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A Core/Periphery Perspective on Individual Creative Performance: Social Networks and Cinematic Achievements in the Hollywood Film Industry

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The paper advances a relational perspective to studying creativity at the individual level. Building on social network theory and techniques, we examine the role of social networks in shaping individuals' ability to generate a creative outcome. More specifically, we argue that individuals who occupy an intermediate position between the core and the periphery of their social system are in a favorable position to achieve creative results. In addition, the benefits accrued through an individual's intermediate core/periphery position can also be observed at the team level, when the same individual works in a team whose members come from both ends of the core/periphery continuum. We situate the analysis and test our hypotheses within the context of the Hollywood motion picture industry, which we trace over the period 1992–2003. The theoretical implications of the results are discussed.

Key words: creative performance; social networks; core/periphery; film industry

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1. Introduction

Building on the basic idea that creativity is sparked by imaginative and uniquely gifted individuals, extant research on individual creativity has mainly examined individual cognitive attributes and traits (e.g., dispositional correlates of creativity) presumed to occasion creative outcomes (e.g., Sternberg 1985, Tardif and Sternberg 1988, Glynn 1996). Stories about the generation of original ideas emphasize the role of creative people, where the creator is attributed with great intellectual ability or some other quality that enabled him or her to come up with unusual solutions. As a result, the majority of studies on creativity have drawn tight boundaries around the “self” as the privileged locus of inquiry (Montuori and Purser 1996).

Although this remains the dominant approach when examining individual creativity, an increasingly large number of studies have stressed the importance of also looking at social factors. In her seminal work, Amabile (1988) showed how various contextual factors (e.g., organizational environment, groups, etc.) influence individual creativity. Woodman et al. (1993, p. 303) study on organizational creativity rests on the premise that the group “constitutes the social context in which the creative behavior occurs.” Likewise, recent evidence by Hargadon and Bechky (2006) suggests that although some creative solutions can be seen as the products

of individual insight, many others are the products of momentary collective processes.

In general, creative outcomes resulting from the interaction between two or more individuals represent instances of social creativity. Examples include feature films, musicals, operas, and other theatrical performances, as well as scientific laboratories and organizations. This relational dimension also is an integral feature of activities that traditionally have been regarded as intrinsically individualistic (John-Steiner 2000). Major achievements in natural sciences, for instance, are often collaborative because they take place in a context in which other people are essential contributors, as indicated by the frequency of coauthorships and joint research projects among scientists (Barabási 2005). Similarly, the study by Yoo et al. (2006) on Frank Gehry's design practices highlights how insight in architectural design and production originates from collaborative networks among multiple actors (e.g., contractors, customers, and engineers).

Following this line of thought and drawing more explicitly from research by sociologists and sociopsychologists (Kavolis 1966, Simonton 1984a), organizational scholars have recently started to investigate the network side of individual creativity (Perry-Smith and Shalley 2003, Burt 2004, Perry-Smith 2006). The key idea of this emerging perspective is that a deeper understanding of how creative outputs are generated “demands

that the creative individual be placed within a network of interpersonal relationships” (Simonton 1984a, p. 1273). Some authors have even argued that creativity “is all in your social network” (Brass 1995, p. 94). However, if creativity truly has a network dimension, we believe certain questions merit further investigation: Which mechanisms shape the interplay between individual creativity and the surrounding social network? What kind of social structures are more likely to stifle or foster an individual’s ability to generate a creative outcome? Are there any discernible social network characteristics typically associated with higher (lower) levels of creativity?

To address these questions, we develop and test a social network model of individuals’ creative performance grounded in Csikszentmihályi’s (1988, 1996) systems view on creativity. According to this view, creativity lies at the nexus of the individual and the larger sociocultural field. As Csikszentmihályi (1996, p. 23) puts it, creativity “does not happen inside people’s heads, but in the interaction between a person’s thoughts and a sociocultural context.” Whereas the individual generates new ideas and variation by interacting with the field, the field in turn conveys legitimacy back to the individual and thus determines which ideas are retained and supported. As the structure of relationships among actors shapes the interplay of these two complementary components—new ideas and social endorsement—within a field, our theory points to two mechanisms by which social networks affect individual creativity. First, we predict that individuals who occupy an intermediate position between the core and the periphery of their social system are in a privileged position to achieve creative results. This position allows them to maintain exposure to alternative sources of inspirations and novel ideas that lie on the fringe of their social system, but without being disconnected from the base of legitimacy and support that is associated with the core and is required to implement those ideas and gain the visibility necessary for them to be recognized as valuable in a given context. Second, we suggest that the same benefits of an intermediate core/periphery position at the individual level can be replicated at the team level when one individual works in a team whose members come from both ends of the core/periphery continuum. Such a “balanced” team provides individuals with a fertile ground for nurturing their creative performance because they have simultaneous exposure to unconventional ideas and the influential players who can mobilize support and attention around promising solutions. We predict that individuals working in balanced teams will exhibit higher creative performance levels on average.

Our approach is premised on a definition of creativity that focuses on the outcome or product rather than the process or the person behind it, because that outcome or product provides the final criterion of whether the

process or the person can be considered creative. Definitions that focus on the attributes of creative products are now widely acknowledged as the most useful approach for empirical study because they recognize that assessments of creativity are ultimately subjective (Amabile 1982, Mumford and Gustafson 1988, Simonton 2004a). As pointed out by Amabile (1996, p. 33),

the identification of a thought process or subprocess as creative must finally depend upon the fruit of that process, product or response Thus, the definition that is most likely to be useful for empirical research is one grounded in an examination of products.

The empirical setting is the Hollywood motion picture industry, which we traced over the period 1992–2003. The movie industry has long embraced arrangements featuring flexible and short-term relationships that rely on enduring networks, in which mutual trust and reputations have been cemented over time (Faulkner and Anderson 1987, Jones 2002, Ferriani et al. 2005). As they work on movie projects, individuals forge a texture of relationships that underpins and shapes their future work and outcomes. The industry therefore is well suited for studying the impact of social networks on individual creative performance. This is our dependent variable and is measured by the number of awards and nominations bestowed every year by professional organizations to key individuals involved in the making of a feature film.

The paper is organized as follows. In the next section (§2), we briefly review the literature on individual-level creativity and present the hypotheses. After we describe the empirical setting (§3), the data (§4), and the variables (§5), we present the model and the method (§6) and the results of the analyses (§7). We finish by discussing the main implications of the findings, the conclusions that follow from them, the limitations of our study, and important topics for future research (§8).

2. Theory

2.1. Individual Creativity and Social Networks

Despite the burgeoning interest among organizational scholars in studying the factors and conditions shaping individual creative performance, disagreement still exists on how creativity should be defined and assessed. One of the key problems is that traditional conceptual definitions are difficult to use for empirical research (Amabile 1996). The most commonly accepted conceptual definition of creativity, for instance, revolves around intrinsic properties of novelty and appropriateness (Barron 1955, Stein 1974). A challenge to these approaches is that novelty and appropriateness are not static properties of an object, but rather are determined within “the bounds of social, cultural, and historical precedents of the field” (Perry-Smith and Shalley 2003, p. 91). For the purposes

of empirical research, therefore, one has to abandon the hope of finding the “ultimate” objective criteria for creativity in favor of a definition that relies on intersubjective criteria. In line with this idea, Amabile proposed a “consensual” definition of creativity in which creativity refers to the production of outcomes that reliably can be assessed as novel or valuable by expert observers. This definition suggests that a given product or response can be viewed as creative

to the extent that appropriate observers independently agree it is creative [...]. Thus, creativity can be regarded as the quality of the products or responses judged to be creative by appropriate observers. (Amabile 1996, p. 33; see also Amabile 1982)

This implies that whether a given outcome is perceived as creative varies over time and thereby is historically and socially determined.

Building on this notion of creativity as a subjective assessment of the product of individual action, Csikszentmihályi (1988, 1990, 1996) developed a theory of creativity where the occurrence of a creative act originates from the interrelationship between the following three subsystems: the individual—i.e., the person who serves as the source of variation to the field; the field—i.e., those people who populate and effect the structure of the domain; and the domain—i.e., the rules and practices of a recognized area of action. Although the individual is critical in triggering change, “the people who compose the field and personify the domain serve to select and retain creative acts that subsequently elaborate the domain” (Ford 1996, p. 1114). The thrust of the theory is that creativity stems from the interplay between the individual act and the enabling social context that decides whether or not to endorse and legitimate such an act. Creativity, in fact, is not “the product of single individuals, but social systems making judgments about individuals’ products” (Csikszentmihályi 1999, p. 314). The relationship between the person and the social system, between new ideas and their legitimation, lies at the core of our social network perspective on individual creative performance. On the one hand, individuals may (or may not) be able to access new and different ideas, depart from existing frames, and set up original connections across disparate social domains as a result of their position in the social network. On the other, the same position signals individuals’ ability to mobilize support from others and hence overcome the initial illegitimacy of their ideas and seize the benefits of shared thought and action (Hargadon 2005).

In the next section we articulate these arguments more thoroughly by suggesting that positional returns to creativity are subject to a core/periphery network trade-off. We make predictions on performance based on both the core/periphery position of the individual within the larger social network and the core/periphery structure of the team of which individuals are members.

In developing our theory we explore the effect of both individual- and group-level core/periphery network features on individual creative performance.

