $\overline{W_y^k \eta_{t-k}}$. Thus,

$$E[(\bar{x}_t - \bar{y}_t)^2] = E\left[\left(\overline{W_x^t x_0} + \sum_{k=0}^{t-1} \overline{W_x^k} \varepsilon_{t-k} - \overline{W_y^t y_0} - \sum_{k=0}^{t-1} \overline{W_y^k} \eta_{t-k}\right)^2\right]$$

$$\underset{E[\eta_{t-k}]=0}{\overset{E[\varepsilon_{t-k}]=0}{=}} E\left[\left(\overline{W_x^t x_0} - \overline{W_y^t y_0}\right)^2\right] + E\left[\left(\sum_{k=0}^{t-1} \overline{W_x^k} \varepsilon_{t-k} - \sum_{k=0}^{t-1} \overline{W_y^k} \eta_{t-k}\right)^2\right]$$

$$= \left(\overline{W_x^t x_0} - \overline{W_y^t y_0}\right)^2 + E\left[\left(\sum_{k=0}^{t-1} \overline{W_x^k} \varepsilon_{t-k} - \sum_{k=0}^{t-1} \overline{W_y^k} \eta_{t-k}\right)^2\right]$$

$$\underset{\text{independent}}{\overset{\varepsilon,\eta}{=}} \left(\overline{W_x^t x_0} - \overline{W_y^t y_0}\right)^2 + E\left[\left(\sum_{k=0}^{t-1} \overline{W_x^k} \varepsilon_{t-k}\right)^2 + E\left[\left(\sum_{k=0}^{t-1} \overline{W_y^k} \eta_{t-k}\right)^2\right]\right]$$

$$\underset{\text{independent}}{\overset{\varepsilon_s,\varepsilon_t;\eta_s,\eta_t}{=}} \left(\overline{W_x^t x_0} - \overline{W_y^t y_0}\right)^2 + \sum_{k=0}^{t-1} E\left[\left(\overline{W_x^k} \varepsilon_{t-k}\right)^2\right] + \sum_{k=0}^{t-1} E\left[\left(\overline{W_y^k} \eta_{t-k}\right)^2\right]$$

$$\underset{(15a)}{\overset{\text{equation}}{=}} \left(\overline{W_x^t x_0} - \overline{W_y^t y_0}\right)^2 + \sum_{k=0}^{t-1} E\left[\left(\sum_{i=1}^{N_x} \varphi_{x,i}^k \varepsilon_{t-k}\right)^2\right] + \sum_{k=0}^{t-1} E\left[\left(\sum_{i=1}^{N_x} \varphi_{y,i}^k \eta_{t-k}\right)^2\right]$$

$$\underset{\text{independent}}{\overset{\varepsilon_s,\varepsilon_t;\eta_s,\eta_t}{=}} \left(\overline{W_x^t x_0} - \overline{W_y^t y_0}\right)^2 + \sum_{k=0}^{t-1} \sigma_x^2 \sum_{i=1}^{N_x} \left(\varphi_{x,i}^k\right)^2 + \sum_{k=0}^{t-1} \sigma_y^2 \sum_{i=1}^{N_y} \left(\varphi_{y,i}^k\right)^2.$$

Note that $\sum_{i=1}^{N_x}\left(\varphi_{x,i}^k\right)^2$ and $\sum_{i=1}^{N_y}\left(\varphi_{y,i}^k\right)^2$ converge. Therefore, asymptotically, the variance in the difference of two different groups' mean values of cultural traits increases linearly in time.

QED

3.3. The role of models and cultural dimensions in group-bound socialization

Next, we deeper scrutinize the impact a role model has on the development of intragroup variance in cultural trait values, VAR^{WIG}. The model's (agent $i = 1$ in W) influence is measured by the parameter r. Moreover, we analyze the effects of two exemplary cultural dimensions on VAR^{WIG}, namely "individualism" and "collectivism" that are incorporated into W via the parameter p. As shown below, both aspects of socialization dynamics are interrelated. Accordingly, Proposition 5 describes the impact of the interplay of r and p on the limit of intragroup variance in trait values:

Proposition 5 VAR^{WIG} increases in r if and only if $p \geq p^{crit}$, where $p^{crit} = \frac{1}{N} - \frac{N-1}{(N-2)N}\left(r - \frac{N}{\alpha}\right)$.

Proof

According to Proposition 3, VAR_t^{WIG} converges and stabilizes at a finite value. We now study the impact of r and p on this limit:

$$VAR^{WIG} = \sigma^2 + \frac{\sigma^2}{N-1}\left(\frac{{\lambda_2}^2}{1-{\lambda_2}^2} + (N-2)\frac{{\lambda_{N-2}}^2}{1-{\lambda_{N-2}}^2}\right) = \sigma^2\left(1 + \frac{1}{N-1}\frac{{\lambda_2}^2}{1-{\lambda_2}^2} + \left(1 - \frac{1}{N-1}\right)\frac{{\lambda_{N-2}}^2}{1-{\lambda_{N-2}}^2}\right).$$

Thus, the effect of the parameters r and p on VAR^{WIG} is determined by their influence on the eigenvalues. First, note that λ_2 is independent of r. Note further that λ_{N-2} increases in r. However, its impact depends on the sign of λ_{N-2}. We distinguish three cases:

1. If $p \geq \frac{1}{N}$, then $0 \leq \lambda_2 < \lambda_{N-2}$. In this case, λ_{N-2} increases in r and thereby $\frac{{\lambda_{N-2}}^2}{1-{\lambda_{N-2}}^2}$ also increases. Hence, VAR^{WIG} increases.

2. If, on the other hand, $p < \frac{1}{N}$ and $\lambda_2 < \lambda_{N-2} < 0$, then λ_{N-2} increases in r while $\frac{{\lambda_{N-2}}^2}{1-{\lambda_{N-2}}^2}$ decreases. Hence, VAR^{WIG} decreases.

3. If $p < \frac{1}{N}$ and $\lambda_2 < 0 \leq \lambda_{N-2}$, then λ_{N-2} increases in r and thereby $\frac{{\lambda_{N-2}}^2}{1-{\lambda_{N-2}}^2}$ increases. Hence, VAR^{WIG} increases.

Thus, VAR^{WIG} increases if and only if $0 \leq \lambda_{N-2}$, i.e., $\frac{Np-1}{N-1} + \frac{r-\frac{N}{\alpha}}{N-2} \geq 0$. Solving for p in case of equality yields the stated critical value for p.

QED

From the finding formulated in Proposition 5 it follows that if $p < p^{crit}$, intragroup variance in trait values is smaller when a more prominent role model takes effect in cultural transmission. Note that if $p \geq \frac{1}{N}$, VAR^{WIG} necessarily increases in r. Note further that p^{crit} equalizes p and an ordinary fellows' weight on all employees except the model, i.e., it solves $p = \frac{\left(1-\left(p+r-\frac{N}{\alpha}+\frac{1-p}{(N-1)}\right)\right)}{N-2}$. Finally, note that p^{crit} decreases in r.

Next, Proposition 6 captures the constraining influence of increasing group size N on the effect of r on VAR^{WIG}, i.e., on the effectiveness of role models in group-bound socialization. Let

$P(N)$ denote the set of parameters (r, p) such that VAR^{WIG} decreases in r. Then, we can state the following result:

Proposition 6 The mass of $P(N)$ decreases in N for $N \geq 5$.

Proof

There are three restrictions that must hold:

1. $p + r - \frac{N}{\alpha} < 1 \Leftrightarrow p < 1 + \frac{N}{\alpha} - r$ - the weight of the role model is smaller than 1,

2. $r - \frac{N}{\alpha} > 0 \Leftrightarrow r > \frac{N}{\alpha}$ - a positive net role model bias,

3. $p < p^{crit} = \frac{1}{N} - \frac{N-1}{(N-2)N}\left(r - \frac{N}{\alpha}\right)$ - and the condition that VAR^{WIG} decreases in r.

