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Creativity:
The Interplay of Structural
and Individual Characteristics

JOOBIN ORDOOBODY

Creativity: the Interplay of Structural and Individual Characteristics

Proefschrift ter verkrijging van de graad van doctor aan Tilburg University

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Table of Contents

INTRODUCTION.....	1
CHAPTER 1.....	10
ABSTRACT	10
BROKERING IDEAS	16
The role of specialization in brokering ideas	17
The role of expertise in brokering ideas.....	22
METHODS.....	24
Data	25
Network Construction	26
Measures.....	27
Analysis.....	32
RESULTS.....	33
DISCUSSION AND CONCLUSION	36
APENDIX: FIGURES AND TABLES.....	41
CHAPTER 2.....	44
ABSTRACT	44
INTERNAL VERSUS EXTERNAL INPUT.....	48
The role of expertise in adopting external input.....	52
The role of specialization in adopting external input.....	56

METHODS.....	58
Network construction	59
Measures.....	59
Analysis.....	61
RESULTS.....	62
DISCUSSION AND CONCLUSIONS.....	66
APPENDIX: FIGURES AND TABLES.....	69
CHAPTER 3.....	76
ABSTRACT	76
NETWORK EVOLUTION AND CREATIVE INFLUENCE	80
METHODS.....	89
Empirical Context	89
Data	90
Network Construction	91
Measures.....	93
Analytical Approach	95
Selection Effects.....	98
Influence Effects.	99
Procedure.....	100
RESULTS.....	101

Selection Model.....	102
Influence Model	104
Robustness Tests	105
DISCUSSION AND CONCLUSIONS.....	106
APPENDIX: TABLES	114
CONCLUSION	117
REFERENCES.....	123

INTRODUCTION

By definition, creativity comprises (a) the production of novel outcomes and that (b) experts find valuable (Amabile, 1983; Uzzi & Spiro, 2005). Both of these elements are intersubjective phenomena, meaning that there is variation across different contexts in what is considered creative (Loewenstein & Mueller, 2016). The emphasis on outcomes (part a) stems from the unobservable and often inaccessible nature of the underlying creative processes. For novelty to be recognized based on experts' consensus, the various features of creation should reach a state that is observable to them (Criscuolo, Dahlander, Grohsjean, & Salter, 2017). Consequently, the definition of creativity often includes some form of outcome, which is more observable and accessible for evaluation than the creative processes (Hoeffler, 2003; Sagiv, Simons, & Drori, 2020).

However, an outcome in the definition of creativity does not necessarily denote the end products but could be an aspect, characteristic, or component of the production as long as it can be distinguished and evaluated separately. For instance, a film produced with less than exceptional quality may still stand out to the expert eye for an original story or screenplay. Likewise, the novelty in designing software or composing a musical piece is often acknowledged separately from other features of the final product (Cattani & Ferriani, 2008; Clement, Shipilov, & Galunic, 2018; Tschang, 2007). In fact, in most areas that involve collaborators in different roles who contribute distinctive domains of expertise to advance various aspects of the final product, each aspect is evaluated separately for creativity.

The value assigned by experts (part b) further underlies that creativity is an intersubjective phenomenon since it is primarily evaluated around facets over which experts in a particular context converge (Criscuolo et. al, 2017; Uzzi & Spiro, 2005). Moreover, creative

outcomes usually stem from novel combinations of existing ideas that have spread through social interactions (Perry-Smith & Mannucci, 2017). That is, in order to produce novelty, individuals utilize various forms of direct and indirect interactions to learn about and build on each other's existing ideas. In fact, previous studies suggest that innovations conceived in complete isolation are extremely rare (Uzzi & Spiro, 2005). While a variety of sources inspire new ideas based on social interaction, substantial exchange of ideas typically occurs between those who know each other (Obstfeld, 2005; Singh, 2005), especially among actors who collaborated previously and share a professional interest (Clement et. al, 2018). In creative contexts, collaborators usually build upon each other's input and intensively engage in exchanging ideas (Caves, 2003).

In this sense, individuals' collaboration ties that are embedded in a larger collaboration network of creative professionals have substantial consequences for their exchange of ideas and therefore, the sort of input they receive. Likewise, individuals' own capacity to process this input is consequential to their creativity. Accordingly, the present dissertation explores the exchange of ideas among collaborators in creative contexts to answer "*how do structural and individual-level factors jointly determine creativity?*". Subsequently, this overarching question is discussed in three chapters, each one addressing a more specific question. Chapter one seeks an answer to "how do an individual's specialization and expertise affect the processing of input that they receive from their collaborators?". Chapter two extends the conceptual framework of the first chapter by specifying the sort of input that is processed and explores "how does the processing of input from outside one's professional field differ from input received from collaborators within the same field?". Chapter three examines the conventional assumptions behind the first two chapters to addresses "whether structural mechanisms in a collaboration

network drive creativity or that individual-level factors, such as creativity and specialization, shape the ties that constitute the collaboration network?”.

The first chapter of this dissertation explains the interplay of network position, expertise, and specialization in generating novel ideas based on interaction among collaborators. This chapter revisits the conventional recombination perspective in innovation research by offering a socio-psychological framework, in which structural and individual-level factors complement each other by providing opportunity, motivation, and the ability to process diverse input. It is argued that while the structure of direct ties to collaborators determine opportunities for accessing diverse input, two key facets of professional background, namely specialization and expertise, affect the extent to which diverse input leads to novel outcomes. Specialization in outcome types -such as genres- determines individuals’ inclination to thoroughly navigate their opportunities, while expertise concerning roles in collaboration defines individuals’ ability to take advantage of these opportunities. These two facets of professional background were specifically adopted to ensure addressing three primary aspects of collaboration in our framework: while the collaboration ties illustrate “with whom does one work?”, specialization hints at “what sort of outcome does one produce?” by capturing the individuals’ focus on outcome types, and expertise answers “how does one participate in collaboration?” by characterizing the distribution of individuals’ activity over multiple roles in collaboration.

This chapter takes an important step towards providing a socio-psychological explanation for creativity. While conventional explanations of creativity in sociology focus on purely structural scenarios that may overlook individuals’ (lack of) ability to enhance their creativity in a given social position (Granovetter, 1985; Soda, Tortoriello, & Iorio, 2018; Tasselli & Kilduff, 2020), psychology offers explanations that emphasize individual-level

factors but do not fully account for the constraints and opportunities provided by one's social environment (Hennessey & Amabile, 2010). The first chapter of this dissertation offers a broader picture of the variation among individuals' creativity by reconciling explanations that rely on social structure and individual agency. Provided a specific social environment, the framework offered in this study hints at individuals' agency to advance towards achieving creativity, by identifying capacities that individuals can build in order to benefit from their specific network position. Moreover, the theory offered in this chapter further highlights the critical role of professional background as an addition to individual-level attributes that psychology commonly associates with creativity.