2.2. Core/Periphery Social Network Position and Individual Creative Performance

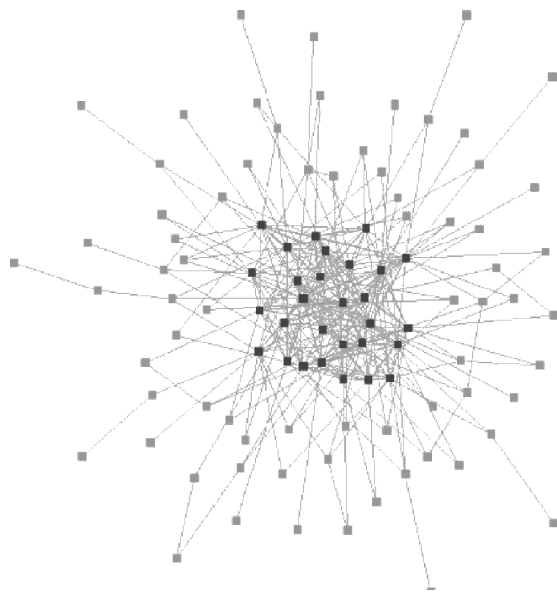
A core/periphery network structure is characterized by a cohesive subgroup of core actors and a set of peripheral actors that are loosely connected to the core (Borgatti and Everett 1999, p. 375). The idea that some groups or organizations have core/periphery structures has enjoyed considerable attention in social network analysis (e.g., Mintz and Schwartz 1981, Barsky 1999, Cummings and Cross 2003). To illustrate this idea, consider Figure 1. This figure—in which nodes can represent individuals and ties their collaborations—presents an ideal core/periphery structure. The core is signified by the darker nodes at the center of the figure, which are deeply entrenched in the social system and therefore tend to more closely share ideas and habits. They are usually key members of the community, including many who act as network coordinators and have developed dense connections between themselves. The periphery is populated by lighter-colored nodes that are tied to the core by looser linkages and are scarcely connected to each other. These nodes reside in the boundaries of the networks and thus are not as visible or as socially engaged as those in the core. As Knoke et al. (1996, p. 23) noted, a domain’s social space

is divided into relatively homogeneous sectors occupied by actors who are likely to share common values, attitudes, and interests. Located at a network’s center are policy actors who play the key coordinating roles in the domain, whereas the periphery is occupied by actors with less integrative importance.

We contend that there are upsides and downsides to creativity from both core and peripheral network positions.

As we noted before, evaluations of creative outcomes tend to depend on the context—particularly the perceptions of others—rather than on intrinsic properties (Csikszentmihályi 1999). It is only when new ideas gain acceptance and legitimacy in a given field that they are recognized as creative. According to this argument, individuals who have access to the social core of their own field find themselves in a more favourable position compared to more peripheral individuals because their work is likely to gain faster recognition and acceptance in a dense and clustered network. Being closer to the core enhances the chance that a creative outcome or response will be readily recognized and legitimated. Individuals at the core can also obtain the kind of consensus necessary to pursue original ideas and overcome the initial illegitimacy of these ideas. Because core individuals are deeply immersed in their social system, they can in fact leverage their credibility among other individuals and gain

Figure 1 Core/Periphery Network



Source: Krebs and Holley (2002).

the support required to protect new ideas from skeptical scrutiny (Hargadon 2005).

However, a peripheral position suggests the existence of connections outside the network that can facilitate creative performance through exposure to different sources of inspiration or stimuli. The idea that peripheral actors (e.g., individuals, firms, etc.) can find themselves in an advantageous position to generate a creative outcome or response has been noted in different fields of human activity. As pointed out by Schilling (2005, p. 133),

it has often been argued that marginal intellectuals (those who may participate in multiple intellectual domains but are central to none) are more likely to introduce creative breakthroughs than well-established experts in a domain.

By standing at the fringe of the network, peripheral actors can elude the homogenizing influences typical of an established institutional framework and therefore attend to divergent ideas without the anxiety of contrasting accepted norms of the field (Perry-Smith and Shalley 2003).

The above observations suggest that the social network influence on individual creative performance can be characterized by a core/periphery trade-off. Individuals who stand at the core of their social field have greater exposure and access to the relevant sources of support and legitimacy, but may find it difficult to recharge the freshness of their ideas and escape the pressures to conform to the established norms of the field. By being entrenched in the prevailing conventions, they become increasingly reluctant to abandon existing ideas and knowledge to explore new ones (Schilling 2005) and are likely to experience a decline in intrinsic motivation due

to adherence to a winning style (Faulkner and Anderson 1987).

Michael Polanyi's (1963, p. 1013) description of the genesis of one of his contributions to physics is indicative of this tension:

I would never have conceived my theory, let alone have made a great effort to verify it, if I had been more familiar with major developments in physics that were taking place. Moreover, my initial ignorance of the powerful, false objections that were raised against my ideas protected those ideas from being nipped in the bud.¹

In contrast, peripheral actors are more likely to contribute fresh perspective to the system and maintain high intrinsic motivations, although they lack the visibility and endorsement necessary to boost their work's recognition. As noted by Collins (2004, p. 436): "... a peripheral position condemns one to coming too late into the sophisticated centre of the action." Although the periphery allows one to explore ideas and information not yet widely shared throughout the network, the core is more effective in mobilizing support around those ideas and information.

We should, then, expect creative performance to be higher among individuals who occupy an intermediate position between the core and the periphery of the network. These individuals do not face the same level of social pressure to conform and are less likely to forgo opportunities from which new creative ideas originate. Being in touch with the core but without losing touch with the periphery "provides a way to acquire knowledge without acquiring the ties that typically bind such knowledge to particular worlds" (Hargadon 2005, p. 17). This line of reasoning suggests the existence of an inverted U-shaped relationship between individuals' degree of coreness in their social network and creative performance. We thus hypothesize:

HYPOTHESIS 1 (H1). *The relationship between individual creative performance and coreness is inversely U-shaped. Creative performance is higher for individuals who occupy an intermediate position between the core and the periphery of their social network.*

2.3. Team Coreness and Individual Creative Performance

The two complementary structural dimensions of individual creative performance examined here, core and periphery, reflect the recognition that creativity derives both its content and meaning from the surrounding social system. Although the social system provides the raw material to feed into the "combinatory play" that underlies the individual's productive thought (Simonton 2004a), the same system also communicates legitimate information and actions back to the individual. As noted by Hargadon (2005), "no matter how original the insight that results, the label of creativity still depends upon

how many others are convinced to adopt and extend these original ideas.” Our first hypothesis postulates that individuals may benefit from these two dimensions by occupying intermediate positions in the core periphery continuum. These two areas, however, are not only different in character, but are often in opposition because each is characterized by different needs and shaped by different criteria.

However, this is not the only way for individuals to address the core/periphery paradox. As an example, consider a situation where two or more individuals—some closer to the core and some closer to the fringe of the network—decide to collaborate. Individuals who are peripheral and therefore lack the legitimacy and influence necessary to gather attention around their work can build on their colleagues’ social clout to gain legitimacy. Conversely, socially entrenched actors who are less likely to gain exposure to unusual sources of inspiration and novel ideas can benefit from their peripheral partners’ perspective to avoid convergence toward conventional wisdom. In this case, although the single individuals occupy extreme positions along the core/periphery continuum, they may complement each others’ structural features by providing a context where the two extremes (core and periphery) meet each other by coming together to form a team. The example points to a plausible situation in which an individual who does not stand at the crossroads of the two social worlds may still be able to draw from both of them through inclusion in a team that combines core and peripheral actors. Accordingly, although we expect moderate levels of network coreness at the individual level to be more advantageous, we also surmise that individuals’ creative performance will depend on the sociostructural characteristics of the people with whom the focal actor most closely collaborates. We bring together two sets of arguments to support this conjecture.

Our first argument builds on complementary productivity theory, which focuses on intrateam skill externalities (Kremer 1993). The theory holds that in collective endeavors where individual talent spills over to other members, individual contributions exhibit multiplicative productivity. It follows that when inputs are complementary, individuals’ performance may crucially depend on the characteristics of the team in which they work (Idson and Kahane 2000). This is a common feature to most creative industries where the final product requires the contribution of workers with diverse but complementary skills (Caves 2000). Research on individual creativity echoes these ideas by emphasizing the importance of work groups not just as drivers of collective creativity, but as arenas where individual creativity may flourish (Amabile 1996, Oldham and Cummings 1996, Woodman et al. 1993). As noted by Choi (2004, p. 190), “group members may also affect individuals’ creative performance. As an immediate social surrounding, the

group exerts substantial influence on the individual.” Features at the team level therefore may have a significant impact on the creative performance at the individual level.

Our second argument draws from social network insights on legitimacy transfer and relational endorsement (Stuart et al. 1999). Sociologists and network theorists have long asserted that relationships implicitly transfer legitimacy between the parties in an association (Faulkner 1983), thus making perceptions of merit dependent on patterns of affiliations (Blau 1964, Merton 1973). Latour (1987), for instance, noted that professional assessments of scientific work are influenced by the prominence of the scientist’s affiliates, particularly in uncertain research areas where there is disagreement over what constitutes a significant contribution. Generalizing these ideas to an entrepreneurial context, Higgins and Gulati (2003) showed that the backgrounds of those who lead and manage a young firm send powerful cues to external parties that affect the endorsement process. These observations suggest that associations with occupants of prominent positions increase the respect paid to the connected actor and its endeavors, especially when the quality of such an actor and/or its endeavor is uncertain (Stuart et al. 1999, Cattani et al. forthcoming). Thus, not only does the group constitute a fertile arena for stimulating productive thought, but its social structure also has important implications for how individual outcomes are perceived externally and hence supported.