The last condition can be expressed by:

$$p < p^{crit} = \frac{1}{N} - \frac{N-1}{(N-2)N}\left(r - \frac{N}{\alpha}\right) = \frac{1}{N} - \frac{N-1}{(N-2)\alpha} - \frac{N-1}{(N-2)N} r.$$

In the following, we show that restriction 3. is the binding condition. We see that $\frac{1}{N} + \frac{N-1}{(N-2)\alpha} < 1 < 1 + \frac{N}{\alpha}$, i.e., the axis intercept of 1. lies above the one of 3.

Set $k \equiv r - \frac{N}{\alpha}$. Then, inequality 1. transforms into: $p = 1 - k$. Moreover, inequality 3. can be expressed as: $p = \frac{1}{N} - \frac{N-1}{(N-2)N} k$. We see that these two lines have an interception with $k > 1$ implying that $r > 1$ must hold. Therefore, the limiting line of 3. (for $0 < r < 1$) lies below the limiting line of 1.

Finally, we evaluate the limiting line of 3. at $r = 1$ and find that: $\frac{1}{N} + \frac{N-1}{(N-2)\alpha} - \frac{N-1}{(N-2)N} 1 > 0$.

From this it follows that the parameter range (p, r) within which VAR^{WIG} decreases is given by

$$P(N) = \int_{\frac{N}{\alpha}}^{1} \left(\frac{1}{N} + \frac{N-1}{(N-2)\alpha} - \frac{N-1}{(N-2)N} r\right) dr = \left(\frac{1}{N} + \frac{N-1}{(N-2)\alpha}\right)\left(1 - \frac{N}{\alpha}\right) - \frac{N-1}{2(N-2)N}\left(1 - \left(\frac{N}{\alpha}\right)^2\right).$$

The derivative of this expression w.r.t. N yields: $\frac{1}{4}\left(-\frac{2}{\alpha^2} + \frac{(\alpha-2)^2}{\alpha^2(N-2)^2} - \frac{3}{N^2}\right)$.

For large N, this term is negative since the very small middle term. More precise:

$$-\frac{2}{\alpha^2}+\frac{(\alpha-2)^2}{\alpha^2(N-2)^2}-\frac{3}{N^2}\underbrace{\leq}_{\alpha\to\infty}\frac{1}{(N-2)^2}-\frac{3}{N^2}<0 \text{ for } N\geq 5.$$

This implies that for $N \geq 5$, the parameter range (p, r) decreases with an increasing N.

The development of intragroup variance in cultural traits is expected to vary with the sort and strength of cultural dimensions, such as, in our case, “individualism” and “collectivism”. Therefore, we analyze the effect of p on VAR^{WIG} by stating the following:

Proposition 7 (1) In a cultural environment with $p \geq \frac{1}{N}$, VAR^{WIG} increases in p. (2) In a cultural environment with $p < \frac{1}{N}$, we differentiate two cases: (a) if $p < p^{crit}$, VAR^{WIG} decreases in p. (b) If $p \geq p^{crit}$, VAR^{WIG} decreases in p if and only if $\frac{\lambda_2}{\left(1-{\lambda_2}^2\right)^2}+(N-2)\frac{\lambda_{N-2}}{\left(1-{\lambda_{N-2}}^2\right)^2}<0$.

Proof

$VAR^{WIG}=\sigma^2\left(1+\frac{1}{N-1}\frac{{\lambda_2}^2}{1-{\lambda_2}^2}+\left(1-\frac{1}{N-1}\right)\frac{{\lambda_{N-2}}^2}{1-{\lambda_{N-2}}^2}\right)$. Thus, the effects of the parameters r and p on VAR^{WIG} are determined by their effects on the eigenvalues. Note that both eigenvalues increase in p. However, their impact depend on the signs of λ_2 and λ_{N-2}. We distinguish three cases:

(1) If $p \geq \frac{1}{N}$, then $0 \leq \lambda_2 < \lambda_{N-2}$. In that case, both eigenvalues increase in p and thereby $\frac{{\lambda_2}^2}{1-{\lambda_2}^2}$ and $\frac{{\lambda_{N-2}}^2}{1-{\lambda_{N-2}}^2}$ increase. Hence, VAR^{WIG} increases.

(2) If $p < \frac{1}{N}$ and $\lambda_2 < \lambda_{N-2} < 0$, then both eigenvalues still increase in p, but $\frac{{\lambda_2}^2}{1-{\lambda_2}^2}$ and $\frac{{\lambda_{N-2}}^2}{1-{\lambda_{N-2}}^2}$ decrease. Hence, VAR^{WIG} decreases.

(3) If $p < \frac{1}{N}$ and $\lambda_2 < 0 \leq \lambda_{N-2}$, then both eigenvalues again increase in p, while $\frac{{\lambda_2}^2}{1-{\lambda_2}^2}$ decreases and $\frac{{\lambda_{N-2}}^2}{1-{\lambda_{N-2}}^2}$ increases. Thus, the effect on VAR^{WIG} depends on the weight of the two opposing effects. Taking the derivative of VAR^{WIG} w.r.t. p yields the last claim.

Note that $\lambda_{N-2} = 0 \Leftrightarrow p = \frac{1}{N} - \frac{N-1}{(N-2)N}\left(r - \frac{N}{\alpha}\right)$, which defines the critical value for p, separating case (2) and (3).

QED

3.4. The pace of convergence of intragroup variance in cultural trait values

In our model, the convergence rate and the limit of the expected intragroup variance in cultural trait values are governed by group size, N, the role model's influence, r, and cultural dimensions such as the degree of "individualism" or "collectivism", measured by p. Consequently, the following proposition relates the rate of convergence of within-group variance in trait values, VAR_t^{WIG}, to the parameters N, r, and p:

Proposition 8 (1) In a cultural environment with $p \geq \frac{1}{N}$, the rate of convergence decreases in p and r. (2) In a cultural environment with $p < \frac{1}{N}$, we consider two cases: (a) if $p < p_{conv}^{crit} = \frac{1}{N} - \frac{N-1}{2(N-2)N}\left(r - \frac{N}{\alpha}\right)$, then the convergence rate increases in p. (b) If $p \geq p_{conv}^{crit}$, then the rate of convergence decreases in p and r.

Proof

$$VAR_t^{WIG} = \sigma^2\left(1 + \frac{1}{N-1}\lambda_2^2\frac{1-\lambda_2^{2t}}{1-\lambda_2^2} + \left(1 - \frac{1}{N-1}\right)\lambda_{N-2}^2\frac{1-\lambda_{N-2}^{2t}}{1-\lambda_{N-2}^2}\right) + \sigma_1^2\lambda_2^{2(t+1)} + \sigma_{-1}^2\lambda_{N-2}^{2(t+1)} =$$

$$\sigma^2\left(1 + \frac{1}{N-1}\lambda_2^2\left(\frac{1}{1-\lambda_2^2} - \frac{\lambda_2^{2t}}{1-\lambda_2^2}\right) + \left(1 - \frac{1}{N-1}\right)\lambda_{N-2}^2\left(\frac{1}{1-\lambda_{N-2}^2} - \frac{\lambda_{N-2}^{2t}}{1-\lambda_{N-2}^2}\right)\right) + \sigma_1^2\lambda_2^2\lambda_2^{2t} +$$