The findings of the first chapter also advance a central concept in network studies of creativity and idea generation, namely brokerage, by revealing specific configurations of expertise and specialization that reverse the effect of brokerage on creativity. A brokerage position is one with ties to two collaborators who do not have a collaboration tie to each other and is conventionally believed to be a source of diverse input (Burt, 2004). This chapter reveals a nuanced pattern concerning the effect of brokerage on creativity. While brokerage benefits the creativity of highly expert professionals with diverse specialization, it hampers the creativity of genre specialists as well as those with diverse expertise.

The second chapter extends this socio-psychological framework to investigate the integration of external input, i.e., input from outside a professional field, as a fundamental way of fostering innovation. While input that already exists and is being exchanged among collaborators within one professional field can foster creativity, input from sources that are outside a particular field can also inspire new ideas. A professional field in this context refers to an industry or other equivalent domain of professional activity, such as artistic, academic or

athletic fields. Lighting and cinematography principles imported from painting, or videogames employing the narrative style of feature films are some examples of how ideas move across different creative fields. In fact, importing input from another professional field into one's own is a fundamental way of increasing the input diversity for both the adopting individual and entire field (Cattani & Ferriani, 2008; Fleming, Mingo, & Chen, 2007).

In addition to the variation of input flow within creative contexts, professionals working in these contexts also differ in their ability to deal with various sorts of input. Collaboration ties within a professional field are likely to convey and foster the exchange of ideas that are relevant to that particular field (Clement et. al, 2018). By contrast, individuals should rely on ties outside their field-specific collaborations to import input from another field and ensure that the imported input will be compatible with production standards in the adopting field. Therefore, the same qualities that enable individuals to successfully take advantage of input circulating within the same field do not necessarily facilitate a similar level of success for integrating input from outside the boundaries of that field. Moreover, while some individuals may have the motivation to explore outside field-specific boundaries in pursuit of fresh input, others may focus their agenda on recombining the existing input within their field in new ways. This chapter draws upon the role of professional backgrounds in order to understand how individuals deal with different sorts of diversity in input to generate novel ideas. In doing so, this chapter also disentangles the mechanisms involving individuals' position within the entire collaboration network and the structure of their immediate connections to direct collaborators. The results of the second chapter confirm that the external input absorbed via the network periphery and the social support provided at the core are best utilized by those in between these two positions, namely the core and the periphery. Furthermore, a fine-grained approach into the origins of coreness mechanisms is adopted to explain, for instance, which configurations of expertise and

specialization enable those at the periphery to function efficiently as gatekeepers who renew the pool of creative input in their field.

As such, this chapter extends diverse networks literature in the context of idea generation by disentangling diversity in two main types of input: internal input sourced from field-specific exchanges and external input, that is imported from another field. Moreover, the theoretical discussion of this chapter further highlights the importance of distinguishing between internal and external input by revealing that they activate substantially different network mechanisms. The findings of this chapter advance our understanding of a key concept in network studies of creativity, namely coreness, by demonstrating that the nonlinear effect of coreness can be reduced into one predominant (dis)advantage when interacted with specialization or expertise. As such, the inverted-U shaped effect of coreness may not strongly hold for some individuals, depending on their specialization level.

The final chapter disentangles the influence of the collaboration structure on individuals' creativity from the extent to which their reputation for past creativity shapes their network. Existing literature provides mixed evidence as to whether network mechanisms drive idea generation (Ahuja, 2000; Cattani & Ferriani, 2008; Clement et. al , 2018; Fleming et. al, 2007; Tortoriello, 2015; Tortoriello, McEvily, & Krackhardt, 2015) or vice versa (Lee, 2010). The third chapter adopts a relatively new method, called SIENA that is specifically designed to disentangle network evolution from the consequences of network related mechanisms for individual performance or behavior. Moreover, SIENA can capture the consequences of the discussed network mechanisms for both a focal individual as well as that individual's collaborators. Using SIENA, the third chapter systematically considers network interdependencies and evolution while contrasting the formation of collaboration ties based on

selection effects with the effect of such ties on the creativity of individuals and their alters. Subsequently, this chapter examines whether an individual's creativity generally comes at the expense of collaborators or enhances collaborators' creativity, by capturing how and in which direction collaborators influence each other's creativity while contributing to the innovativeness of a project. Moreover, this chapter examines whether similar specialization levels (concerning genres) merely make collaboration more likely to occur or also facilitate inspiration via collaborators' creative influence on each other. SIENA allows to empirically address this dilemma while controlling for structural mechanisms, such as popularity, which may affect creativity during idea selection and evaluation.

This final chapter extends the existing research about tie formation in creative contexts by theorizing that similar levels of reputation and specialization increase the likelihood of individuals to collaborate on the same project. Furthermore, the chapter expands on the notion of network externality that had been mainly related to brokerage positions in past research (Clement et. al, 2018; Galunic et. al, 2012), to show that network interdependencies by which one's performance or behavior is tied to others' performance broadly apply to exchanging ideas in a collaboration network. More precisely, this chapter explains how, after forming a collaboration tie, collaborators substantially influence each others' creativity via formal and informal exchange of ideas as well as building on intermediate outcomes that they produce towards the end product. Accordingly, this study provides a more complete answer to ambiguities regarding whether networks drive creativity or vice versa and reveals that while similar levels of creativity drive tie formation, the exchange of ideas in a collaboration network remains to be a major antecedent of creativity. To this end, this study also advances the epistemology of innovation and creativity studies by introducing a design that allows for systematically contrasting selection mechanisms and network influences, while retaining the

bimodal order of organizational affiliations (Benton, 2016) that reflects the structure of professional relationships in project-based, network organization (Powell, 1990).

Overall in this dissertation, we synthesize the sociological and psychological explanations of creativity to examine the interplay of individual level and structural mechanisms in the generation of novel ideas. Particularly, we introduce a socio-psychological approach to the creativity literature suggesting that in addition to a social position that provides opportunities for accessing diverse and new input ideas, one's (a) motivation to recognize and (b) ability to utilize this input is critical for producing novel ideas. Based on this socio-psychological approach, we contribute to research about idea generation by developing a conceptual framework in which individuals' specialization (in terms of outcome types, such as genres) and expertise (in terms of role in collaboration) explain respectively their motivation and ability in dealing with diverse input. To this end, we also advance diverse networks literature by disentangling two sorts of diversity in input and their corresponding network mechanisms. While the ego-network structure facilitates diversity in input that has already been exchanged within an industry, i.e., internal input, whole network positions allow importing new input from other industries, namely external input. Our findings reveal brokerage and coreness to have a strong combined effect with specialization and expertise, indicating that individuals with varying levels of expertise and specialization can overcome the possible drawbacks of their professional background if they have the right social network position and structure. Furthermore, we contrast dyad level mechanisms in which (a) the extent to which structure of a collaboration network affects creativity vs (b) the degree to which individuals' reputation for creativity shapes their network. In doing so, we explain how, after forming a collaboration tie, collaborators influence each other's idea generation via formal and informal exchange of ideas

as well as building on intermediate outcomes that they produce towards the end product. Figure-1 illustrates an overview of the dissertation framework.