Following this line of reasoning, we anticipate that individuals seeking to enhance their creative performance will be better off belonging to teams with a balanced composition of core and peripheral individuals. On the one hand, these individuals will be exposed to the stimuli and novel insights that spill over from peripheral actors. On the other, the presence of highly embedded members who stand at the core of their social system will convey to them the legitimacy that is indispensable for individual ideas to be sustained and leveraged among key observers. As suggested by Cross and Cummings (2004, p. 930),

contacts higher in the hierarchy can be valuable for the legitimacy they provide Obtaining information from those of higher status might confer legitimacy to either a person or an idea and thereby help people put their plans into action.

Thus, balanced teams are likely to provide the two critical dimensions in the creative process: fresh new ideas as well as legitimacy and support (Hargadon 2005). Accordingly, we hypothesize:

HYPOTHESIS 2 (H2). *The relationship between individual creative performance and team coreness is an inverted U-shape. Individual creative performance will be highest for moderate level of team coreness.*

3. Research Setting

We situate our analysis within the context of the Hollywood film industry. In the course of several decades the U.S. film industry underwent a transition from the firm-based studio system to the market-based “package unit” system (Staiger 1985). Before this transition the studios—also known as “The Majors” (i.e., 20th Century Fox, Metro Goldwyn Mayer, Paramount, RKO, and Warner Brothers)—integrated across all of the stages of the value chain. Antitrust action led to a 1948 consent decree in which they agreed to divest their theater (i.e., presentation) holdings. During the same time period, competition forced them to end exclusive contracting with talents, greatly reducing the extent of in-house production (Balio 1985). By the end of the 1970s, the film industry was organized around projects and personal networks rather than traditional hierarchies and in-house human resource departments (Jones 1996). In this system,

Firms and subcontractors combine for a specific project, disband when the project is finished, and then combine for new projects [...]. Self-employed subcontractors move from project to project, while the role of the company is to finance and distribute the finished product. (Jones 1996, p. 58)

This is a very promising setting in which to study the influence of social networks on individual creative performance. First, creativity is central to the film production process because each movie is a unique product and requires the daily creative effort of the crew members in order to be completed. Second, although much previous writing on the relational character of project work has focused on interactions among project workers within the context of the organization, much less attention has been paid to the embeddedness of project workers in social relationships that extend beyond organizational boundaries. Project organizations are organizations with open boundaries through which individuals can expand their social network by moving freely from project to project without facing the constraints typically encountered in more stable organizations with less-permeable boundaries. As a result, project participants in the film industry “work together closely in a complicated dance of mutual adjustment and communication” (Jones et al. 1997, p. 916).

4. Data

Our data consist of the entire population of core crew members who worked in at least one of the 2,137 movies distributed in the United States by the eight major studios—i.e., the seven historical majors (Universal, Paramount, Warner Bros, Columbia-Tristar, Disney, 20th Century Fox, and Metro-Goldwyn-Mayer) and Dreamworks—and their corresponding subsidiaries over the 12-year period 1992–2003.² We focused on

Table 1 Studios and Their Distribution Divisions

Studio	Distribution division
Sony	American International Pictures Columbia Screen Gems Sony Classics Sony Repertory TriStar
Universal	Focus Features Good Machine Gramercy October October Classics Polygram Rogue Pictures USA Films
20th Century Fox	Fox International Classics Fox Searchlight
MGM (purchased by Sony in 2005)	Orion Classics Orion Pictures United Artists Samuel Goldwyn
Warner Bros.	Castle Rock Fine Line New Line Warner Independent
Paramount	Paramount Classics (now Paramount Vantage) Republic
Disney	Buena Vista Caravan Pictures Dimension Hollywood Pictures Miramax Touchstone Pictures
Dreamworks (purchased by Viacom in 2006)	

Notes. The studios purchased distribution divisions at different points in time. Many of these divisions changed ownership during the study period (for instance: Focus Features is the art house films division of Universal Studios and originated from the 2002 divisional merger of USA Films, Universal Focus, and Good Machine; October was purchased by Universal in 1997; Screen Gems became a specialty film-producing arm of Sony group in 1999; Samuel Goldwyn was purchased by MGM in 1997; Castle Rock and New Line were purchased by Warner in 1996, etc.). In attributing film releases to major studios we accounted for the timing of all such transactions.

these studios for several reasons. First, they dominate the industry either directly, through their financial power, or indirectly, through distribution control. In the last decade, on average, the movies released by these companies consistently have accounted for approximately 90% of the entire U.S. box office.

Second, although focusing on the major studios might suggest a neglect of artistically oriented movies in favor of commercial ones, within these companies there are numerous divisions that specialize in different types of

films and represent multiple labels carried over from previous acquisitions (see Table 1 for a list of major studios and corresponding divisions). Some of these divisions specialize in the distribution of small-budget niche films and have been widely acknowledged in the press to focus on developing more artistically oriented movies and cultivating less-visible talents, as testified by the use of adjectives such as “repertory,” “independent,” or “classic” in their names to signal their distinction from the parent companies (Wang 2006). Thus, although we do not have data on the entire population, the risk of misrepresenting the periphery of the system should be mitigated. Third, and consistent with the previous point, we note that 88% of the movies (i.e., 66 out of 75) that the *New York Times* lists among the best 1,000 movies ever for the years covered by our study were distributed by Hollywood majors and therefore made it to our data set—whereas only 12% of the movies (9 out of 75) in the *New York Times* list were distributed by organizations other than the Majors or their subsidiaries—suggesting that despite its growing focus on generating blockbusters, the industry has retained the ability to produce movies of high artistic quality.³ The setting is therefore well suited for studying the social structural foundations of individual creativity.

For each movie in the sample we collected information on the composition of the production team as well as the creative performance of key crewmembers. As is apparent from examination of film credits, movies are the collective creation of a large number of separate individuals, each contributing creative input, unique talents, and technical expertise to the project. Notwithstanding this wealth of contributors, a very restricted group of people usually is credited with the critical creative work in a motion picture. Our analysis focused on the following members of this team—sometimes referred to as the “core crew” (Goldman 1983): producer, director, writer, editor, cinematographer, production designer, and composer. Our selection resulted in a total of 11,974 crewmembers distributed across the seven core roles already mentioned. The distribution of crewmembers and movies by year is presented in Table 2. The yearly average number of core crewmembers per movie ranges between 11 and 15. This number is different from the sheer amount of roles considered because professionals sometimes performed multiple roles in the same project or the same role was collectively performed by multiple individuals. Because not all professionals were involved in a movie in any given year of the study period, our final data set is an unbalanced panel. We identified the crewmembers using the Internet Movie Database (IMDB), an online source owned by Amazon.com and supported largely through advertising. Most of the data provided by IMDB are submitted on a voluntary basis and validated by an in-house staff of 70 members. In recent years, a growing number

Table 2 Movies and Crewmembers by Year

Year	Movies	Core crewmembers	Average size of core team
1992	150	1,711	11.4
1993	171	1,890	11.1
1994	176	1,990	11.3
1995	197	2,312	11.7
1996	195	2,279	11.7
1997	201	2,406	12.0
1998	183	2,638	14.4
1999	183	2,272	12.4
2000	166	2,129	12.8
2001	171	2,132	12.5
2002	183	2,398	13.1
2003	152	1,936	12.7

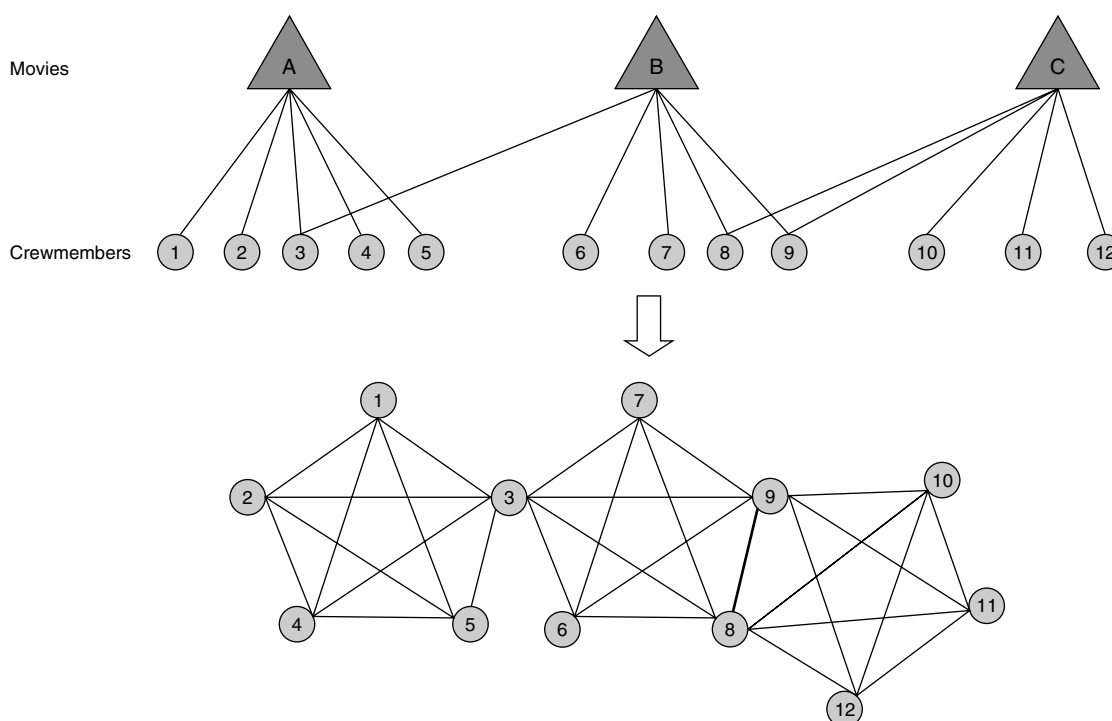
of studies have used this data source (Barabási 2002, Sorensen and Waguespack 2006, Ferriani et al. 2005). To insure data quality, we also cross-checked the reliability of the information with the Alan Goble film index (Goble 2003).