$$\sigma_{-1}^2\lambda_{N-2}^2\lambda_{N-2}^{2t} =$$

$$\sigma^2\left(1 + \frac{1}{N-1}\frac{\lambda_2^2}{1-\lambda_2^2} + \left(1 - \frac{1}{N-1}\right)\frac{\lambda_{N-2}^2}{1-\lambda_{N-2}^2}\right) - \sigma^2\left(\frac{1}{N-1}\frac{\lambda_2^2}{1-\lambda_2^2}\lambda_2^{2t} + \left(1 - \frac{1}{N-1}\right)\frac{\lambda_{N-2}^2}{1-\lambda_{N-2}^2}\lambda_{N-2}^{2t}\right) +$$

$$\sigma_1^2\lambda_2^2\lambda_2^{2t} + \sigma_{-1}^2\lambda_{N-2}^2\lambda_{N-2}^{2t} = VAR^{WIG} + \left(\lambda_2^2\sigma_1^2 - \frac{\sigma^2}{N-1}\frac{\lambda_2^2}{1-\lambda_2^2}\right)\lambda_2^{2t} + \left(\sigma_{-1}^2\lambda_{N-2}^2 - \sigma^2\left(1 - \right.\right.$$

$$\left.\left.\frac{1}{N-1}\right)\frac{\lambda_{N-2}^2}{1-\lambda_{N-2}^2}\right)\lambda_{N-2}^{2t}.$$

Thus, we can write within-group variance at time t as:

$$VAR_t^{WIG} = a_0 + a_1\mu_2^t + a_2\mu_{N-2}^t,$$

$$VAR_t^{WIG,s} = \sigma^2\left(1 + \lambda^2\frac{1-\lambda^{2t}}{1-\lambda^2}\right) + \sigma_0^2\lambda^{2(t+1)}$$

where

$$a_0 = VAR^{WIG}, a_1 = \lambda_2^2\sigma_1^2 - \frac{\sigma^2}{N-1}\frac{\lambda_2^2}{1-\lambda_2^2}, a_2 = \sigma_{-1}^2\lambda_{N-2}^2 - \sigma^2\left(1-\frac{1}{N-1}\right)\frac{\lambda_{N-2}^2}{1-\lambda_{N-2}^2}, \mu_2 = \lambda_2^2, \mu_{N-2} = \lambda_{N-2}^2.$$

Apply the following typical definition for the rate of convergence p for a convergent sequence of real number x_t with limit x and initial value x_0: $R = \lim_{t\in□} \sup\left(\frac{|x_t - x|}{|x_0 - x|}\right)^{1/t}$. In our case, this implies $R = \lim_{t\in□} \sup\left(\frac{|a_1\mu_2^t + a_2\mu_{N-2}^t|}{|x_0 - x|}\right)^{1/t} = \max\{\mu_2, \mu_{N-2}\}$. In the following, we therefore analyze the impact of r, and p on $\max\{|\lambda|_2, |\lambda|_{N-2}\}$.

Note that for $p \geq \frac{1}{N}$, $0 \leq \lambda_2 < \lambda_{N-2}$. In that case, the partial derivatives of λ_{N-2} determine the impact of p and r on the rate of convergence. Since λ_{N-2} increases in p and r, the rate of convergence decreases in p and r. Note, that $\frac{\partial\lambda_{N-2}}{\partial N} = \frac{1-p}{(N-1)^2} - \frac{r-\frac{2}{\alpha}}{(N-2)^2}$. Hence, if the net role model bias is sufficiently small, the second largest eigenvalue increases in N, and thereby lowers the rate of convergence. If, on the other hand, p is large and the role model bias sufficiently strong, an increase in N induces the opposite effect.

If, on the other hand, $p < \frac{1}{N}$, two cases can be distinguished: (1) $|\lambda_2| > |\lambda_{N-2}| \Leftrightarrow 2\frac{N-2}{N-1}(1 - Np) > r - \frac{N}{\alpha}$ and (2) $|\lambda_2| \leq |\lambda_{N-2}| \Leftrightarrow 2\frac{N-2}{N-1}(1 - Np) \leq r - \frac{N}{\alpha}$. In the former case, the partial derivatives of λ_2 determine the impact of the respective parameter on the rate of convergence. Since λ_2 increases in p and does not depend on r, the rate of convergence increases in p. In the latter case, the partial derivatives of λ_{N-2} determine the impact of the respective parameter on the rate of convergence. Again, λ_{N-2} increases in p and r, while the rate of convergence decreases in p and r.

$$\text{for } p < \frac{1}{N}: |\lambda_2| = \frac{1-Np}{N-1} < \left|\underbrace{\frac{Np-1}{N-1}}_{<0} - \underbrace{\frac{r-\frac{N}{\alpha}}{N-2}}_{>0}\right| = \frac{1-Np}{N-1} + \frac{r-\frac{N}{\alpha}}{N-2} \Leftrightarrow 2\frac{1-Np}{N-1} < \frac{r-\frac{N}{\alpha}}{N-2}$$

$$1 - Np < \frac{N-1}{2}\frac{r-\frac{N}{\alpha}}{N-2} \Leftrightarrow p > \frac{1}{N} - \frac{N-1}{2N}\frac{r-\frac{N}{\alpha}}{N-2}.$$

Thus, if $p \leq \frac{1}{N} - \frac{N-1}{2N}\frac{r-\frac{N}{\alpha}}{N-2}$ then $|\lambda_2|$ is the second largest eigenvalues according to absolute value. Since, $\frac{\partial \lambda_2}{\partial N} = \frac{1-p}{(N-1)^2} > 0$, and $\lambda_2 < 0$, $|\lambda_2|$ decreases and thereby the rate of convergence increases. If $p > \frac{1}{N} - \frac{N-1}{2N}\frac{r-\frac{N}{\alpha}}{N-2}$, then $\lambda_{N-2} > 0$ is the second largest eigenvalue in absolute terms. Again, $\frac{\partial \lambda_{N-2}}{\partial N} = \frac{1-p}{(N-1)^2} - \frac{r-\frac{2}{\alpha}}{(N-2)^2}$. Therefore, the same reasoning as for $p \geq \frac{1}{N}$ applies, i.e., for a sufficiently low net role model bias, λ_{N-2} increases in N while the rate of convergence decreases. In summary, if $p > \frac{1}{N} - \frac{N-1}{2N}\frac{r-\frac{N}{\alpha}}{N-2}$ and $\frac{1-p}{(N-1)^2} - \frac{r-\frac{2}{\alpha}}{(N-2)^2} > 0 \Leftrightarrow 1-p > \frac{(N-1)^2}{(N-2)^2}\left(r - \frac{2}{\alpha}\right) \Leftrightarrow 1 - \frac{(N-1)^2}{(N-2)^2}\left(r - \frac{2}{\alpha}\right) > p$, then an increase in N lowers the rate of convergence. These conditions, therefore, add up to: $\frac{1}{N} - \frac{N-1}{2N(N-2)}\left(r - \frac{N}{\alpha}\right) < p < 1 - \frac{(N-1)^2}{(N-2)^2}\left(r - \frac{2}{\alpha}\right)$.

QED

4. The governance of socialization in organizations and internal transaction costs

Our model of cultural evolution enables us to derive some interesting insights for organization theory concerning governance structures, socialization processes therein, and related transaction costs due to CD. We differentiate between alternative modes of organizational governance that differ in the kinds of socialization processes they enable. Hence, our contribution to the economics of governance (Williamson, 2005) concerns the implementation of organizational structures that economize on internal transaction costs by facilitating socialization processes that reduce CD between agents or groups. Transaction cost-minimizing adaptation to a culturally heterogeneous (social) environment is claimed to be a key purpose of economic organization, especially of multinational enterprises (also Kogut and Singh, 1988; Schein, 1990; Hennart, 2003). First, this section addresses the problem of CD as an additional attribute of transactions and, second, offers some principles of the governance of socialization that capture the problem of the development of intra- and intergroup CD. We show that concrete lessons for organization theory reside in our analysis above and that it is possible to derive refutable implications, inviting empirical testing.