CREATIVITY					
<i>CHAPTER-3</i>					
		NETWORK (OPPORTUNITY)	SPECIALIZATION (MOTIVATION)	EXPERTISE (ABILITY)	
INPUT		ACCESS	NAVIGATE	CONVERT	
MECHANISMS OF CREATIVE INFLUENCE	INTERNAL INPUT	<i>CHAPTER-1</i>	EGO NETWORK (BROKERAGE)	<u>RECOGNIZE</u>	INTEGRATE
	EXTERNAL INPUT	<i>CHAPTER-2</i>	WHOLE NETWORK (CORENESS)	SUPPORT	<u>COMPREHEND</u>

Figure 1- Dissertation Overview

CHAPTER 1

THE CONTINGENT VALUE OF BROKERAGE: A SOCIO-PSYCHOLOGICAL APPROACH TO CREATIVITY

ABSTRACT

This chapter explains creativity as an outcome of the interplay between an individual's professional background and structural properties. More precisely, this chapter investigates whether and how individuals' brokerage position interacts with their specialization and expertise to determine creativity. We posit that a brokerage position reveals (or constrains) opportunities for enhancing creativity, yet individuals have agency in developing specialization and expertise that would enable them to recognize and utilize such opportunities. As such, the theoretical approach of this chapter departs from purely structural explanations of creativity that project a deterministic view and incorporates person-specific elements that interact with an individual's structural characteristics. These dynamics are explored in the American film industry with a focus on feature film titles distributed in the 90s to early 2010s. The findings of the study indicate, for example, that a filmmaker who can broker ideas of other film professionals is most creative when working across genres (e.g. Drama and Comedy) but focused on one role (directing). These findings contribute to the literature on diverse networks, idea generation, and creative industries.

Creativity, defined as the production of novel outcomes that experts find valuable (Amabile, 1983; Uzzi & Spiro, 2005), is explained differently by two major scientific disciplines. Sociologists describe creativity as an outcome of the social structure surrounding individuals (Burt, 2004). They assume that creativity is based on novel combinations of existing ideas (Ahuja, 2000; Clement, Shipilov, & Galunic, 2018; Fleming, Mingo, & Chen, 2007; Uzzi & Spiro, 2005). Such creative ideas form through collaboration and interactions among multiple individuals who provide input into creative processes. Consequently, sociology relates creativity to the characteristics of an individual's social or professional network: the number of connections, their structure, and their variety collectively determine the diversity in input an individual receives and, in turn, allow for more novel combinations of that input. In support of this notion, multiple studies have shown that the network structure of collaborations can explain the difference in creativity among individuals (Cattani & Ferriani, 2008; Clement et. al, 2018; Perry-Smith & Mannucci, 2017; Uzzi & Spiro, 2005).

Alternatively, a longstanding stream of psychology research attributes creativity to individual-level characteristics and behavior: individual-level factors, including ability and motivation, interact to stimulate creative thinking (Amabile, 1983; Amabile & Pillemer, 2012). This stream of research focuses on the different capabilities possessed by individuals in the process of converting input into novel outcomes, linking creativity to individual characteristics, traits, and emotions (Kozbelt, Beghetto, & Runco, 2010) as well as neurological, affective, cognitive, and personality differences (Hennessey & Amabile, 2010). Moreover, certain patterns of behavior among individuals also play an important role in explaining creativity. For example, repeated work within the same genre may invoke a sort of myopia that hampers

creativity over time, even though it may initially facilitate skill development (Mannucci & Yong, 2018)¹.

Although research in sociology and psychology garnered valuable insights into the origin of individual creativity, neither field fully captures the variation of creativity among individuals. As enticing as it appears, the structural argument proposed by sociology fails to address two major issues. First, it implies that different individuals in similar structural positions are equally creative, overlooking differences in their characteristics and choices. In fact, most network studies model individuals as interchangeable nodes, lacking the particularities that could add to the understanding of individual creativity (Granovetter, 1985; Soda, Tortoriello, & Iorio, 2018). Yet, more recent studies show that individuals differ in recognizing and exploiting their structural positions to their creative advantage (Fleming et. al, 2007; Mannucci & Yong, 2018; Perry-Smith & Mannucci, 2017; Soda et. al, 2018). Second, the structural approach has conventionally neglected the role of agency by the individual, even though recent social network research has emphasized the relevance of individual agency and calls for advancing research about agency as an addition or complement to structural characteristics (Tasselli & Kilduff, 2020). For creativity, individual agency implies that

¹ Notably, specialization in a particular genre enhances the chances of a novice to be selected for collaboration (Zuckerman, Kim, Ukanwa, & Von Rittmann, 2003), but favoring individuals in selection does not generally advance their creativity. Chapter 3 explains when selection for projects is likely to enhance individuals' creativity.

individuals activate their connections differently in pursuit of novelty (Perry-Smith & Mannucci, 2017; Tortoriello, McEvily, & Krackhardt, 2015).

Alternatively, psychology research provides a suitable account of how individuals deal with the amount and diversity of input to convert it into creative outcomes. However, psychological studies do not address how individuals systematically differ in relation to their social environment. These studies assume that social structures provide similar opportunities or constraints for every individual (Hennessey & Amabile, 2010). However, social network studies reveal that access to existing ideas and input is not equal for everyone, even when working in the same organization or team (Clement et. al, 2018; Singh & Fleming, 2010; Tortoriello et. al, 2015). Moreover, psychology research on creativity has often focused on the novelty and originality of individuals' output, but such output also has to be recognized by external expert audiences (Loewenstein & Mueller, 2016). The ability to recognize the sort of novelty that experts appreciate varies among individuals and is determined, to some extent, by their environment (Cattani & Ferriani, 2008; Witt & Beorkrem, 1989).

The previous discussion exposes the complementary nature of these two strands of literature on the origins of individual creativity. Incorporating elements from the individual-level explanations of creativity into the sociological approach allows for a deeper understanding of the relationship between structural mechanisms, such as social network position and structure, and creative outcomes. Specifically, individuals may differ in their ability to take advantage of the opportunities provided by their connections or position in their professional network (Carnabuci & Diószegi, 2015). While past social networks research has promoted a contingent view that accounts for individual-level factors (Burt, 1997; Perry-Smith & Mannucci, 2017), empirical studies that incorporate individual differences remain scant. In

addition, most studies combining structural and individual characteristics focus on mechanisms that improve efficiency-based dimensions of performance, but these are quite distinct from mechanisms that explain creativity (Clement et. al, 2018). As a result, there is a dearth of insight into which combination of an individual's characteristics and social position fosters creativity.