4.1. Social Network Structure of the Hollywood Film Industry

To unveil the sociorelational fabric of the industry, we analyzed the bipartite affiliation network between professionals and movies. An affiliation network is a network of vertices connected by common group memberships such as projects, teams, or organizations. Examples studied in the past include interlocking directorates (Davis and Greve 1997), coauthorships (Newman 2001), and collaborations among Broadway artists (Uzzi and Spiro 2005). Data on affiliation networks tend to be more reliable than those on other social networks because group membership often can be determined with greater precision than in cases of friendship or other types of ties (Newman et al. 2002). We constructed networks of film professionals in which a link between any two professionals indicates collaboration on the making of a movie. It is reasonable to assume that most of the core crewmembers working on the same movie are familiar with one another. Although coparticipation in a project does not tell us the extent to which people communicate, the chance that this network reflects professional interaction between individuals is fairly high. In the global network, professionals are “directly” connected to each other when they worked on the same movie project, and “indirectly” connected when they are linked through at least one professional who worked on two or more movies.

The affiliation network was created starting from an individual-by-movie matrix X where $x_{ij} = 1$ if the i th individual participated in making the j th movie, and $x_{ij} = 0$ otherwise. We then multiplied matrix X and its transpose X' , whose ij th cell indicates the number of movies to which both professional i and professional j contributed. This value can be interpreted as an

Figure 2 Unipartite Projection of a Two-Mode Crewmember-by-Movie Network



index of the strength of social proximity between the two individuals (Borgatti and Everett 1997). The resulting social structure is visually exemplified in Figure 2. A, B, and C (at the top of the figure) can be imagined as feature films, with Vertices 1 to 10 being a selection of crew members joined to the corresponding movies by a line. Because some of these movies share one or more crewmembers, the unipartite projection of the two-mode crewmembers-by-movie social structure results in the network shown in the lower part of Figure 2, in which two crewmembers are connected by an edge if they collaborate on the same movie. It is notable from this illustration that the interconnectivity of the system rests on the presence of individuals (Vertices 3, 8, and 9) working across more than one project. Because two or more individuals may work together repeatedly across multiple projects, some relationships are assumed to be stronger than others. In the example, this is illustrated with a thicker edge between Vertices 8 and 9, which represents two crewmembers who worked together in both films B and C.

In defining a tie, we had to make an assumption about the duration of the relationship between professionals. With no control for relationship decay, professionals' network connectedness would be highly inflated due to the inclusion of ties to inactive artists. Following a common practice in network studies, we used a three-year moving window to control for the duration of each tie, hence making the adjacency matrixes time varying. In other words, if professionals did not work on a movie for three years, we removed them and their ties from the

network in the fourth year. If they reentered the industry in the following year, we included them and their links back into the network (for a similar approach, see Uzzi and Spiro 2005). We also used alternative windows of two, four, and five years, but found no significant differences in the results.

Thus, the adjacency matrix for a given year records collaborations formed in that year and in any of the previous three years. We started with the core crewmembers who worked in 1995 and used the earlier three-year data to construct the accumulative relational profiles. (That is, the period 1992–1994 can be viewed as the time required for establishing the network structure that professionals bring to the period 1995 onward.) Starting from 1995, we worked forward in time until 2003, adding new professionals each year in accordance with the distribution of new movies. We used the resulting nine time-varying matrices to compute all individual-level network measures.

5. Variables

5.1. Dependent Variable

As we noted before, the definition of creativity adopted in this paper is based on the creative “outcome” rather than the creative “process” or the “individual traits” of the person (see Amabile 1996). Consistent with this definition, we operationalized film professionals' creative performance using the awards and nominations they received for the quality of their performance from the

two most prominent categories of industry observers: film critics and industry peers. Three additional reasons support this choice. First, the use of awards and nominations as indicators of creativity reflects a fairly established practice in the tradition of creativity research that dates back to Francis Galton (1869) and represents one of several methods used to provide an operational definition of creativity (e.g., Caird 1994; Feist and Barron 2003; Simonton 2004b, c). Second, both industry peers and film critics have long been organized in various independent professional bodies that provide systematic assessment of the individual contributions in the various domains of cinematic creativity (Simonton 2004b). Third, by employing a count measure of awards and nominations, we can determine the extent to which individuals are creative, in line with the idea that creativity is a continuous concept. In fact, we do not merely distinguish between creative and noncreative outcomes, but argue that there exist different degrees of creativity. The assumption of a continuous underlying dimension of creativity implies that “observers can say with an acceptable level of agreement that some products are more creative or less creative than others” (Amabile 1996, p. 34).

Accordingly, we collected data on the awards and nominations assigned to the seven selected crewmembers by at least one of the following 10 professional societies (O’Neil 2003): (1) the Academy of Motion Picture Arts and Sciences; (2) the Directors Guild of America; (3) the Writers Guild of America; (4) the American Society of Cinematographers; (5) the American Cinema Editors; (6) the Producers Guild of America; (7) the Hollywood Foreign Press Association; (8) the National Board of Review Awards; (9) the New York Film Critics Circle; or (10) the Los Angeles Film Critics Association.⁴ We focused on these organizations for various reasons. They have consistently granted annual awards and nominations in all major categories of filmmaking expertise, have been in existence for several decades, and are widely regarded as reliable and competent organizations (for a similar approach, see also Simonton 2004c). Together, they reflect the judgments of hundreds of experts from the worlds of film practice and criticism who are devoted to identifying and rewarding exceptional achievements in filmmaking. For example, the mission of the Hollywood Foreign Press Association is “to recognize outstanding achievements by conferring annual Golden Globes;” the National Board of Review “celebrates the distinctive voice of the individual artist, honoring excellence and supporting freedom of expression in film;” the New York Film Critics Circle Awards is committed to “honoring esthetic merit in a forum that is immune to commercial and political pressures;” the Directors Guild of America’s mission is to “pass judgment on the creative ability of the director... free from prejudice and unhampered by outside influence;” the Los Angeles Film Critics aims at

“honoring each year’s outstanding cinematic achievements;” the American Society of Cinematographers has the “purpose of recognizing... the pursuit of excellence in the art and craft of cinematography” (O’Neil 2003). The types of awards used in the analysis therefore allow us to minimize the risk of including only awards—such as Oscars—whose assignment often is driven more by commercial (or political) than artistic considerations (see Holbrook 1999). Using these data, we created the variable *Individual awards & nominations* to capture each professional’s creative performance, as measured by the number of awards and nominations s/he received in a given year. The primary data sources were the official websites of each organization.

5.2. Independent Variables

5.2.1. Core/Periphery. A core/periphery network “entails a dense, cohesive core and a sparse, unconnected periphery” (Borgatti and Everett 1999, p. 375). Following the approach developed by Borgatti and Everett (1999), we estimated the degree of coreness of each node (i.e., professional) by fitting a continuous model of core/periphery structure to our network data. By coreness we refer here to the degree of closeness of each node to a core of densely connected nodes observable in the network. The algorithm achieves this by attributing high values to core members and low values to periphery. As a result, the product of two core values will be a high value (high interaction among core members), the product of one core value and one periphery value will be a medium value (moderate interaction between core and periphery), and the product of two periphery values will be a small value (lack of interaction among periphery members) (Borgatti and Everett 1999). We opted for a continuous model because one limitation of discrete models with two-class partition is the oversimplicity inherent in defining just two classes of nodes as core and periphery. Similar considerations also hold for three or more class partitions. It is worth noting that although all actors in a core are highly central as calculated by virtually any measure, the converse is not true because “not every set of central actors forms a core... This is because each actor may have high centrality by being strongly connected to different cohesive regions of the graph and need not have any ties to each other” (Borgatti and Everett 1999, p. 393). We computed the *Coreness* measure by applying the continuous core/periphery procedure available in UCINET VI (Borgatti et al. 2002)⁵ to the nine affiliation matrices described earlier. These networks are highly connected, with the average percentage of nodes that connected to the main component over the study period at close to 98%.

5.2.2. Team Coreness. Besides identifying a cohesive subgroup of core actors and a set of peripheral actors that are loosely connected to the core, a core/periphery analysis can also be extended to examine

the degree of team coreness. Teams can differ with respect to the degree of coreness of their individual members. A team can, in fact, consist of actors who occupy a position closer to the core or the periphery of the network or a mix of both structural positions. To test Hypothesis 2, we thus created the variable *Team coreness* to capture the extent to which the team to which a professional belongs consists of members that are closer to the core or the periphery or a mixture of both. We identified professionals as peripheral or core depending on whether their coreness value was below or above the median.⁶ We then created the variable by computing the ratio of team members who are closer to the core of the network to the total number of team members working on the same movie. For those professionals who worked in two or more movies in a given year, we calculated the average team coreness by first summing the ratios at the movie level and then dividing the sum by the number of movies in which each professional worked in that particular year. The variable varies from zero (a professional worked on movies in which all team members were peripheral) to one (a professional worked on movies in which all team members were core).

5.3. Control Variables

To rule out possible competing hypotheses, we included several control variables at the individual, team, and project (movie) levels in the final model specification.

5.3.1. Structural Holes. Structural holes may influence individual creativity by providing access to diverse knowledge and facilitating the identification of options that would otherwise remain unseen. Research by Burt (2004) on the networks around managers in a large American electronics company suggests that good ideas originate disproportionately from individuals who span structural holes. To account for this effect, for each professional in the network we estimated the variable structural holes using Burt's (1992) classic network constraint index.