4.1. CD as an attribute of transactions within organizations

Williamson (2002, 2005) names the transaction as the basic unit of analysis when it comes to characterize different governance structures that are meant to manage transactions. For this purpose, he defines several attributes of transactions – asset specificity, disturbances, frequency and adaptive needs – that are to be aligned with appropriate governance structures, which differ in their cost, in an economizing way. We argue that CD is another important attribute of transactions, especially in an intraorganizational context: transaction cost theorists associate higher CD with higher costs of transaction due to communication and information costs or less efficient transfer of knowledge, competencies, and skills (e.g., Buckley and Casson, 1976; Kogut and Zander, 1993; Bartlett and Ghoshal, 1998; Nahapiet and Ghoshal, 1998; Buckley and Carter, 2004). Disparate cultural endowments of agents, i.e., different languages, values, frames of reference, beliefs, norms, world views, etc., underlie CD-induced internal transaction costs. For example, employees responsible for encoding and decoding of knowledge in transactions not sharing implicit assumptions and interpretations cause additional costs in the intraorganizational transfer of knowledge. Consequently, the collaboration of employees, who have different cultural backgrounds leads to higher intraorganizational transaction costs as compared to organizational units whose members conform to one culture. While disjoint skill sets of members of a multi-cultural group can potentially yield diversity gains, communication and transfer problems due to CD entail higher costs of transacting (Lazear, 1999; for evidence from psychology see van Knippenberg and Schippers, 2007). Furthermore, CD, as an attribute of newly incorporated transactions, is an important factor in mergers and acquisitions' failures or successes and entry mode choice (e.g., Kogut and Singh, 1988; Weber et al., 1996). It is also applied to explain organizational performance in general, foreign investment, headquarter-subsidiaries relations, recruitment policies, and make-or-buy decisions (reviewed in Shenkar, 2001).

Hence, a central lesson of our study of socialization dynamics in organizations is that they lead to different internal transaction costs for these are likely to vary with CD between agents or groups. Lower CD in homogenous group cultures or between separate groups economizes on communication and transfer costs and enables the putting together of disjoint skills and competencies. Therefore, modes of governance as organizational constructions are a means by which to infuse socialization dynamics that mitigate the problem of CD as an attribute of intraorganizational transactions. One strategy of firms to minimize internal transaction costs is, therefore, to devise governance structures supportive of socialization dynamics that close CD within and between groups or organizational units. Consequently, key features of socialization governance should vary along intraorganizational constellations of CD. Interpreting governance structures in this way infuses further operational content to this concept. A comparative analysis of organizational structures in terms of their transaction costs due to CD should be feasible as well as a corresponding predictive theory of economic organization.[3]

4.2. Modes of organizational governance of socialization dynamics: some principles

Our model of cultural evolution demonstrates that alternative modes of socialization governance can lead to convergence or divergence processes of intra- and intergroup CD. Furthermore, we suggest that the governance of socialization processes in organizations is complicated by the fact that employees have been presocialized in their prior social environments, for example, their national cultures (e.g., Ralston et al., 1997). People's behavior is strongly affected by their previous experiences in the family, school, and society as a whole. Hence, initial cultural trait values, the relative strength of learning biases, and cultural dimensions, such as "individualism" or "collectivism" (see Hofstede et al., 1990; Greif, 1994) are expected to vary among individuals due to prior socialization. These aspects of individuals' cultural backgrounds affect later intraorganizational socialization dynamics.[4] Moreover, these biases and cultural dimensions also differ across organizations endowed with different corporate cultures: strong firm cultures may emphasize collective goals and interaction, while in other organizations agents may focus on their personal, individual agendas. Therefore, when governing socialization processes in and between groups, organizations should take into account employees' prior socialization histories and a business unit's idiosyncratic culture for these take effect on agents' susceptibility to certain socialization processes and thus on intra- and intergroup CD. In the following, we draw some concrete implications for organizational design from the theoretical insights of our formal analysis.

Based on a simplified cultural transmission table, W^s, which does not include an extraordinarily influential role model or business leader, Proposition 1 presents a general finding

[3] For an empirical research agenda to emerge from our perspective on intraorganizational socialization, it is necessary to estimate some key parameters capturing the main features of the transmission matrix, such as, for example, group size, the relative extent of role model bias versus peer group influence, or the effect of well-established cultural dimensions, such as "individualism" or "collectivism" on individual learning behavior.

[4] Further cultural dimensions not considered in the present model, such as "power distance" that measures the acceptance of unequally distributed power within groups (Hofstede, 1989), can affect, for example, a role model's weight in cultural transmission. What is more, cultural dimensions may themselves be subject to change during socialization within the organization.

of socialization governance: group-bound joint socialization leads to a reduction of intragroup variance in cultural trait values, irrespective of individual learning processes. Communication and interaction among members thus decreases within-group CD. In fact, evidence from social psychology strongly supports the existence of such general convergence processes in groups (e.g., Festinger, 1950; Bandura, 1977; Levine and Moreland, 1998). Moreover, Proposition 2 delivers a condition that is to be met for decreasing intragroup variance if we allow for an influential role model taking effect in the socialization of employees, as captured by our transmission matrix W: group-bound socialization processes including a model also lead to a reduction of intragroup variance when individual learning forces are not too strong.

The Corollary of Proposition 2 presents the details of sufficient conditions for intragroup variance to monotonically decrease or increase in the presence of a role model. We see that if the variance of the random component in individual learning, σ^2, does not exceed a certain threshold, VAR_t^{WIG} decreases. Otherwise, if individual learning introduces a too high amount of extra variation to individuals' trait values including those of the role model, intragroup variance in trait values and corresponding CD among group members increases. Strong individual learning forces then offset the harmonizing effect of communication and interaction among employees. As long as organizations avoid a corporate culture with high levels of individual learning, which would indicate low group coherence and focus on personal (potentially opportunistic) agendas, within-group CD decreases due to shared socialization.

In addition, the Corollary states that in a culturally very homogenous group with sufficiently small initial intragroup variance in trait values, this variance can be expected to initially increase due to individual learning processes. Intragroup variance also raises in groups whose members are endowed with sufficiently large values for p, indicating a high degree of individualism or a low level of group interaction, in combination with a relatively small net role model bias, as measured by $(r - \frac{N}{\alpha})$. Individuals then primarily rely on their own cultural trait values in their updating processes. If, on the other hand, the intragroup variance among non-role models and the cultural distance of the model to the group's average trait values are sufficiently high, then VAR_t^{WIG} decreases, irrespective of the strength of individual learning forces. Given the empirical evidence from social psychology as to the harmonizing effects of group-bound communication (see references above) and role models (e.g., Labov, 2001; Chudek et al., 2012) on group behavior, we assume VAR_t^{WIG} to decrease in most cases. However, the Corollary of Proposition 2 theoretically predicts cases where we expect this empirical regularity to be violated. Finally, Proposition 3 states that intragroup variance in cultural trait values stabilizes at a finite value in the course of group-bound socialization. Due to the homogenization effect of joint socialization in organizational units, variance in traits does not grow beyond a finite value irrespective of ongoing individual learning. As laid out by Propositions 1 through 3, socialization in groups is expected to bridge CD by reducing and stabilizing the variance in cultural traits among individuals, i.e., group-bound communication and interaction explains why the variance in behaviors, norms, attitudes, etc. among employees tends to decrease and converge over time. Hence, we claim that homogenization effects of shared socialization can lower intraorganizational transaction costs via reducing intragroup CD. We state the following first principle of governance of socialization in organizations:

Principle 1 *Governance structures that allow shared socialization experiences among members of an organizational unit lower cultural distance among individual employees and thus economize on internal transaction costs.*

Mas and Moretti (2009), for example, show that work ethos is a cultural trait whose variance and convergence among group members depends on the influence of employees' social environment within organizations and role models therein. Moreover, according to Pettigrew and Tropp (2000), mixing between individuals with different cultural identities (or cultural endowments) and subsequent prolonged communication and interaction breaks down stereotypes and encourages deeper mutual understanding, a process expected to lower CD between agents (also Boisjoly, Duncan et al., 2006). Hence, a distinctive advantage of the governance structure of the firm is that it provides a framework for group-bound socialization reducing CD among employees and thus internal transaction costs – a benefit not feasible via market contracting. This can be considered another reason why firms exist as a form of economic organization (see Coase, 1937; Alchian and Demsetz, 1972).