The present chapter introduces a configurational approach (Meyer, Tsui, & Hinings, 1993) to synthesize the structural framework of sociology with psychological explanations for individual differences in creativity. Subsequently, this chapter theorizes who can better recognize and utilize opportunities arising from their network position based on individual-level mechanisms that characterize professional backgrounds. To this end, this study explores two fundamental dimensions of individuals' professional background: expertise (Caves, 2000; Lampel, Lant, & Shamsie, 2000) and specialization (Mannucci & Yong, 2018). Prior research on creativity has shown that these are two important yet distinct dimensions of diversity in professional backgrounds (Caves, 2000; Lampel et. al, 2000; Mannucci & Yong, 2018). Expertise distinguishes individuals in terms of role-specific knowledge and skills, corresponding to broad functional categories such as composing vs. performing in music or writing vs. directing in cinema. Specialization denotes the cognitive processes that result from focusing one's professional background on fewer or more types of outcomes in his professional field— such as movie genres, writing styles, or the various media of visual arts. The present study argues that structural characteristics and professional background jointly determine individual creativity: while social structure reveals (or constrains) opportunities to receive diverse input, having suitable expertise and specialization enables (or constrains) individuals to (a) recognize and (b) make use of the diversity in that input in order to generate novel ideas. Accordingly, we hypothesize how expertise and specialization influence the ability and

motivation to exploit opportunities stemming from various network mechanisms in order to produce novel outcomes.

In doing so, the current chapter focuses on the exchange of ideas that occurs due to collaboration within one's professional field². Particularly, the current chapter examines all collaborations directly involving a focal individual. More precisely, this chapter is focused on the structure in which an individual's immediate connections to collaborators are organized at the ego-network level— a subset of an entire collaboration network that comprises only direct connections to a focal individual's collaborators (Oh & Kilduff, 2008). Since collaborators exchange relevant ideas and build professional relationships that may sustain the exchange of ideas among the same collaborators for several years, collaboration ties largely determine the flow of ideas and input for creative processes within a field (Clement et. al, 2018). In other words, collaboration ties direct the flow of ideas and input among individuals who work in the same professional field (Uzzi & Spiro, 2005). Therefore, individuals' access to input that may foster the generation of novel ideas is highly dependent on the structure of their collaboration ties. For instance, when collaborators offer similar ideas to each other, the receiving individual may be constrained in idea recombination by a highly redundant input. Prior research suggests that individuals in brokerage positions, such as those whose direct collaborators have not

² *Field* in this dissertation refers to industry or other particular domain of professional activity that is not labeled as such, including athletic, artistic, or academic fields.

worked with each other, receive diverse input that contains fewer redundant ideas and facilitates idea recombination (Ahuja, 2000; Burt, 2004; Fleming et. al, 2007). We apply our socio-psychological framework to ego-network mechanisms that involve brokerage positions so as to hypothesize which configurations of expertise and specialization enable brokers to benefit from the diverse input offered by their collaborators. In this way, the first study taps into the interplay of sociological and psychological processes that convert diverse input into novel ideas.

The hypotheses are tested in the context of the American film industry. An empirical analysis of feature film releases by the major studios from 1993 to 2015 provides broad support for the conceptual framework of the paper. The findings contribute to the existing research on brokerage by revealing that specific configurations of expertise and specialization may reverse the effect of brokerage on creativity. Notably, while brokerage benefits the creativity of those who are expert in a single role but do not specialize in a particular genre, it hampers the creativity of others who specialize in one genre or work in multiple roles. This chapter also contributes to research on creativity by synthesizing the sociological and psychological explanations of creativity, particularly concerning ego-network mechanisms and two primary facets of professional background, namely expertise and specialization. Furthermore, the present chapter revisits the recombination perspective on creativity by clarifying the relationship between motivation, ability, and opportunity in the process of recombining existing ideas. The discussion section provides a more detailed look into the findings and contributions of this chapter.

BROKERING IDEAS

Individuals differ in finding opportunities to generate novel outcomes through exchanging ideas since they vary in their access to diverse input. During each collaboration,

individuals start exchanging ideas and input based on a common ground that applies to the focal project and extend their exchanges based on shared views and interests (Clement et. al, 2018). As these exchanges repeat or intensify, similarities in perspectives and input tend to increase among collaborators. However, when frequent collaborators concentrate on their shared views and gradually converge in ideas and perspectives, ties among them may no longer bring new input (Burt, 1997). From a recombination perspective, which regards most novel ideas as new combinations of existing ideas (Burt, 2004), redundant input limits individuals in generating novel outcomes.

In contrast, when working with peers who have not collaborated with each other, individuals have a chance to broker and recombine a variety of ideas that come from their separate groups of collaborators who are only connected through the broker. Therefore, the high diversity in brokers' input allows them to find additional combinations of existing input ideas that have not been produced before. In this sense, one is expected to face more opportunities to harvest new combinations of ideas by brokering the ideas of such disparate collaborators (Ahuja, 2000). Accordingly, and in line with the conventional theory of brokerage in the context of idea generation and creativity (Ahuja, 2000; Burt, 2004; Fleming et. al, 2007), the baseline hypothesis of the study concerning the flow of input among collaborators within a field predicts the following:

H0: Individuals in brokerage positions are more creative compared to others not occupying a brokerage position.

The role of specialization in brokering ideas

Receiving diverse input is only one step in the process of creativity (Perry-Smith & Mannucci, 2017) and in order to generate novelty, individuals have to convert their input into

new ideas. The baseline hypothesis H0 addresses the differences in accessing diverse input among individuals in distinctive network positions. However, facing abundant or diverse input does not necessarily lead to conceiving and processing the input (Soda et. al, 2018). Moreover, early conceptualizations of brokerage indicate that different individuals in brokerage positions can have a variety of motivations and agendas. For example, bridges or *tertius iungens* (Obstfeld, 2005) often start from a brokerage position but fill structural holes by introducing their collaborators to each other (Quintane, Carnabuci, Robins, & Pattison, 2012). In contrast, another group of brokers, *tertius gaudens* (Lingo & O'Mahony, 2010), benefits from keeping their peers divided. Accordingly, understanding creativity requires incorporating both its psychological and structural drivers. From a psychological perspective, converting diverse input into novel ideas depends on one's motivation and ability to (a) recognize the underlying value and (b) make use of the diversity in their input. In collaborative contexts, these factors are rooted in distinctive facets of individuals' professional backgrounds: their roles in collaborations and the types of outcomes resulting from those collaborations.

In this context, types refer to the classification of creative outcomes resulting from variation in production recipes and standards within a professional field (Melero & Palomeras, 2015). For example, production standards in the music industry differ (Hsu & Hannan, 2005) across different genres (e.g. Jazz vs. classical composing), media (Quartet vs. Symphony), or styles (New Orleans Quartet vs. Dixieland Jazz Quartet). Consequently, input within the same field still has substantial diversity across outcome types. Moreover, a great deal of the diversity in existing input within a field –which excludes more fundamental forms of diversity that stem

from beyond the boundaries of that field³– originates from type variety. Individuals can substantially renew the creative processes of their field by combining the input or production formula for different outcome types (Mannucci & Yong, 2018; Melero & Palomeras, 2015). For instance, the combination of Jazz and Rock resulted in a different genre, so-called Fusion. Likewise, combining Comedy with Crime and Thriller inspired some of the maverick films in the late 20th century, such as *Pulp Fiction* (1994) and *Ghost Dog* (1999).