5.3.2. Newcomer. Award voters may prefer to recognize new talents rather than giving accolades to professionals who received an award in the past or to the same veterans who make movies frequently and whose presence may therefore appear "inflated" in the eyes of the voters. Professionals new to the industry might thus receive disproportionate attention from award voters to the disadvantage of incumbents. We accounted for this possibility by creating a dummy variable that takes on the value one if a professional is a newcomer and zero if a professional is an incumbent.

5.3.3. Individual Role. As we mentioned before, our analysis is focused on the following core crewmembers: producer, director, writer, editor, cinematographer, production designer, and composer. Because these roles embody different artistic and technical dimensions and therefore draw on diverse cognitive and practical

abilities, the assumption that the same relational mechanisms are equally consequential across different roles might be inappropriate. For instance, the different role requirements between a producer and a cinematographer might affect the way they pattern their social relations or their proclivity toward engaging in repeated collaborations. As a result, when such a distinction is not made, observed effects in creative performance might conceal different processes at work. To account for this possibility and control for the particular role held by each professional, we created a dummy for each role using the composer role as the reference category. In those cases where the same professional covered multiple roles in the same movie or across different movies, the attribution was based on the role most frequently held.

5.3.4. Individual Creative Freedom. Prior research has shown how intrinsic motivation is more conducive to creativity than extrinsic motivation (see Amabile 1996). It appears that when the primary motivations are interest in and enjoyment of an activity, outputs tend to be more creative than when the only motivation is the achievement of goals imposed by others. We therefore created the variable *Creative freedom* to capture the extent to which professionals enjoy enough latitude to express their creativity by looking at the number of different roles performed in the movies they made. Although in many cases there is one specialist per role, sometimes the same artist or professional can perform multiple roles in a single movie (e.g., Clint Eastwood was director, actor, and producer for *Unforgiven* in 1992) or the same role is collectively performed by multiple individuals (e.g., Joel and Ethan Cohen codirected *Fargo* in 1996). The variable measures the average number of different roles each professional performed in the movies s/he realized in a given year.

5.3.5. Individual Quality. A high number of awards in an individual's career may indicate an exceptional talent and thus a higher proclivity toward the generation of creative outcomes. Past research in the film industry suggests that the most successful professionals often enjoy preferential access to better resources and information (Faulkner and Anderson 1987). Accordingly, we might expect current creative performance to be positively affected by a history of accolades and awards. On the other hand, it is unclear the extent to which award recipients will maintain the same level of creative performance over time. Evidence in the creativity research tradition indicates that creative performance is not only unstable over time, but can decline with increased practice (Simonton 2000). If we were to follow this perspective, which contrasts with the previous view, we should expect prior accomplishments to be poor predictors of current creative performance. Because these two perspectives provide opposing interpretations, we remain agnostic about the directionality of this effect, but we control for it by introducing the variable *Individual*

quality, i.e., the number of awards won and nominations received by each professional in the two years (i.e., $t - 1$ and $t - 2$) prior to the focal year t . (The results do not vary if we change the time period to three to five years.)

5.3.6. Team Quality. Individuals who work within a talented team may perform better due to higher incentive, superior commitment, or richer stimuli. For instance, in a recent study Huckman and Pisano (2006) suggest that freelancers may perform differently across organizational settings due to different enabling conditions in terms of human capital and assets. We accounted for this possibility by measuring the quality of the core team—*Team quality*—as the average number of awards and nominations the team members (other than the focal individual) received in movies they were involved in during the two years (i.e., $t - 1$ and $t - 2$) prior to the observation year t . (The results did not change when we increased this to the previous three to five years.)

5.3.7. Movie Critical Reception. The likelihood of receiving an award or a nomination could be affected by how well the movies each professional worked in fare among the critics. Movies highly praised by critics might receive disproportionate attention and visibility in the eyes of those who assign the awards/nominations. Because film critics judge the overall quality of a movie, a positive review from critics might be an indication that the focal professional worked within a particularly inspired ensemble of people, which may have favored his creativity. As an indicator of critics' assessment we used an aggregate measure of critical reception. Data on critical reception came from a well-established online public source (humorously called) www.rottentomatoes.com, which rates all movies distributed in the United States. Using a wide number of movie reviews from accredited media outlets and online film societies, this source assigns each movie a summary score of critical reception.⁷ For each review, the critic's score is converted to a 0–10 point scale. In those cases when a critic does not provide a numeric score, the internal staff converts the reviewer's general impression into a score based on that critic's word choice, tone, and authoritativeness. The individual scores are then averaged to produce an overall rating of critical acceptance. Because the same list of critics is used to evaluate each movie, the score is consistent and the risk of bias is mitigated. We thus created the variable *Avg. movie critical reception* by computing the average of the metascore values of all movies in which each professional was involved in a given year. This variable could also partly control for the effect of professionals' status—due to their critical acclaim—on the likelihood of receiving an award/nomination.

5.3.8. Movie Sequels. The likelihood of receiving an award/nomination also can depend on whether movies

reflect a genuine search for artistic novelty or focus on more formulaic content, as in the case of sequels. We thus computed the variable *Movie sequels* as the ratio of movies that are sequels to the total number of movies in which each professional was involved in a given year.

5.3.9. Movie Genre. The likelihood of generating a creative outcome, and therefore receiving an award or nomination, could also depend on movie genre on the premise that the artistic content of a movie might vary across genres. For example, one could argue that a professional working on an action movie is less likely to win an award because action movies typically reflect more formulaic conventions. We thus computed the variable *Movie genre* as the ratio of movies that belong to a given genre to the total number of movies in which each professional was involved in a given year. We collected genre information from IMDB (e.g., Hsu 2006).

5.3.10. Year. Because we had no a priori expectations about the existence of a time trend over the study period, we controlled for the effect of all unobserved factors (e.g., macroeconomic trends, changes in taste or fashion, and other factors that might affect the movie industry) by including dummies for each year of the study period into the model.

6. Model

Our dependent variable measures individual creative performance by computing the number of awards and nominations each professional received in a given year. Because the dependent variable—*Individual awards & nominations*—can take on only nonnegative integer values, a Poisson or a negative binomial specification is recommended. In the Poisson distribution, both the mean and the variance are equal to the single parameter λ , which is a function of the explanatory variables—i.e., $E[Y] = \text{var}[Y] = \lambda$ (Allison 2005). However, in the presence of overdispersion—as in our data—the variance tends to be greater than the mean. Although overdispersion does not bias the coefficient estimates, standard errors might be underestimated and chi-square values statistics overestimated. We thus included the stochastic component ε_{it} , which allows for the effect of omitted explanatory variables to correct for this problem as follows:

$$E[Y_{it}] = \lambda_{it} = \exp(y_{it} = \mu_t + \beta x_{it} + \gamma z_i + \alpha_i + \varepsilon_{it}),$$

where $\exp(\varepsilon_{it}) \sim \Gamma[1, \alpha]$ —i.e., it is assumed to have a gamma distribution. The subscripts i and t indicate that the parameter λ is allowed to vary across individuals ($i = 1, \dots, n$) and time ($t = 1, \dots, m$). In this formulation of the negative binomial model, the parameter α is estimated directly from the data and captures overdispersion. Because λ cannot be less than zero, it is generally

expressed as a log-linear function of the covariates as follows:

$$\begin{aligned} \text{Log } \lambda_{it} = & \alpha_i + \beta_1(\text{Movie genre}_{it}) \\ & + \beta_2(\text{Avg. movie critical reception}_t) \\ & + \beta_3(\text{Movie sequel}_t) + \beta_4(\text{Team quality}_{it-1}) \\ & + \beta_5(\text{Individual creative freedom}_{it}) \\ & + \beta_6(\text{Individual quality}_{it-1}) \\ & + \beta_7(\text{Newcomer}_{it}) + \beta_8(\text{Structural holes}_{it}) \\ & + \beta_9(\text{Coreness}_{it}) + \beta_{10}(\text{Coreness squared}_{it}) \\ & + \beta_{11}(\text{Team coreness}_{it}) \\ & + \beta_{12}(\text{Team coreness squared}_{it}) \\ & + \text{Individual role dummies} + \text{Year dummies}. \end{aligned}$$

We estimated the final model using the generalized estimating equations (GEE) to control for heterogeneity at the individual level and the existence of any systematic difference across individuals due to unobserved effects. This method allows for correlation in the dependent variable across observations over time—due to repeated yearly measurements—by estimating the correlation structure of the error terms (Liang and Zeger 1986). By using an autoregressive structure, we assumed the correlations between repeated measurements of the dependent variable to decline from period to period (Allison 2005). We also ran the model by imposing an exchangeable correlation structure, which assumes that the correlations between repeated measurements of the dependent variable are equal across time, but found the results to be qualitatively similar to those reported here. We finally tried a less restrictive specification in which the correlation matrix for values of the dependent variable across the observation years has a “banded” structure. There is, in other words, one correlation for values that are one year apart, another correlation for values that are two years apart, and so on. All specifications yielded similar results. We report significance levels based on Huber-White robust standard errors to control for any residual heteroscedasticity across panels. We obtained our estimates using PROC GENMOD in SAS (version 9.1).