The consequence of idiosyncratic socialization processes in distinct (sub-) groups has been formulated by Proposition 4: the variance in the difference of the mean values of cultural traits between separated groups, denoted by VAR_t^{BTG}, increases (asymptotically) as a linear function of time. This has concrete implications for CD within organizations. Even if two groups consist of members that have all been socialized in the same culture and have acquired the same initial cultural endowment, subsequent within-group learning dynamics will, *ceteris paribus*, increase intergroup CD. This is due to two effects: (1) individual learning introduces variation to a group's cultural traits (as captured by the random component ε) and (2) the cultural transmission matrices capturing the respective groups' inner socialization dynamics will never be exactly identical. There will always be some variance in, for example, the influence of a particular role model in socialization in a certain group because of differences in personal characteristics, such as charismatic potential or prestige. As a consequence of the lack of interaction between the two groups, these changes in trait values are not "averaged out" but rather accumulated over time. From this follows a cultural divergence principle in socialization governance:

Principle 2 *Idiosyncratic socialization processes within organizational units necessarily lead to an increase in intergroup cultural distance and thus higher costs of transacting between them.*

Organizational governance structures have to cope with this permanent challenge of rising intergroup CD: given our first principle of socialization governance, we expect shared socialization experiences to also alleviate the problem of rising CD between organizational units. Socialization governance structures that enable systematic exchange among groups and that establish ongoing intergroup communication lower intraorganizational transaction costs. At the same time, the cultural divergence principle may also underlie appearing growth crises in organizations that have been split up in several non-communicating subgroups with increasing firm size.

Therefore, we also expect increasing intergroup CD in the case of a large group partitioned into two or more subgroups whose respective members confine themselves – at least to a great extent – to communicating with one another: each subgroup will then develop its own cultural endowment as a result of its idiosyncratic pattern of social interaction and individual learning.[5] Variance in trait values within subgroups converges (Principle 1), while CD between subgroups grows (Principle 2). If contributions of all subgroups are required for attaining unit goals, this process of divergence of CD between subgroups is likely to impair organizational performance via increased internal transaction costs. Business leaders may, therefore, deliberately devise socialization governance structures that avoid the emergence of isolated subgroups within business units. The development of distinct dialects for subgroups of a population provides an empirical example for increasing intergroup CD and concomitant convergence of CD within

[5] Such constellations of larger group structures can be captured by specifying the social interaction structures in the cultural transmission table, W. It allows for the existence of more or less isolated subgroups.

groups: Labov and Harris (1986) show that Black English of different metropolitan areas has converged, while it diverged at the same time from (White) Standard American English. The authors take this observation as an indicator of growing CD between these groups due to a low level of social interaction among them.

Business leaders play an outstanding role in socializing employees by providing prestigious role models for cultural learning within groups (e.g., Milgram, 1974; Schein, 1992; Van den Steen, 2010).[6] In line with this general insight, Proposition 5 found that more influential models can reduce the variance in a group's trait values in socialization: as long as $p < p^{crit}$, a role model's rising weight in cultural transmission, as measured by r, decreases intragroup variance in cultural traits, i.e., the model lowers aggregate intragroup CD.[7] We suggest two settings in which this condition is fulfilled: (1) a relatively low value of p may imply individuals presocialized in a collectivistic cultural environment rendering them more susceptible to group influence including the role model. (2) $p < p^{crit}$ is also met if a collectivistic, cooperative corporate culture motivates employees – irrespective of their prior cultural backgrounds – to subordinate their personal agendas. They would then put a relatively low weight on own cultural traits (low p) and subscribe to the group's and model's goals and values, i.e., they would put a relatively high weight on these traits when updating their own ones. Employees would be willing to follow a charismatic, prestigious role model and would exhibit a high degree of identification with the organization (see Akerlof and Kranton, 2005). This finding leads to a principle concerning the potential role of models in governing socialization:

Principle 3 *Governance structures that rely on influential role models in socialization can lower intragroup cultural distance and therefore reduce transaction costs between members.*

If, on the other hand, $p \geq p^{crit}$, then (1) a pronounced cultural dimension of "individualism" in prior socialization may have led to agents less amenable to the influence of their social environment including the role model. (2) $p \geq p^{crit}$ could also imply a situation in which agents' personal – potentially opportunistic – agendas are prioritized over the corporation's collective goals. In both cases, variance in trait values increases in r, i.e., assigning an influential model could tighten the negative transactional effects of CD within a business unit. Consequently, as to

---

[6] The outstanding influence of some individuals can be due to differences in, for example, agents' charismatic potentials (Milgram, 1974; Langlois, 1998).

[7] Formally, the additional weight of the role model establishes a more balanced weighting of individuals' trait values, thereby lowering intragroup variance.

the assignment of role models, the choice of modes of socialization governance depends on individuals' cultural backgrounds and a corporation's culture: if employees have enjoyed presocialization in a collectivist cultural context or if firm culture leads to high coherence among employees (both captured by low values of p), assigning influential, charismatic role models to business units probably is an appropriate means to reduce within-group CD. If, however, agents experienced a prior socialization episode in a pronounced individualistic cultural environment or if firm culture is weak, other modes of socialization governance will be more effective in lowering intragroup CD and corresponding transaction costs.[8] Hence, while the assignment of role models is another important tool of socialization governance, their effect on intragroup variance in trait values is mediated by a group's culture.

Group size and culture affect many aspects of group-bound socialization (e.g., Olson, 1994; Spoor and Kelly, 2004). Therefore, the structures of business units as well as the implementation of certain corporate cultures are important means of socialization governance. For instance, there is a group size and culture-related problem that a role model faces and that derives from Propositions 5 and 6: as soon as a business leader fails to keep up a collectivistic group culture with a sufficiently low p, within-group CD starts to increase due to (learned) personal goals becoming more important than collective ones.[9] As an unavoidable effect of increasing unit size, the intensity of communication and the frequency of face-to-face contacts between a business leader and a single group member necessarily dwindles with growing group size (see Cordes et al., 2008). This makes it harder for a role model to influence individual group members and to maintain a strong group culture. Moreover, Proposition 6 formally shows an implication of growing group size: it reduces a role model's potential effectiveness in intragroup socialization by decreasing the set of parameters (p, r) such that intragroup variance in cultural trait values decreases in r (for $N \geq 5$). Hence, the greater a unit's size, the more narrow is the range of group cultures and role model bias strengths within which a business leader can reduce CD among group members. A role model's capacity to lower the variance in a group's cultural traits is, therefore, subject to constraints imposed by the size of organizational units. This leads to a "dilution principle" in organizational design of socialization governance structures:

[8] p^{crit} decreases in r, i.e., the higher a model's weight in socialization, the more narrow is the range of collectivist group cultures in which she can lower within-group CD. This may reflect the fact that an extraordinarily strong personality is more likely to evoke social resistance on the part of ordinary group members.