The creation of novelty based on input existing within a field may demand individuals' attention to different types of outcomes within their professional field, favoring those with a more versatile background in terms of outcome types (Grégoire & Shepherd, 2015; Henderson & Clark, 1990; Rhee & Leonardi, 2018a, 2018b; Tellis, 2017). However, individuals who specialize in a particular type extend their focus over the production standards and methods of that type (Mannucci & Yong, 2018). For example, individuals who focus their professional activity on Comedy TV series expand their specialization in the production formulae that are particular to the Comedy genre and the medium of the TV series. Specialization denotes the extent of concentration on the outcome types that characterize one's professional background. Accordingly, highly specialized individuals are those who have worked towards fewer types of

³ For a full discussion of sourcing diverse input from outside of a field please refer to the next chapter.

outcomes, whereas those who contributed to various outcome types hold a lower degree of specialization.

Moreover, specialization has substantial implications for structural mechanisms. Based on the conventional argument for the effect of brokerage on creativity (H0), accessing diversity in existing input within a network depends on the structure of an individual's direct connections to collaborators. Once the opportunity to access diverse input is provided, specialization can affect individuals' motivation to process that input. Highly specialized individuals expand their perspective through specialization in fine-tuning production formulae for a certain type of outcome (Mannucci & Yong, 2018). However, an exclusive focus on one type limits the intake of competing perspectives (Dane, 2010; Kacperczyk & Younkin, 2017) and can result in a lack of flexibility over input that is regularly associated with other types of outcome (Mannucci & Yong, 2018). As a result, specialists may develop an extremely rigid perspective, withdrawing their interest in processing highly diverse input.

Moreover, high levels of specialization constrain individuals' ability to identify opportunities that enrich their intake of input (Dushnitsky & Lenox, 2005; Grégoire & Shepherd, 2015). An individual who exclusively focuses on one type has to rely primarily on the existing standards of that type when asking for input from peers. Therefore, when specialists initiate the exchange of ideas with a peer who focuses on a different outcome type, they will likely fail to identify the questions that expose the most valuable input. Instead, they will adhere to the standards of their own genre for initiating the exchange of ideas (Rhee & Leonardi, 2018a). Therefore, specialists may overlook interactions that incorporate the most diverse input within their field and disregard the opportunities that can lead to highly novel recombinations of existing input (Taylor & Greve, 2006). In contrast, individuals who have worked towards

various outcome types have to deal with a variety of production formulae and standards. This additional exposure to diversity within their field enhances their familiarity with diverse input and enables them to initiate the most prolific interactions with peers with various specializations (Reagans & McEvily, 2003).

Highly specialized professionals also face an additional challenge in recognizing the value of diverse input. Even when their peers identify and offer promising input, specialists may view it from their highly specialized angle rather than the most compatible perspective and filter out part of their input (Rhee & Leonardi, 2018a, 2018b). In this way, specialists may overlook valuable ways of processing input diversity. In contrast, individuals who have worked towards a wider variety of outcomes may conceive a broader range of input diversity when receiving input from peers with different specializations (Cohen & Levinthal, 1990; Dane, 2010; Kacperczyk & Younkin, 2017; Mannucci & Yong, 2018). Therefore, when these individuals occupy brokerage positions, they can utilize their access to diverse input and enhance the novelty of the outcomes they produce.

In conclusion, highly specialized individuals may dismiss valuable opportunities (Grégoire & Shepherd, 2015) that arise from their interaction with other collaborators, since they only partially recognize the creative value in their input. As argued for H0, the structure of one's direct connections determines whether collaboration conducts a diverse input flow towards that individual. Moreover, it was argued that brokerage positions provide an advantage in accessing diverse input. However, highly specialized individuals may dismiss valuable opportunities provided by the structure of the direct connections within their ego-network. When acknowledging that individuals with different levels of specialization also vary in recognizing input diversity, the following hypothesis is expected:

H1: Specialization diminishes the positive effect of brokerage on creativity.

The role of expertise in brokering ideas

Expertise is another facet of professional background that has substantial implications for structural mechanisms. Expertise concerns the focus of an individual's background in terms of roles in collaboration. In creative contexts, collaboration often engages several different roles (Caves, 2000; Lampel et. al, 2000). Most professional fields combine specific functional domains, each of which involves a distinctive set of theoretical principles and deals with the technical aspects of their application (Fleming et. al, 2007). For instance, collaboration within the film industry incorporates creative writing, music, sound design, acting, cinematography, editing, and directing. Conventionally, film professionals develop expertise in a certain domain through education, self-study, and observation (Ebbers & Wijnberg, 2019) as well as via working in a related role (Baker & Faulkner, 1991; Bechky, 2006), such as writer, composer, etc. Working in each role is different in terms of fundamental principles and technical aspects (Baker & Faulkner, 1991). Accordingly, an individual's expertise in a creative context can be broadly associated with the concentration of roles performed in collaborations throughout one's career. Since expertise denotes individual differences in comprehending substantially distinctive functional domains, this facet of professional background is fundamentally different from specialization. For instance, even though auteur filmmakers develop expertise in writing, directing, and sometimes producing films, the diversity of their expertise has little to do with the variety of genres or media in which they specialize. Hence, unlike specialization, expertise is not highly relevant to recognizing diversity in the input associated with different types.

However, understanding the configurations of individual expertise and structural mechanisms can resolve another complexity in the creative processes that involve the flow of

existing input among collaborators. The direct connections of each individual usually comprise collaborators in different roles (Bechky, 2006; Ebbers & Wijnberg, 2017). Subsequently, the input received by an individual in a particular role likely originates from or is conducted via someone in another role. As a consequence, the individual who provides input may have little knowledge of the technical details that are critical for implementing ideas in the target role to which input is provided (Baker & Faulkner, 1991). For example, screenwriters are not expected to understand the technical details of cinematography or musical composition, even though they may have suggestions in these areas for the director or his crew to best illustrate the story. In fact, the practical implications of the same idea can fundamentally differ across roles. For instance, the extreme tempo of the story and high rhythm of cuts in the Baptism sequence of *The Godfather* (1972) – where all rivals of the Corleone family are eliminated as planned by Michael Corleone – was not accompanied with music of the same pace. Instead, to maintain the anxious atmosphere without forgoing the harmony of the entire sequence, a continuum of church organ music with a relatively slow rhythm was used. The result is one of the most remarkable examples of filmmaking to date that showcases the complexities of input coordination across multiple roles. In similar contexts that involve highly complex coordination of ideas and input (Bechky, 2006; Caves, 2000), in-depth expertise in the technicalities of the target role can enhance the feasibility of integrating input (Tortoriello, 2015; Tortoriello et. al, 2015) from other roles. Therefore, the expertise of the receiving person has notable implications for the feasible integration of the input into that person’s role.