7. Results

Tables 3 and 4 present the descriptive statistics and the correlation values for all variables. The correlation values are relatively low, except for the linear and squared terms of the independent variables *Coreness* and *Team coreness*. In a separate set of analyses we centered them around their mean value to reduce the degree of correlation, but found no difference from the results reported here. We also checked for the existence of multicollinearity by computing the variance inflation factors

Table 3 Descriptive Statistics

Variables	Mean	Std. dev.	Minimum	Maximum
Individual awards & nominations	0.087	0.682	0	27
Avg. movie critical reception	5.469	1.430	0.7	9.5
Movie sequels	0.094	0.220	0	1
Team quality	0.138	0.298	0	3.25
Individual creative freedom	0.667	0.592	0	7
Individual quality	0.121	0.864	0	30
Structural holes	0.180	0.097	0.013	0.607
Coreness	0.01	0.019	0	0.623
Team coreness	0.717	0.343	0	1

(VIFs) using PROC REG in SAS, and found multicollinearity not to be a problem. Because we are using GEE, we cannot use either the deviance or log-likelihood to compare models and assess their fit. These statistics apply to the maximum-likelihood estimates, not to the GEE estimates. However, in PROC GENMOD, we can use CONTRAST statements to compare models (see Allison 2005).

Table 5 presents the GEE coefficient estimates for the negative binomial regression model. We estimated all models, controlling for movie genre, but the coefficient estimates are not reported due to space constraints. Model 1 is the baseline model with all controls. The coefficient estimates of the variables *Avg. movie critical reception*, *Movie sequels*, *Team quality*, and *Individual creative freedom* are significant and in the expected direction, suggesting that professionals are more likely to receive an award and/or nomination for their performance(s) in a given year when they work on movies that obtained positive critics’ reviews and are not sequels, and work in teams of high quality. By contrast, the variables measuring the quality of each professional’s human capital (*Individual quality*) and the brokerage advantage (*Structural holes*) turned out to be nonsignificant. The former result seems to support the view that past creative achievements are not necessarily good predictors of future ones (Simonton 2000). For example, an award-winning director might later deliver a poor performance due to self-imitative mannerism, conflict or lack of chemistry with other crewmembers, or excessive complacency. The lack of support for the structural hole variable suggests that the brokerage logic underlying structural holes could be at odds with the inherently collaborative nature of filmmaking and the high degree of reciprocity that characterizes this setting (Jones 1996, Bechky 2006). In such a context a *tertius iungens* orientation, i.e., a behavioral inclination to create or facilitate ties among people in one’s social network instead of keeping them far apart (as the *tertius gaudens* approach would suggest), might be more conducive to creativity, as recent findings by Obstfeld (2005) seem to indicate.⁸

Table 4 Pearson Correlation Coefficients ($N = 22,115$)

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Individual awards & nominations	1										
2. Avg. movie critical reception	0.191	1									
3. Movie sequels	−0.028	−0.137	1								
4. Team quality	0.120	0.198	−0.047	1							
5. Individual creative freedom	0.146	0.013	0.007	0.011	1						
6. Individual quality	0.127	0.068	−0.015	0.353	0.106	1					
7. Structural holes	−0.033	0.013	0.017	−0.110	0.031	0.053	1				
8. Coreness	0.057	0.009	−0.012	0.064	−0.028	−0.027	−0.244	1			
9. Coreness squared	0.027	0.008	−0.001	0.016	−0.028	−0.015	−0.059	0.847	1		
10. Team coreness	0.046	0.013	−0.065	0.161	−0.001	−0.006	−0.245	0.235	0.034	1	
11. Team coreness squared	0.044	0.012	−0.060	0.143	−0.008	−0.038	−0.201	0.250	0.037	0.910	1

Model 2 shows the results after we entered the linear and the quadratic terms for the first variable of theoretical interest—*Coreness*—to test Hypothesis 1. The coefficients of both terms are significant and in the expected direction, indicating the existence of an inverted U-shaped relation between the degree of network coreness and individual creative performance. In line with our theory, individuals who are in contact with both the core and the periphery of the social network are more likely to produce a creative outcome. In contrast, individuals who are either highly peripheral or over-entrenched in the social network tend to be less creative. We compared the improvement in the goodness of fit of adding the linear and the quadratic terms of the variable *Coreness* by testing the null hypothesis that both coefficients are equal to zero. This can be done in SAS by using the CONTRAST statement in PROC GENMOD. The resulting chi-square test for two degrees of freedom shows that Model 2 improves significantly

on the baseline ($Pr > \chi^2$ is 0.0001). The results, therefore, support the hypothesis.

Model 3 reports the coefficient estimates after we included the linear and the quadratic terms of the variable *Team coreness*, which measures the extent to which the team of which the focal professional is a member consists of professionals who are close to the periphery or the core of the network, or a mixture of both. The linear and the quadratic terms are statistically significant and in the expected direction. Again, we tested the null hypothesis that both coefficients for the *Team coreness* variable are equal to zero by using the CONTRAST statement. The chi-square test for two degrees of freedom shows that Model 3 improves significantly on the baseline ($Pr > \chi^2$ is 0.0001). The results indicate the existence of an inverted U-shaped relation between the degree of team coreness and individual creative performance, thus supporting Hypothesis 2.

Table 5 Determinants of Individual Creative Performance GEE Estimates for a Negative Binomial Regression Model (22,115 Observations)

Variables	Model 1		Model 2		Model 3		Model 4		
	Coeff.	Std. err	Coeff.	Std. err	Coeff.	Std. err	Coeff.	Std. err	Standardized coeff.
Intercept	−15.510***	1.604	−16.263***	1.832	−17.634***	1.715	−18.310***	1.901	
Year (dummies)	yes		yes		yes		yes		
Movie genre	yes		yes		yes		yes		
Avg. movie critical reception	1.253***	0.048	1.278***	0.045	1.274***	0.049	1.295***	0.046	2.717
Movie sequels	−0.542*	0.316	−0.581*	0.334	−0.353	0.315	−0.393	0.336	−0.127
Team quality	0.789***	0.085	0.701***	0.092	0.569***	0.086	0.539***	0.091	0.235
Individual role (dummies)	yes		yes		yes		yes		
Individual creative freedom	0.766***	0.080	0.845***	0.082	0.846***	0.082	0.906***	0.083	0.788
Individual quality	0.003	0.035	−0.015	0.041	0.007	0.033	−0.009	0.039	−0.011
Newcomer (dummy)	1.181***	0.162	0.929***	0.159	0.846***	0.159	0.648***	0.157	0.435
Structural holes [†]	−0.855	0.663	−0.295	0.648	−0.627	0.667	−0.167	0.651	−0.024
Coreness			28.967***	2.931			25.815***	3.252	0.719
Coreness squared			−34.043***	5.364			−29.120***	5.740	−0.402
Team coreness					5.431***	0.958	5.910***	0.981	2.975
Team coreness squared					−3.201***	0.788	−3.807***	0.805	−2.307
Log likelihood	−16,499.9		−16,098.2		−16,168.6		−15,817.6		
df	21,192		21,190		21,190		21,188		

Notes. Standard errors are heteroskedastic-consistent ("robust")—Two-tailed tests for all variables, [†]1-year lag.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.001$.

Model 4 presents the results for the full model when all variables are entered. The linear and the quadratic terms of both variables of theoretical interest are statistically significant and in the expected direction. Even when individuals do not occupy an intermediate position between the core and the periphery of the social network, they can still get the same benefits by being members of teams that combine core and peripheral actors.⁹ The overall fit of the model improves as compared to the baseline, but also with respect to Models 2 and 3, indicating that the full model better fits our data. The chi-square test for two degrees of freedom using the CONTRAST statement shows that Model 4 improves significantly on any other model ($Pr > \chi^2$ is 0.0001). The last column also reports the standardized coefficients for the final model to better appreciate the actual significance of the variables. Overall, the analysis provides strong evidence for the influence of social network on individual creative performance.

7.1. Robustness Tests

We tested the robustness of the results to alternative model specifications. First, although we assumed that the concept of creativity is continuous (Shalley 1995, Amabile 1996), we also ran the analysis by simply distinguishing between creative and noncreative outcomes. More specifically, we estimated a logistic regression model where the dependent variable takes on the value one if an individual received an award and/or a nomination, and zero otherwise. The results of the analysis were consistent with those presented here and are available from the authors upon request. In particular, as we add the variables of theoretical interest, the overall fit of the models improves significantly as compared to the baseline model with the controls only.

As mentioned above, in the analysis we focused on the following core crewmembers: producer, director, writer, editor, cinematographer, production designer, and composer. In creating the network, we then made an implicit assumption that all these professionals interact with each other whenever they participate in a movie. Although some of these members (e.g., the director) clearly collaborate directly with all the other crewmembers during the making of a movie, this assumption might not always be true for all of them. Depending on the nature of their tasks, different roles may be involved in the production process at different stages (see Ferriani et al. 2005). For instance, the producer and the writer are primarily involved during the preproduction phase and the composers in the postproduction phase. We thus checked whether this assumption might affect the results by focusing on a subset of roles present in the same production phase: director, editor, cinematographer, and production designer. Because these individuals are all involved during the actual shooting of the movie (principal photography), it is realistic to assume that

they collaborate and interact directly with each other. We recomputed all network variables of theoretical interest for this subset of roles and reestimated their effect, but found no significant difference in the results.

Because critics awards temporally precede Guilds and Academy awards it is possible that earlier announcements by the various critics' organizations affect later judgments by industry peers, rendering independent judgments amongst observers less likely. To control for this endogeneity problem, where earlier award announcements may cumulatively shape later perceptions about what is creative, we separated out the two categories of observers and run a model using only the critics awards (critics awards occur literally within a day of one another so the judgments are the most likely to be independent) as the dependent variable.¹⁰ Results from this analysis are consistent with those presented in the paper and are available from the authors upon request.

Some scholars (e.g., Sorensen and Waguespack 2006) have measured professionals' human capital by looking at the overall number of movies they made to capture differences in their level of experience. We checked the robustness of our results by estimating the model and substituting the number of movies each professional worked on for the number of awards/nominations received in the previous two years. Since the variable is highly skewed (with a few professionals making several movies per year) we entered the variable into the model after taking the logarithm. Again, the results did not change appreciably. It is worth noting that we could not enter this variable when the variable *Individual quality* was included because they are highly correlated.