[9] If $p \geq p^{crit}$, VAR^{WIG} necessarily increases in r, see Proposition 5.

Principle 4 *Increasing group size lowers a role model's effectiveness as a socialization governance response to reduce intragroup CD and corresponding transaction costs.*

A role model's potential to take effect in socialization would be maximized in a setting where few new recruits are paired with a senior manager as a mentor since social interaction would be intense and due to the fact that the set of parameters (p, r) such that VAR^{WIG} falls in r, decreases for $N \geq 5$. Such a strong mode of model-based socialization governance has been successfully employed by firms and can be expected to reliably reduce intraorganizational CD.[10] Another interesting feature of this "dilution principle" of socialization governance is that it has implications for dynamic governance structure: the size-contingent constraints on the influence of business leaders in socialization constitute potential limits to firm growth or the size of subunits. It is, therefore, a potential reason for systematically appearing growth crises in organizational development (e.g., Greiner, 1998; Cordes et al. 2010) or poor performance of subunits (e.g., Wagner III, 1995).

Above, Proposition 7 has shown how the development of intragroup CD is affected by the varying strength of a cultural dimension. In an environment where $p \geq \frac{1}{N}$ holds, intragroup variance in cultural traits increases with a rising level of individualism, as measured by growing values of p. Given a certain group size, this condition may be met in organizational units whose members already exhibit a relatively high level of "individualism" due to a weak firm culture or prior socialization. An increase in this dimension would turn agents even less susceptible to group-bound socialization, as a result augmenting within-group CD. Since the likelihood that the condition $p \geq \frac{1}{N}$ is fulfilled increases, *ceteris paribus*, with growing group size, the empirically more relevant case may be larger organizational units whose members start to focus more on their personal agendas, i.e., their own cultural traits, causing within-group CD to rise. Given this finding, the next principle of socialization governance in organizations is this:

Principle 5 *When "individualism" among employees increases, CD between agents and corresponding transaction costs are more likely to grow in larger groups.*

This is in line with evidence from social psychology that shows that members of larger, more anonymous groups tend to feel less attached to other group members (e.g., Levine and Moreland, 1990, 1998; Forsyth, 2006, chapter 9) – a potential manifestation of increased within-group CD.

[10] See, e.g., Monica Higgins' (2005) case study on the "Baxter Boys".

Moreover, these findings are another reason for organizations to keep unit sizes small in transaction cost-minimizing socialization governance, especially when recruiting individualistically presocialized employees.

In a collectivistic cultural environment with $p < \frac{1}{N}$, we differentiate two cases: (1) as long as $p < p^{crit}$, indicating "collectivism" to dominate among group members, VAR^{WIG} decreases in p. Thus, a reduction of the influence of the group and more "self-reliant" agents would lower intragroup CD up to a threshold given by p^{crit}. Formally, this effect is due to a more equal weighting of peers and the model in an agent's social environment. (2) If the level of individualism exceeds the threshold, i.e., if $p \geq p^{crit}$, then a further increase in individualism reduces intragroup variance only if a certain condition is met (see proof of Proposition 7), otherwise VAR^{WIG} increases. The latter is due to a more unequal weighting of individuals' own weights and those of peers and the role model. For an agent's p values are both a result of socialization before entering the organization and a corporation's – changing – culture, we state the following general proposition:

Principle 6 *The effect of a cultural dimension on cultural distance and intraorganizational transaction costs depends on the strength of this cultural dimension in group members' prior socialization and an organizational unit's culture.*

These insights bear some transaction cost-relevant implications for a firm's composition of organizational units and its recruitment strategy: groups of agents who enjoyed presocialization in a collectivist environment may – up to a limit – profit from a corporate culture emphasizing a higher degree of individual autonomy, while groups composed of employees with a strongly individualistic prior imprinting would gain from a more team-oriented firm culture.

Next, we look at the determinants of the pace of convergence of intragroup variance in cultural trait values in the course of socialization. Faster convergence yields organizations a transaction cost-related advantage: within-group CD is lower the higher is the rate of convergence. Following Proposition 8, the set of parameters (p, r) for which the pace of convergence of intragroup variance increases in p or r, decreases with growing group size. Therefore, for a broader range of group cultures and role model weights, socialization in small groups facilitates a higher pace of convergence and lower final intragroup variance in cultural trait values as compared to larger groups. Face-to-face communication, cooperation, and identification, for instance, are more intensive in small groups and foster convergence (e.g., Asch, 1955; Levine and

Moreland, 1998; Bond and Smith, 1996; Forsyth, 2006). We capture this observation by a "socialization in small groups principle":

Principle 7 *Governance structures that rely on small group socialization are relatively more efficient in economizing on transaction costs for they allow for faster convergence of and lower final variance in cultural traits within an organizational unit.*

Hence, a firm can rely on a mode of governance of socialization based on small organizational units to more rapidly and efficiently cope with internal CD and corresponding transaction costs, presumably especially in the case of newly recruited employees.

Furthermore, also the cultural dimensions of "individualism" and "collectivism" affect the pace of convergence of intragroup variance: if $p \geq \frac{1}{N}$, i.e., if individualism among employees is high or if group size is large, the rate of convergence of the intragroup variance in trait values decreases with an increasing level of "individualism", as reflected by a growing p, yielding higher final within-group CD. The more agents rely on their own cultural trait values in socialization,, i.e., the less they subscribe to firm goals, the slower is convergence. The same holds true if $p < \frac{1}{N}$ and $p \geq p_{conv}^{crit}$. As to the effect of p on speed of convergence, an exception is the case when $p < \frac{1}{N}$ and $p < p_{conv}^{crit}$, where an increasing p raises the rate of convergence and lowers final CD in a group. In such a pronounced collectivistic environment, agents taking more effect on their own socialization would accelerate convergence. We state:

Principle 8 *For most group culture settings, a rising level of "individualism" among members decreases the pace of convergence of intragroup variance in cultural traits and increases final within-group CD and transaction costs.*

One way for firms to cope with this challenge is the deliberate implementation of a collectivistic firm culture with strong interaction and identification on the part of employees that would enable more rapid socialization and lower final CD.

Finally, also following from Proposition 8, if $p \geq \frac{1}{N}$ is given, assigning a more influential role model to a group reduces the pace of convergence of intragroup variance in trait values, i.e., the rate of convergence decreases in r leading to higher final within-group CD.[11] This finding is captured by our last principle of socialization governance:

---

[11] Again, the same holds if $p < \frac{1}{N}$ and $p \geq p^{crit}$.

Principle 9 *In individualistic cultural environments, role models are likely to delay convergence of trait values and to raise CD and transaction costs among group members.*

Consequently, the assignment of influential role models as a governance of socialization response to intraorganizational CD faces constraints constituted by group size and culture. In highly collectivistic environments, however, where individualism becomes insignificant, role models can have a harmonizing effect also in larger groups, as also shown by evidence form social psychology.

Given these principles of socialization governance, transaction cost-reducing governance can be accomplished through organizational structures facilitating socialization processes on the part of their members that lower intra- and intergroup CD. For this purpose, organizations can implement alternative modes of socialization governance: allowing shared socialization experiences among employees (Principle 1), organizing intergroup exchange (following from Proposition 2), assigning influential role models to groups endowed with a certain culture (Principle 3), adjusting group size to facilitate socialization in small groups that leads to fast and effective reduction of CD and maintains a role model's extraordinary influence in group-bound learning (Principles 4 and 5), creating group cultures as a governance response that facilitate effective, i.e., variance-reducing, socialization processes and recruiting employees with specific cultural backgrounds (Principle 6), and setting up cultural environments and group structures within which the pace of convergence is increased to lower final CD (7,8, and 9).