When collaborators in a project are experts in different disciplines, they may not be fully capable of performing the necessary technical adjustments when providing input for a different role. Instead, the receivers’ expertise in the technical details of their own role is critical to the integration of input within multidisciplinary collaborations (Fleming et. al, 2007). In these

contexts, even though brokerage provides access to diverse input, this input is often provided by a collaborator in a different role than the receiving person. Moreover, working in various roles can limit one's familiarity with the nuances of technical details in each role (Dane, 2010; Kacperczyk & Younkin, 2017; Melero & Palomeras, 2015). Therefore, the lack of experience and in-depth training of brokers with a low level of expertise can lead to poor coordination of input that subsequently prevents the realization or recognition of these brokers' creative ideas. Consequently, the novelty of expert brokers' ideas would be only partially assessed, hampering their creativity (Fleming et. al, 2007; Perry-Smith & Mannucci, 2017). By contrast, brokers who advance their expertise by focusing on one role can utilize their expertise in tailoring their input to meet the practical requirements of their specific role.

H2: Expertise strengthens the positive effect of brokerage on creativity.

METHODS

The empirical context of the current dissertation is the American film industry. The film industry provides a unique setting that exemplifies both network-based organizations (Cattani & Ferriani, 2008) and a creative context (Caves, 2000). Production in the film industry relies on a temporary form of organization within which individuals partake in a project that is aimed at producing a unique outcome and part ways after the production is finished. As a result, the collaboration network changes regularly, providing a valuable and fitting setting for longitudinal analyses of creativity. The film industry also involves the orchestration of inputs by various roles and provides room for the study of expertise and role diversity in creative production. In addition, collaboration ties in this network are formed based on common formal affiliation to a project which makes the empirical reconstruction of project participants' social

network more reliable than, for instance, networks of friendship that rely on knowledge of informal connections among individuals.

Data

The predictions of this study are tested utilizing over twenty-three years of panel data (1993-2015) from major releases in American film industry. Delineating the network in this way focuses the analysis on professionals working in Hollywood. Hollywood provides an ideal setting for the study of recombinant idea generation processes. While every project engages film professionals in creative processes that are necessary to produce a unique outcome since no two films are identical in all aspects, some of these outcomes stand out as highly novel, extending production methods and advancing standards of the industry. Yet, creative processes that generate novelty in Hollywood are largely based on finding new combinations of existing ideas and meeting or exceeding existing industry standards. The predominance of recombination creative process in Hollywood greatly resonates with the adopted concepts and theoretical arguments in this dissertation.

Data from Metacritic.com are combined with IMDB (Internet Movie Database), both being original datasets provided for non-commercial purposes. Metacritic provides Metascores, which aggregate the assessments of critics in the film industry in terms of artistic success as well as the quality of a movie. IMDB is the largest available database and documents the entire history of the film industry as well as related contexts such as TV and videogame production. IMDB data for feature films have been cross-validated with other sources in past studies (e.g. Cattani and Ferriani, 2008) and includes rich data such as title, genre, technical aspects, and production-related details of film projects as well as primary genre(s), the roles of film professionals and their dates of birth and death, among other details.

All cast and crew members of the movie were included in network construction and calculating network measures – as discussed below. However, the sample subjects of the analysis in this study consist solely of core crew members of film projects who manage various creative aspects throughout film production, namely writers, directors, production designers, cinematographers, editors, and composers (Mathieu & Strandvad, 2009) since these are in charge of the creative aspects of film production. Because an individual’s structural position changes over time, repeated observations are made in annual intervals. Therefore, every data point could be considered as an individual-year observation which may comprise data from one or more film titles. The sample comprises 10545 of such individual-year observations. In cases where a subject participates in more than one project during the same year, every measure is aggregated across all such projects.

Network Construction

The network analyzed in this study is a collaboration network, where the nodes of the network represent film professionals and the ties are common affiliations of film professionals to the same movie title. The collaboration network is thus constructed based on the adjacency matrix of the affiliation network, which denotes the affiliations of individuals to movie projects. These networks are delineated by time and place: major studio releases of the American feature film industry during 1993-2015, as per the sampling criteria outlined in the previous subsection (Data). To avoid an inflated level of connectivity in the network, we use a five-year moving windows, where each window comprises only collaborations during the observation year or its four preceding years (Uzzi & Spiro, 2005). Since any collaboration tie may directly or indirectly convey relevant input for the generation of new ideas, the ego-network for each professional was extracted by including only direct connections to other film professionals.

Measures

Main Variables. *Creativity* is operationalized at the individual level by counting the number of artistic nominations in individual role-based categories that a person has received from critics and peers in a given year (such as best screenplay, best filmscore, etc.). This measure is directly in line with the definition of creativity, which relies on experts' inter-subjective assessment of novelty in production. Cattani and Ferriani (2008) review the statements accommodating a wide range of these awards, which mainly concern creative value in artistic production within the film industry. Hence, we adhere to their validated list of most relevant nominations, which include those granted by Academy Awards, Directors Guild of America, Writers Guild of America, American Society of Cinematographers, American Cinema Editors, Golden Globes, National Board of Review, New York Film Critics Circle, and Los Angeles Film Critics Association.

Brokerage describes the structure of a person's ego-network. The ego-network structure is commonly computed based on Burt's measure of constraints, which represents the degree to which the ego-network of an individual includes redundant ties⁴ (Burt, 2004). Burt's constraints typically range from 0 to 1, with lower values assigned to brokers who efficiently connect otherwise disconnected individuals. The level of constraints is deducted from one to calculate

⁴ Here, redundancy concerns the flow of exchanging input among individuals.

brokerage scores. Therefore, brokerage for each individual was calculated via the following formula:

$$C_i = 1 - \sum_j (P_{ij} + \sum_q P_{iq} \cdot P_{qj})^2, \text{ for } i \neq j$$

where i, j , and q represent different nodes, and P^{ij} represents the proportion of ties from node i to node j over the rest of ties from node i .

Specialization is measured via Herfindahl–Hirschman Index (HHI). Applying HHI index to our context, we measure the concentration of one’s past movie projects classified by their genre, so that the result for every individual at a given year can range from 0 (extremely generalist) to 1 (extremely specialist). Technically, this index computes the fraction of observations (here, an individual’s movie projects) belonging to each genre, and then sums the squares of these fractions. Accordingly, specialization in the context of this study indicates the sum of the squared shares of all genres from a person’s activity in film projects up to and during the observation year⁵. Share in this ratio refers to the fraction of an individual’s affiliations to film titles that belong to a specific genre. The following formula represents the calculation of specialization:

⁵ Using rolling windows of five or three years for including recent projects only, did not substantially change our findings.

$$HHI = s_1^2 + s_2^2 + s_3^2 + \dots + s_n^2$$

where s_n is the percentage of film titles affiliated to one's professional background which are associated to genre n , expressed as a decimal number. In the case of multiple film genres, each one is weighted equally.