8. Discussion and Conclusions

The use of social network lenses to understand and predict individual-level outcomes has become increasingly popular among sociologists and organizational scholars. Researchers have analyzed the role of social networks in influencing job searches (Granovetter 1973), career success (Burt 1992), job performance (Cross and Cummings 2004), the acquisition of power in the work place (Brass and Burkhardt 1993), and information seeking (Borgatti and Cross 2003). In this paper we have tried to extend this line of inquiry by advancing a social network perspective on individual creative performance. Although creative individuals are often described as working in isolation, in film and other collaborative endeavors their ability to generate a creative outcome originates from the interaction and collaboration with other individuals (Csikszentmihályi and Sawyer 1995). Even in the most primal moments of genesis, creativity connects with concrete social conditions (Becker 1982, Montuori and Purser 1996). Indeed, "any influence of artist depends on her being embedded in a group" (White and White 1993, p. xi). Drawing from social network theory and techniques, we examined the theoretical

and empirical underpinnings of this claim. To this end, we looked at the network of collaborations among key professionals working on Hollywood feature films. We reconstructed individual- and team-level networks using archival sources listing every professional involved in the sampled movies and created variables at the individual, team, and project levels. Our longitudinal analysis highlighted several important mechanisms through which the sociorelational system feeds into individuals' creative performance. Below, we discuss them separately and summarize the key theoretical and empirical contributions of the study.

8.1. Theoretical Contribution

With a few exceptions (e.g., Perry-Smith and Shalley 2003, Schilling 2005, Perry-Smith 2006), there has been virtually no systematic theoretical work probing the social network foundations of individual creativity. Our study is distinctive in that it contributes a comprehensive conceptualization of social structures as enablers of individual creative achievements. Building on Csikszentmihályi's system view on creativity (1990, 1996) and drawing on network theory, we described two social network mechanisms shaping individual creative performance. First, we elaborated on the notion of core/periphery network structures to emphasize the relationship between individuals' creative performance and their relative position in the larger social system. Individuals who span the boundaries between the core and the periphery of the social system, we argued, are in a vantage position to enhance their creative performance. By being close to the core, they can benefit from being directly exposed to sources of social legitimacy and support crucial to sustaining creative performance; at the same time, by not losing touch with the periphery, they can access fresh new inputs that are more likely to blossom on the fringe of the network while escaping the conformity pressures that are typical of a more socially entrenched field. For example, the Weinstein brothers—founders of Miramax—epitomize the case of professionals who have become so entrenched within the system that their ability to generate a creative outcome has diminished significantly over the years. After winning an Oscar for *Shakespeare in Love* in 1999, Harvey Weinstein, who displays the highest coreness values over the study period, received only an Oscar nomination in 2003 for *Gangs of New York*—but the Oscar is the award among those we used in the analysis that tends to be driven more by commercial than artistic considerations. As a former Miramax executive recently observed:

Harvey Weinstein became like a drug addict trying to support his habit. In the end, he went native. He wanted to be another big player in Hollywood. He used to be a real outsider. And now he and Bob want to be let into the club.¹¹

In line with our theory high levels of coreness are associated with low probability of receiving an award or a nomination.

Second, we highlighted how having moderate levels of coreness does not imply that extreme positions (core or periphery) always have negative implications for individual creativity. Even when individuals do not occupy an intermediate position between the two social worlds, they can get the same benefits by participating in balanced teams that combine core and peripheral actors. The simplest case—a dyad—can be used to illustrate this point. Consider two individuals—one closer to the core and the other closer to the fringe of the network—that decide to collaborate. In this situation, the dyad, not the individual, occupies an intermediate position. The two individuals are simultaneously exposed to the core and the periphery, and therefore have a higher chance of enjoying the benefits accruing to that position by working together rather than remaining separate. In this instance the dyadic context, rather than the individual, embodies the structural features that are predicted to be most beneficial to its members. As an illustration, consider the interaction between producer Harvey Weinstein and director Jim Sheridan. Coming from the United Kingdom in the late 1980s, Sheridan was clearly an outsider to the Hollywood network, whereas Weinstein was already central within the system. When in 1989 Miramax decided to bet on Jim Sheridan's first feature film *My Left Foot*, Weinstein leveraged all his networks to boost Sheridan's visibility within the Hollywood community. As Biskind (2004, pp. 98–99) explains:

...he (Harvey Weinstein) persuaded director Sheridan and producer Noel Person to relocate to L.A. to work the Hollywood old-boy network, whose votes weighed so heavily in the outcomes of the Academy Awards [...] the dinners became items in the trades and gossip columns which in turn generated word of mouth [...]. You create evening social activity where influence peddling can take place as an innocent, natural thing. More mouths to more ears. Such gatherings were particularly useful in introducing actors and directors who weren't part of the community.

Jim Sheridan went on to win many awards and become an acclaimed filmmaker. He was clearly very talented, yet it is apparent that without the kind of endorsement and recognition that Weinstein facilitated through his contacts, Sheridan's rise to fame would have been much harder. Similar considerations hold for groups of more than two members so long as the latter differ with respect to their degree of coreness. These mechanisms rest on the basic idea that creativity cannot be manifested in the absence of a field that recognizes and legitimizes the novel contribution. Even extremely gifted people will not be able to make a difference in a domain unless recognized and endorsed by a community that

will witness the appropriateness of their contribution (Csikszentmihályi 1996).

Our core/periphery perspective on creativity shares with Burt's (2004) notion of brokerage the crucial intuition that creativity is more likely to emerge at the interstice of social worlds. However, it also adds to Burt's classic theory by emphasizing the role of the social structure in conveying legitimacy beside and beyond providing idea-conducive conditions. Successful ideation depends not only on brokering knowledge by bridging structural holes across social contexts, but also on a network structure capable of supporting and protecting those ideas from skeptical scrutiny. Because the coreness measure carries with it the whole network's pattern of ties (Borgatti and Everett 1999), our approach is better suited to capture the duality of this process as compared to an approach that is focused exclusively on egocentric properties like in the case of structural holes.

We believe that the theory developed, as well as the evidence presented in this paper, advances our understanding of the determinants of creative performance by integrating facets of social relationships at different levels of analysis. Although a few scholars have emphasized the need to "extend research beyond the level of the small-group project" (Drazin et al. 1999, p. 288) and to develop multilevel models of creativity (Glynn 1996), extant empirical research on the relational drivers of creativity has been limited either to the "ego" (Burt 2004), the "dyad" (Alvarez and Svejnova 2001), or the "industry" (Uzzi and Spiro 2005) levels. Our study is distinctive in that it offers an integrated network view on individual creative performance that embraces two levels simultaneously—i.e., the individual and the team—while including control variables at the individual, team, and project levels. A key strength of the network approach is its potential for multilevel analysis. Multilevel models provide a deeper, richer portrait of organizational phenomena and allow more integrated inquiry (Klein et al. 1999). Because both creativity and network embeddedness are multilevel phenomena with causal processes cutting across multiple levels of analysis, we see this analytical approach as particularly promising.

8.2. Empirical Contribution

This research represents an original attempt to introduce network analytic techniques within the realm of individual creative performance. The viability of using sociometric tools to unravel the relationship between creativity and social networks was recognized a long time ago (Moreno 1940, Northway and McCallum Rooks 1955, Crane 1972). However, only recently have systematic attempts been made to untangle this relationship based on formal network measurement and operationalization (Burt 2004, Uzzi and Spiro 2005). Our paper takes various measures to address this shortcoming.

To unveil the social fabric of the Hollywood movie industry, we examined the bipartite affiliation network resulting from collaboration among professionals across projects (i.e., movies). The use and analysis of unipartite projections of affiliation networks has a few distinctive advantages over more traditional ways of gauging social networks (Newman et al. 2002). First, it allows reconstructing networks of much larger size than in experimental research because compiling substantial data sets based on pure sociometric questionnaires is very time consuming and costly. To the extent that project membership's archival sources get updated regularly, social structures derived from affiliation networks can easily be tracked longitudinally. The present study examines individuals' social interactions not only on a large scale (the number of nodes involved over the period 1992–2003 is 11,974), but also longitudinally. Although in recent years much progress has been made in the analysis of longitudinal network structures, the challenges of gathering network data over time are still a major obstacle to the development of network research and are arguably one of the most common sources of criticism of network studies (Borgatti 2005).

Finally, much research on individual creativity builds on fine-grained qualitative evidence or experimental designs, only a few studies look at this issue on a large sample scale (Runco 2004). This study is distinctive not only in that it investigates determinants of individual creative performance within a large sample research framework, but also because it introduces a research design and operationalization strategy that lend themselves to replication in many other contexts, including opera, theaters, advertising, the TV industry, and other project-based settings where individual creativity is assessed systematically and judged by external experts, and individuals' linkages can be tracked by means of their affiliation structures.

8.3. Limitations and Future Directions

The study suffers from obvious limitations that represent opportunities for future research. The distinctive nature of the industry casts some doubt on the generalizability of our findings; therefore, the results should be interpreted with caution outside the film industry. In our setting, organizations are created and dissolved in a short period of time. Project organizations operate under highly uncertain and volatile circumstances, and it is under these conditions that networks conveying knowledge and identity become critical in fostering creativity. It is notable, however, that project organizations typify the collaborative endeavors that are becoming increasingly common across various social systems (DeFillippi and Arthur 1998).