5. Conclusions

In this paper, we have claimed that the governance of socialization processes as a means to deal with cultural distance among employees is a key purpose of economics organizations. Based on our findings and adding to Williamson's (1981, 2002) problem of economic organization, we suggested that by lowering CD between employees or groups, socialization processes as a mode of governance have the potential to economize on intraorganizational transaction costs. We have been discussing socialization processes based on a model of cultural evolution that explains the development of cultural distance within and between groups or organizational units. Idiosyncratic socialization dynamics in these entities are, we have argued, one determinant of CD and related transaction costs in corporations. Characteristics that define an organization's socialization governance structure included shared or divided social experiences in (sub-) groups, the assignment of role models, group sizes, the assignment of new recruits, culture-specific features of cultural transmission, and, related to the latter, the implementation of a certain culture in a business unit. Each of these alternative modes of governance is defined by the particular socialization dynamics it facilitates and yields differential capacities of organizations to adapt internal structures in a transaction cost-minimizing way.

The governance form of the firm enables intraorganizational socialization processes that lower intra- and intergroup CD and that are not feasible via market contracting and, thus, provide another motive for choosing the organizational form of the firm (Coase, 1937; Arrow, 1969). Organizations have the capacity to capture transactional benefits arising from the governance of socialization experiences, i.e., a further challenge for the modern corporation is to align governance structures with socialization dynamics.

References

Akerlof, George A. and Kranton, Rachel E. (2005): "Identity and the Economics of Organizations", *Journal of Economic Perspectives,* Vol. 19, No. 1, pp. 9-32.

Alchian, Armen A. and Demsetz, Harold (1972): "Production, Information Costs, and Economic Organization", *American Economic Review,* Vol. 62, No. 5, pp. 777-795.

Arrow, Kenneth J. (1969): "The Organization of Economic Activity: Issues Pertinent to the Choice of Market versus Nonmarket Allocation", *U.S. Joint Economic Committee, 91st Congress, 1st Session, The analysis and evaluation of public expenditure: The PPB system, Vol. 1*, Washington, DC: U.S. Government Printing Office, pp. 39-73.

Asch, Solomon E. (1955): "Opinions and Social Pressure", *Scientific American,* 193, 5, pp. 31-35.

Atkisson, Curtis, O'Brian, Michael J. and Mesoudi, Alex (2012): "Adult Learners in a Novel Environment Use Prestige-Biased Social Learning", *Evolutionary Psychology*, 10, 3, pp. 519-537.

Bandura, Albert (1977): *Social Learning Theory,* Englewood Cliffs, N.J.: Prentice-Hall.

Banerjee, Abhijit V. (1992): "A Simple Model of Herd Behavior", *Quarterly Journal of Economics,* 107, 3, pp. 797-817.

Bartlett, Christopher A. and Ghoshal, Sumantra (1998): *Managing Across Borders: The Transnational Solution*, Boston: Havard Business School Press.

Bernheim, Douglas B. (1994): "A Theory of Conformity", *Journal of Political Economy,* Vol. 102, No. 5, pp. 841-877.

Bikhchandani, Sushil, Hirshleifer, David and Welch, Ivo (1998): "Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades", *Journal of Economic Perspectives,* Vol. 12, No. 3, pp. 151-170.

Boisjoly, Johanne, Duncan, Greg J., Kremer, Michael, Levy, Dan M. and Eccles, Jacque (2006): "Empathy or Antipathy? The Impact of Diversity", *American Economic Review,* 96, 5, pp. 1890-1905.

Bond, Rod and Smith, Peter B. (1996): "Culture and Conformity: A Meta-Analysis of Studies Using Ash's (1952b, 1956) Line Judgment Task", *Psychological Bulletin,* 119, 1, pp. 111-137.

Boyd, Robert and Richerson, Peter J. (1985): *Culture and the Evolutionary Process*, Chicago: University of Chicago Press.

Brock, William A. and Durlauf, Steven N. (2007): "Identification of Binary Choice Models With Social Interactions", *Journal of Econometrics,* Vol. 140, pp. 52-75.

Buckley, Peter J. and Carter, Martin J. (2004): "A Formal Analysis of Knowledge Combination in Multinational Enterprises", *Journal of International Business Studies,* Vol. 35, No. 5, pp. 371-384.

Buckley, Peter J. and Casson, Mark (1976): *The Future of the Multinational Enterprise*, London: MacMillan.

Chudek, Maciej, Heller, Sarah, Birch, Susan and Henrich, Joseph (2012): "Prestige-Biased Cultural Learning: Bystander's Differential Attention to Potential Models Influences Cildren's Learning", *Evolution and Human Behavior,* 33, pp. 46-56.

Cialdini, Robert B. and Goldstein, Noah J. (2004): "Social Influence: Compliance and Conformity", *Annual Review of Psychology,* Vol. 55, pp. 591-621.

Coase, Ronald H. (1937): "The Nature of the Firm", *Economica*, Vol. 4, No. 16, pp. 386-405.

Commons, John R. (1934): *Institutional Economics*, New York: Macmillan.

Cordes, Christian, Richerson, Peter J., McElreath, Richard and Strimling, Pontus (2008): "A Naturalistic Approach to the Theory of the Firm: The Role of Cooperation and Cultural Evolution", *Journal of Economic Behavior & Organization*, Vol. 68, No. 1, pp. 125-139.

Cordes, Christian, Richerson, Peter J. and Schwesinger, Georg (2010): "How Corporate Cultures Coevolve with the Business Environment: The Case of Firm Growth Crises and Industry Evolution", *Journal of Economic Behavior & Organization,* Vol. 76, No. 3, pp. 465-480.

DeGroot, Morris H. (1974): "Reaching a Consensus", *Journal of the American Statistical Association,* 69, 345, pp. 118-121.

DeMarzo, Peter M., Vayanos, Dimitri and Zwiebel, Jeffrey (2003): "Persuasion Bias, Social Influence, and Unidimensional Opinions", *Quarterly Journal of Economics*, Vol. 118, No. 3, pp. 909-968.

Ellison, Glenn and Fudenberg, Drew (1993): "Rules of Thumb for Social Learning", *Journal of Political Economy,* Vol. 101, No. 4, pp. 612-643.

Ellison, Glenn and Fudenberg, Drew (1995): "Word-of-Mouth Communication and Social Learning", *Quarterly Journal of Economics,* Vol. 110, No. 1, pp. 93-125.

Feldman, Marcus W. and Cavalli-Sforza, Luigi L. (1975): "Models for Cultural Inheritance: A General Linear Model", *Annals of Human Biology,* Vol. 2, No. 3, pp. 215-226.

Festinger, Leon (1950): "Informal Social Communication", *Psychological Review,* 57, 5, pp. 271-282.

Forsyth, Donelson R. (2006): *Group Dynamics*, Belmont: Thomson Wadsworth.

Frank, Robert H. (1997): "The Frame of Reference as a Public Good", *The Economic Journal,* Vol. 107, No. 445, pp. 1832-1847.

French Jr., John R. P. (1956): "A Formal Theory of Social Power", *Psychological Review,* Vol. 63, No. 3, pp. 181-194.

Greif, Avner (1994): "Cultural Beliefs and the Organization of Society: A Historical and Theoretical Reflection on Collectivist and Individualist Societies", *Journal of Political Economy,* Vol. 102, No. 5, pp. 912-950.

Greiner, Larry E. (1998): "Evolution and Revolution as Organizations Grow", *Harvard Business Review,* Vol. 76, No. 3, pp. 55-67.

Harrington Jr., Joseph E. (1999): "Rigidity of Social Systems", *Journal of Political Economy,* Vol. 107, No. 1, pp. 40-64.

Hennart, Jean-François (2003): "Theories of the Multinational Enterprise", in: Rugman, A. M. (ed.), *The Oxford Handbook of International Business*, Oxford: Oxford University Press, pp. 125-145.