Likewise, *expertise* is measured by a Herfindahl–Hirschman Index of the different roles an individual fulfilled in past movie projects. Specifically, we look at all the roles the individual played in movies during and prior to the observation year and then compute the HHI concentration ratio ranging from near 0 (large number of different roles) to 1 (only fulfilled one role)⁶.

Control Variables. *Role consolidation*, also known as creative freedom, is another factor that affects the creative performance of an individual and occurs when an individual performs more than a single role in a project (Cattani & Ferriani, 2008; Delmestri et al., 2005). This would allow, for instance, a writer-director, to craft the project for implementing his ideas.

⁶ Given that many film professionals take on additional or different roles over the course of their career it is reasonable to expect variance in expertise across individuals, even though most may adhere to one primary role category. Some role combinations may appear more intuitive, such as writer and director. However, many remain overlooked, as for example auteur filmmakers have an active role in editing or occasionally take part in composing their film score, while some cinematographers also experiment with filmmaking when they get a chance.

Role consolidation is measured based on the average number of roles an individual takes on in film projects within a given observation interval.

Field Experience was entered as a control variable since newcomers to a professional field are reported to make a better impression on evaluators compared to incumbents with the same level of creativity (Cattani & Ferriani, 2008). Experience is measured based on the number of movies with which a professional has been affiliated, since the level of activity within the same period of tenure may differ for individuals due to the freelancing nature of work in this industry.

Genre confusion was used to control the average number of genres associated with an individual's film titles up until the year of observation. As every film title is often associated with more than one genre, these associations may signal a combination of different genre elements that results in confusion when classifying films. Recent studies call for controlling (genre) confusion when calculating concentration measures (Narayanan, Balasubramanian, & Swaminathan, 2009).

METASCORE is included as a proxy for various quality aspects of a film that could be reflected in the critical reception of the film. Critical reception is known as an important predictor of artistic nominations, as films panned by critics are less likely to be nominated for awards. "A METASCORE is a weighted average of reviews from top critics and publications for a given movie" (Metacritic, 2001). Metacritic.com curates reviews of a large group of prominent critics whose rating may belong to different scales. Hence, these scales are converted to a unified scale and aggregated using a weighted average that discriminates the critics based on their "overall stature." The result is a normalized scale of 0 to 100 for each movie, namely

a Metascore, for which higher values indicate higher levels of critical acclaim. Information about scaling and aggregation is available on the website (Metacritic, 2001).

Sequels often face additional constraints in the generation of ideas since a significant portion of the ideas should be connected to the original title. Moreover, the repetition of previously successful elements, which is often targeted at maximizing box-office receipt, may not be favored in assessments of novelty by critics and peers, limiting the recognition of a sequel for its novelty. A count variable was created to control for the number of sequels in which an individual was involved in a given year.

Quality reflects one's path dependent success in terms of creativity and is calculated separately for every given year. Individual quality is measured by counting the number of individual nominations a person has received in the preceding two years. A short interval focuses measurement on the person's recent quality rather than reputation for creativity (Ebbers & Wijnberg, 2010), which may persist for a while despite evolving quality.⁷

Team quality which is measured based on the average number of nominations received by a person's collaborators during the preceding two years, controls for the interdependence of the person's creativity and the typical quality of other collaborators' contribution to a focal film project.

⁷ The results remain consistent when choosing longer intervals (Cattani & Ferriani, 2008)

Team coreness, which is measured based on the average of coreness degrees of a person's collaborators, controls for the effect of indirect ties that may inflate one's intake of ideas or support on a temporary basis. Coreness is an important centrality measure in the study of creativity that controls for persons' position in the entire network.

This study also accounts for how the range and variation of production formulas differs per *genre*. Certain genres, such as drama or romance, are more likely to absorb critics and awarding associations (Shamsie, Martin, & Miller, 2009) due to their centrality and long history in the field. Moreover, production in genres such as comedy or horror that primarily rely on provoking particular feelings and sensations may be more binding (JONES, 2019). Therefore, a series of count variables were created to capture the frequency of one's involvement in production within certain genres in a given year.

Similarly, to control the variations of creative processes which apply to each one of the six *role* categories in which the individuals may have worked, namely writers, directors, production designers, cinematographers, editors, and composers, another count variable was included. A count variable was preferred over dummies, since when an individual is affiliated to multiple film projects during the observation year, a count measure allows to control the frequency of working in each role. For instance, dummy variables fail to capture whether a person carried out directing and writing in one and directing only in another project, or directing and writing in both projects.

Analysis

Our sample is an unbalanced panel of individual-year observations in which individuals appear each year they participated in the creation of at least one movie. The dependent variable (creativity measured by the number of nominations) is a non-negative integer variable which

requires a non-parametric estimation method. As the dependent variable displayed overdispersion, a negative binomial estimation is preferred over a Poisson estimation. We added time dummies to control for the effects of time. To control for the non-independence of observations, as individuals may appear in the sample in multiple years, we added random effects. The alternative, conditional fixed effects, would result in a significant attrition rate because certain individuals only appear once or are never nominated for an award. Random effects control for individual-level unobserved heterogeneity without the loss of observations. The results were compared with a simple pooled negative binomial estimation for ensuring credibility. Moreover, mean-centered variables were used to avoid multicollinearity.

RESULTS

Table 1 describes the variables used in the analysis and their pairwise correlations. The number of nominations that measure creativity as the dependent variable of this study range from 0 to 13 and exhibit high levels of overdispersion with a mean of 0.2 and a variance of 0.6. Over-dispersion is highly visible in the distribution of the dependent variable, with a standard deviation of more than four times the mean. The high level of overdispersion implies the necessity of a negative binomial specification for the estimation of this count variable. Moreover, ego network structure varies among the subjects with nearly absent to almost perfect levels of brokerage, with a relatively high score of 0.7 as the average. Interestingly, the subjects vary substantively in their expertise with standard a deviation of 0.22 while for specialization this value is 0.15, which denotes a more moderate level of variance. Moreover, the data include a wide range of films in terms of critical reception, given the substantive level of heterogeneity in METAScore.

Correlation among network factors, meaning brokerage and team coreness are notably higher than among other factors, yet still within an acceptable range. Among factors that have a moderate correlation with creativity, measured by the number of nominations that individuals receive, are METAScore ($\beta=0.31$) and quality ($\beta=0.22$). Moreover, creativity has lower levels of correlation with team-quality ($\beta=0.13$), and role-consolidation ($\beta=0.12$), followed by expertise ($\beta=-0.11$) and other key variables, such as brokerage ($\beta=0.04$) and specialization ($\beta=-0.04$) among other factors. Overall, the full set of control variables correlate with the dependent variable, even though the high number of individuals with no nominations to some extent mitigates the possible level of correlation. Moreover, brokerage shows a positive (although limited) correlation with the number of nominations, while both dimensions of professional background, namely specialization and expertise correlate with the number of nominations, in a negative direction. It is also important to note that brokerage moderately correlates with specialization ($\beta=-0.39$) whereas a much higher correlation effect would be expected, should the brokers overly experience certain levels of specialization. This observation lends support to the assumptions of the study regarding the discriminant nature of brokerage and specialization. Moreover, the estimation of variance inflation factors did not reveal high levels of multicollinearity.