The definition of creativity used in this paper focuses on the quality of the outcome of the creative effort. Other definitions model creativity as a process rather than as

an outcome by emphasizing an individual's engagement in a creative act (e.g., Drazin et al. 1999), or by specifying a constellation of personality traits or attributes that characterize creative people. Although a finer examination of the process represents a valuable opportunity for future research, looking at the quality of individuals' work as revealed by the outcomes they produce is a more viable approach to studying individual creative performance within a large sample design based on analysis of archival data (Simonton 1984b). Researchers interested in creative processes rather than outcomes need to adopt different methodological approaches to deal effectively with meanings and cognitive frames, such as in-depth case studies, participant observation, or interviews (Drazin et al. 1999).

Doubts could also be cast on our operationalization of creative performance, which is contingent on the plausibility of two critical assumptions: (1) creativity is context dependent, and as such cannot be defined irrespective of the perceiver (creativity, in other words, depends on subjective evaluations of creative outcomes or responses); (2) awards and nominations are reasonably correct indicators of film professionals' cinematic creativity and achievements. Although we recognize that the violation of these two assumptions would undermine the viability of the study, we also believe that they both rest on robust arguments. As to the first assumption, some researchers have favored more individual—rather than contextual—notions of creativity, emphasizing intrinsic properties of novelty and appropriateness (Barron 1955, Stein 1974) as well as the personal perspective of the creator (Baer 1997). However, there is no other way of knowing the intrinsic properties of an object than through our subjective perceptions (e.g., Amabile 1982, 1996). A given outcome or response can be considered to be creative when relevant judges independently perceive it as such (Csikszentmihályi 1996). Our award-based measure of creativity is consistent with this principle, and the multiple awards we employ bring together the assessments of the two most relevant groups of judges of industry output quality: industry peers and film critics. From a different perspective, it would be interesting to investigate more deeply the extent to which these judgmental criteria are in turn socially and structurally determined. Although this is beyond the scope of this study, the ideas and evidence presented here might prove useful in addressing such a problem.

Despite our longitudinal research design, reverse causality might represent a threat to the robustness of the results. It is clearly plausible to assume that highly creative accomplishments could themselves trigger preferential rules of attachments among film professionals, thus resulting in the endogenization of one or more structural properties of the network. We believe our multilevel estimation model with time-varying network windows and controls for prior creative accomplishments

provides a reasonable response to the reverse causality issue. On the other hand, addressing the problem more thoroughly would involve analyzing network properties and creative performance as joint dependent variables in a longitudinal framework where individual creativity and network structure simultaneously constitute a dynamic process. Recently, Snijders et al. (2006) have proposed a family of stochastic models based on a continuous-time Markov model to formalize this process. However, the computational power required to apply such a framework to large-size networks of the kind examined would be prohibitive for this study. In addition, the application of these techniques is still in an exploratory phase. These limitations notwithstanding, the analysis of network dynamics (Snijders 2001) is a fascinating frontier of network inquiry, and one that may contribute greatly to our understanding of behavioral dynamics given simultaneous evolving social structure.

Interestingly enough, even for creative processes that are typically viewed as confined to the workings of lone individuals—e.g., poets, novelists, sculptors, or anybody working alone (literally, in physical isolation)—the creative effort often is embedded in an underlying network of social relationships. In his extensive study on intellectual progress in art, science, and philosophy, for instance, Collins (1998) suggests that several revolutionary ideas developed by thinkers such as Freud, Hegel, Conrad, and Beethoven almost invariably were associated with specific positions within larger chains of social interaction among contemporary intellectuals. In the world of painting, the French Impressionists' movement was to some degree “a result of the social structure of their group and the circumstances of their work in partial isolation from the official system and its styles” (White and White 1965, p. 118). Although in our study we sought to control for some key individual-level characteristics, further research might extend our contribution by providing a finer assessment of the interplay between the human and social attributes in shaping creative performance. This is a promising area of research, and one that still lacks systematic inquiry.

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Endnotes

¹Similar patterns can also be observed in other fields. For instance, even a "casual survey of the history of art reveals periods when the established view of art has been challenged by relatively marginal artists whose ideas in turn sometimes came to dominate. One thinks of the French Impressionists who rejected the tenets of nineteenth-century representational painting in France, the abstract expressionists who challenged the modern art 'establishment' of the 1950s, and the 'op art' movement more recently" (Crane 1972, p. 134).

²Our interest is in feature films made and distributed by Hollywood. Thus, we did not include documentaries, foreign-made films, short films, and compilation screen classics.

³For the period covered in this study (1992–2003) we identified 125 movies in the *New York Times* list. Although 75 of these movies were produced and distributed in the United States—i.e., our focal population—the remaining 50 movies were produced outside the United States (e.g., Europe). They form a completely different population, and therefore are not relevant for our study.

⁴The Academy of Motion Picture Arts and Sciences is a professional honorary organization composed of over 6,000 motion picture professionals dedicated to the advancement of the arts and sciences of motion pictures. All the members have received special recognition for their own contributions to filmmaking. The Directors Guild of America is a craft union founded in 1960 enlisting approximately 12,000 directors. The Writers Guild of America is a labor union founded in 1921 comprising more than 11,000 writers in the motion picture and television industries in the United States. The American Society of Cinematographers is a cultural and professional organization founded in 1919 whose membership extends only to directors of photography with distinguished credits in the industry, currently numbering approximately 340 members. The American Cinema Editors is an honorary society founded in 1950 that includes film editors selected for the qualities of professional achievements and their dedication to editing. The Producers Guild of America is a labor union founded in 1962 whose membership exceeds 2,300 producers worldwide. The Hollywood Foreign Press Association is a nonprofit organization established in 1943, consisting of approximately 90 international journalists representing almost 50 nations. The National Board of Review Awards is a nonprofit organization founded in 1909 and composed of both film professionals and film critics. The New York Film Critics Circle is a group comprised of 34 print journalists who write for New York City based publications such as *Newsweek*, *Time*, *The New Yorker*, the *New York Times*, *Entertainment Weekly*, and *Rolling Stone*. The Los Angeles Film Critics Association is a group of 53 members based in Los Angeles who, unlike members of its print-only New York counterpart, review for newspapers, magazines, TV, and online media.

⁵The output for the continuous model in UCINET also includes an overall measure of "fitness" that indicates how well the observed data approximates an ideal core/periphery structure. Although there is no standard statistical test to assess the fitness significance (for recent developments see Boyd

et al. 2004), a high fitness measure implies a good agreement with the model, whereas a lower fitness measure suggests that the model should be rejected. Running the continuous model on our nine matrices yielded an average correlation criterion of 0.55, suggesting a satisfactory agreement with the model.

⁶To double-check the soundness of our approach, we also computed *Team coreness* by fitting a discrete core/periphery model to the data. The model partitions the network into two classes, where one class is the core and the other is the periphery (i.e., professionals are directly distinguished between core and peripheral actors). We then created the variable by using the ratio described above, but found no difference with the results presented here.

⁷Accepted critics must have one of the following active membership: (1) Boston Society of Film Critics; (2) Broadcast Film Critics Association; (3) Chicago Film Critics Association; (4) Cinemarati; (5) Dallas-Fort Worth Film Critics Association; (6) Film Critics Circle of Australia; (7) Florida Film Critics Circle; (8) Kansas City Film Critics Society; (9) Las Vegas Film Critics Society; (10) London Film Critics Circle; (11) Los Angeles Film Critics Association; (12) National Society of Film Critics; (13) New York Film Critics Circle; (14) New York Film Critics Online; (15) Online Film Critics Society; (16) Phoenix Film Critics Society; (17) San Diego Film Critics Society; (18) Santa Fe Film Critics Circle; (19) San Francisco Film Critics Circle; (20) Southeastern Film Critics Association; (21) Toronto Film Critics Association; (22) Vancouver Film Critics Circle; (23) Washington D.C. Area Film Critics Association.

⁸We also note that in adhering to the notion of structural holes as structural conditions for creativity, one must make an implicit assumption that new ties are unlikely to be added to the network. In fact, the broker's exposure advantage is plausible only if the ego's alters do not become connected to one other (Borgatti 2005). Although this is typically the case within large and mature organizations of the kind researched by Burt (2004), the film industry project network is characterized by a continuous rewiring of ties, due to the "one-off" nature of projects. In light of these observations, we are inclined to think the structural hole argument to be less cogent here than in other contexts.

⁹For purposes of illustration it may prove helpful to provide some further interpretation of the curvilinear coefficients. Based on the coefficient estimates reported in Model 4, the effect of coreness on the expected number of awards is given by: $Y = 25.815(Coreness) - 29.120(Coreness^2)$. The value of *Coreness* such that *Y* reaches the maximum is given by: $Coreness_{max} = -(25.815)/2(-29.120) = 0.44$. We note that this value falls within the actual range of variation of *Coreness* ($0 < Coreness < 0.62$). Similarly, the full effect of *Team coreness* on the expected number of individual awards is given by: $Y = 5.910(Team\ coreness) - 3.807(Team\ coreness^2)$. This function reaches its maximum for $Team\ coreness_{max} = -(5.910)/2(-3.807) = 0.776$. Also, this value lies within the variable interval ($0 < Team\ coreness < 1$).

¹⁰We thank one anonymous reviewer for suggesting this robustness check.

¹¹The quote comes from an October 11, 2004, *New York Magazine* article that goes on to explain: "When we did the original Miramax deal, they [*the Weinstein brothers*] had a formula that was very appealing . . .," says one movie executive. "Do

these \$10 million movies, and maybe on some you lost a little, and on some you made a whole lot. The Weinsteins became emboldened by their success. They had become a major studio disguised as an independent film company.” We thank one anonymous reviewer for bringing this article to our attention.

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