Henrich, Joseph, Boyd, Robert and Richerson, Peter J. (2008): "Five Misunderstandings about Cultural Evolution", *Human Nature,* Vol. 19, No. 2, pp. 119-137.

Henrich, Joseph and Gil-White, Francisco J. (2001): "The Evolution of Prestige: Freely Conferred Deference as a Mechanism for Enhancing the Benefits of Cultural Transmission", *Evolution and Human Behavior,* Vol. 22, No. 3, pp. 165-196.

Higgins, Monica C. (2005): *Career Imprints: Creating Leaders Across an Industry*, San Francisco: Jossey-Bass.

Hodgson, Geoffrey M. (1996): "Corporate Culture and the Nature of the Firm", in: Groenewegen, J. (ed.), *Transaction Cost Economics and Beyond*, Boston: Kluwer, pp. 249-269.

Hofstede, Geert (1989): "Organizing for Cultural Diversity", *European Management Journal,* Vol. 7, No. 4, pp. 390-397.

Hofstede, Geert, Neuijen, Bram, Ohayv, Denise D. and Sanders, Geert (1990): "Measuring Organizational Cultures: A Qualitative and Quantitative Study Across Twenty Cases", *Administrative Science Quarterly,* Vol. 35, No. 2, pp. 286-316.

Kirman, Alan (1993): "Ants, Rationality, and Recruitment", *Quarterly Journal of Economics,* 108, 1, pp. 137-156.

Kogut, Bruce and Singh, Harbir (1988): "The Effect of National Culture on the Choice of Entry Mode", *Journal of International Business Studies*, 19, 3, pp. 411-432.

Kogut, Bruce and Zander, Udo (1993): "Knowledge of the Firm and the Evolutionary Theory of the Multinational Corporation", *Journal of International Business Studies,* Vol. 24, No. 4, pp. 625-645.

Labov, William (2001): *Principles of Linguistic Change: Social Factors*, Oxford: Blackwell.

Labov, William (2006): *The Social Stratification of English in New York City*, New York: Cambridge University Press.

Labov, William and Harris, Wendell (1986): "De Facto Segregation of Black and White Vernaculars", in: Sankoff, D. (ed.), *Current Issues in Linguistic Theory 53: Diversity and Diachrony*, Amsterdam: John Benjamins Publishing, pp. 1-24.

Langlois, Richard N. (1998): "Personal Capitalism as Charismatic Authority: The Organizational Economics of a Weberian Concept", *Industrial and Corporate Change*, Vol. 7, No. 1, pp. 195-213.

Lazear, Edward P. (1999): "Globalization and the Market for Team-Mates", *The Economic Journal,* 109, 454, p. C15-C40.

Levine, John M. and Moreland, Richard L. (1990): "Progress in Small Group Research", *Annual Review of Psychology,* Vol. 41, pp. 585-634.

Levine, John M. and Moreland, Richard L. (1998): "Small Groups", in: Gilbert, D. T., Fiske, S. T. and Lindzey, G. (eds.), *The Handbook of Social Psychology*, Boston: McGraw-Hill, pp. 415-469.

Manski, Charles F. (2000): "Economic Analysis of Social Interactions", *Journal of Economic Perspectives,* 14, 3, pp. 115-136.

Mas, Alexandre and Moretti, Enrico (2009): "Peers at Work", *American Economic Review,* 99, 1, pp. 112-145.

Milgram, Stanley (1974): *Obedience to Authority: An Experimental View*, New York: Harper&Row.

Nahapiet, Janine and Ghoshal, Sumantra (1998): "Social Capital, Intellectual Capital, and the Organizational Advantage", *Academy of Management Review,* 23, 2, pp. 242-266.

Nooteboom, Bart (2000): "Learning by Interaction: Absorptive Capacity, Cognitive Distance and Governance", *Journal of Management and Governance,* 4, pp. 69-92.

O'Brian, Michael J., Lyman, R. L., Mesoudi, Alex and VanPool, Todd L. (2010): "Cultural Traits as Units of Analysis", *Philosophical Transactions of the Royal Society B: Biological Sciences,* 365, 1559, pp. 3797-3806.

Olson, Mancur (1994): *The Logic of Collective Action*, Cambridge, MA: Harvard University Press.

Parsons, Talcott (1967): *Sociological Theory and Modern Society*, New York: Free Press.

Pettigrew, Thomas F. and Tropp, Linda R. (2000): "Does Intergroup Contact Reduce Prejudice: Recent Meta-Analytic Findings", in: Oskamp, S. (ed.), *Reducing Prejudice and Discrimination*, Mahwah, NJ: Lawrence Erlbaum Associates, pp. 93-114.

Ralston, David A., Holt, David H., Terpstra, Robert H. and Kai-Cheng, Yu (1997): "The Impact of National Culture and Economic Ideology on Managerial Work Values: A Study of the United States, Japan, and China", *Journal of International Business Studies,* 28, 1, pp. 177-207.

Richerson, Peter J. and Boyd, Robert (2005): *Not by Genes Alone: How Culture Transformed Human Evolution*, Chicago: The University of Chicago Press.

Sacerdote, Bruce (2001): "Peer Effects With Random Assignment: Results for Dartmouth Roommates", *Quarterly Journal of Economics*, 116, 2, pp. 681-704.

Schein, Edgar H. (1990): "Organizational Culture", *American Psychologist,* Vol. 45, No. 2, pp. 109-119.

Schein, Edgar H. (1992): *Organizational Culture and Leadership*, San Francisco: Jossey-Bass Publishers.

Schelling, Thomas C. (1972): "The Process of Residential Segregation: Neighborhood Tipping", in: Pascal, A. H. (ed.), *Racial Discrimination in Economic Life*, Lexington, MA: Lexington Books, pp. 157-184.

Shenkar, Oded (2001): "Cultural Distance Revisited: Towards a More Rigorous Conceptualization and Measurement of Cultural Differences", *Journal of International Business Studies*, Vol. 32, No. 3, pp. 519-535.

Spoor, Jennifer R. and Kelly, Janice R. (2004): "The Evolutionary Significance of Affect in Groups: Communication and Group Bonding", *Group Processes & Intergroup Relations*, Vol. 7, No. 4, pp. 398-412.

Van den Steen, Eric (2010): "On the Origin of Shared Beliefs (and Corporate Culture)", *RAND Journal of Economics*, Vol. 41, No. 4, pp. 617-648.

van Knippenberg, Daan and Schippers, Michaéla C. (2007): "Work Group Diversity", *Annual Review of Psychology*, 58, pp. 515-541.

Wagner III, John A. (1995): "Studies of Individualism-Collectivism: Effects on Cooperation in Groups", *Academy of Management Journal*, Vol. 38, No. 1, pp. 152-172.

Weber, Yaakov, Shenkar, Oded and Raveh, Adi (1996): "National and Corporate Cultural Fit in Mergers / Acquisitions: An Exploratory Study", *Management Science*, Vol. 42, No. 8, pp. 1215-1227.

Williamson, Oliver E. (1979): "Transaction-Cost Economics: The Governance of Contractual Relations", *Journal of Law and Economics*, Vol. 22, No. 2, pp. 233-261.

Williamson, Oliver E. (1981): "The Modern Corporation: Origins, Evolution, Attributes", *Journal of Economic Literature*, Vol. 19, No. 4, pp. 1537-1568.

Williamson, Oliver E. (2002): "The Theory of the Firm as Governance Structure: From Choice to Contract", *Journal of Economic Perspectives*, Vol. 16, No. 3, pp. 171-195.

Williamson, Oliver E. (2005): "The Economics of Governance", *American Economic Review,* 95, 2, pp. 1-18.