Tables-1 to be inserted around here

The random-effects estimations of the panel data with a negative binomial specification are included in Table 2. The first model (Model-1) provides the baseline estimation of only control variables. Experience, quality of the individual, team quality, and Metascore reviews all have a positive effect on award nominations whereas working on sequel movies has a negative effect.

The effects of specialization and expertise were only hypothesized as moderators for the relationship between brokerage and creativity. Nevertheless, we controlled for the main effect of these variables too. Interestingly, both of these variables consistently show negative effects in our estimations. According to the baseline model (model-1), both specialization and expertise have highly significant negative effects on creativity ($\beta_{\text{Specialization}}=-1.06, p<.01, \beta_{\text{Expertise}}=-0.75, p<.01$). These effects maintain direction across all models.

The main effect of brokerage is exhibited in the second model (Model-2). As predicted in the baseline hypothesis (H0), model 2 shows that brokerage exerts a significant and positive direct effect on creativity ($\beta_{\text{Brokerage}}=0.67, p<.05$). Overall, these results provide support for the baseline hypothesis of the study and hold across various specifications including pooled, and negative binomial estimations with clustered individual effects as well as zero inflation. Furthermore, the results indicate that creativity declines as a result of focusing on a single role in collaboration or specializing in an outcome type. Especially, expertise has a more significant effect on creativity ($p<.01$ consistently across all models).

The third regression model (Model-3) in Table 2 includes the interactions between brokerage and the two dimensions of professional background, namely specialization and expertise. Particularly, Hypothesis 1 stated a moderation effect of specialization on the relationship between brokerage and creativity, predicting that specialization weakens the positive effects of brokerage. The results confirm that a strong focus on fewer genres -denoting a specialized background- significantly mitigates the positive effect of brokerage on creativity ($\beta_{\text{Specialization*Brokerage}}=-3.13, p<.05$). These results suggest that at low levels of specialization, creativity increases with brokerage (by factor 1.2). The effect is visualized in Figure 1 and demonstrates a remarkable contrast in brokerage effects for individuals with different levels of

specialization: while brokerage increases the probability of receiving a nomination at lower levels of specialization, it reduces the chance of nomination for highly specialized individuals. As such, the results lend very strong support to the first interaction hypothesis of the paper.

Tables-2 and Figure-1 to be inserted around here

Hypothesis 2 stated a moderation effect of expertise on the relationship between brokerage and creativity, predicting that an exclusive expertise (in fewer roles) reinforces the positive effects of brokerage. Based on the results of Model-3, a high degree of expertise - characterized by strong focus on fewer roles- indeed reinforces the positive effect of brokerage on creativity with a high level of significance ($\beta_{\text{Expertise*Brokerage}}=+2.493, p<.01$). Accordingly, at high expertise levels, creativity increases with brokerage (by factor 3). This effect, visualized in Figure 1, demonstrates a critical contrast: although brokerage increases the probability of nomination for an award at high levels of expertise, it decreases the chance of nomination at low levels of expertise. Therefore, the results also fully support the second interaction hypothesis of the paper.

DISCUSSION AND CONCLUSION

This chapter illustrates how variations in the professional backgrounds of individuals with similar network positions will differentiate their intake of new ideas and hence their creativity. This provides a unique insight into the interplay of individual and structural characteristics in the context of creativity. To this end, the study conceptualized two distinct dimensions of professional backgrounds, namely specialization and expertise. The findings of the study demonstrate that both dimensions have direct effects on creativity and also significantly moderate the impact of a brokerage position. In particular, while network structure

may reveal or constrain novel possibilities, creativity is only achieved when an individual's specialization and expertise respectively allow for appreciating and integrating these possibilities at different stages of creating novel outcomes. On the one hand, generalist brokers have an advantage over specialist brokers as they are motivated to explore a wide variety of input. Specialists may lack appreciation for the highly diverse input that is associated with various outcome types since they primarily seek input that is compatible with the outcome type in which they specialize. On the other hand, experts have an advantage in integrating diverse input into their creative work since they can tailor input to become more compatible with their own role. Therefore, among those in brokerage positions, role experts tend to be more creative than those who take on different roles.

The findings of this study contribute to research on social networks, creativity, and professional careers. Firstly, past studies of social networks have related individuals' creative performance to their ability in accessing novel and diverse information, something which is directly related to the structure of a social network (Burt, 2004). In addition, few studies have incorporated individual-level differences that moderate this relationship, but these studies usually focus on individual features that are stable over time like gender or personality (Carnabuci & Diószegi, 2015), or aspects of performance that are based on fundamentally different structural mechanisms from creativity (Clement et. al, 2018). This study focused on the configurations that an individual's professional background imposes on network effects regarding creativity, which vary and develop over time. Individuals either tend towards becoming specialists in a single genre or generalists working on various outcome types (Melero & Palomeras, 2015), while developing exclusive expertise in one professional role or diverse expertise in a broader range of roles. These time-variant characteristics of individuals cause variation in their ability to recognize the value in fresh and diverse input. While prior research

emphasized that social network position and structure influence individuals' opportunity to access relevant input, their ability to employ and turn this input into creative outcomes is determined by their expertise and specialization. Moreover, this study showed that the benefits of social position are not always complemented by higher levels of specialization and expertise. In particular, the study contributes to social network theory by showing that the benefits of a brokerage position for creativity deteriorate or even turn into adverse effects when the broker's professional background is overly specialized or lacks adequate expertise. By analyzing the interplay of various conditions for processing input once a particular network position is obtained, the present study reveals which network positions are more likely to advantage an individual with a specific professional background.

Secondly, the present study also contributes to the psychological literature on creativity that has often related individuals' ability in developing novel creations to their cognitive and behavioral characteristics (Amabile, 1983). This study shows that professional background itself has a profound effect on the ability to generate new, highly-appreciated outcomes in addition to personal characteristics. In doing so, the study distinguishes between two fundamental aspects of professional backgrounds that have rarely been studied in relation to each other despite their conceptual proximity. By disentangling for the first time the underlying mechanisms involving these distinct dimensions of professional background, the study enhances the existing understanding of creativity. Particularly, while prior studies may have found benefits of specialization and expertise on performing efficiently (Levitt & March, 1988; Schilling, Vidal, Ployhart, & Marangoni, 2003), we observe that such factors have a more complex interaction with network effects when performance is related to developing creative, original outcomes.

Finally, this study contributes to research on the creative industries (Koppman, 2016). Extant studies have shown the importance of professional connections for improving career outcomes (Lingo & O'Mahony, 2010) as well as the importance of prior experience (Fleming et. al, 2007; Koppman, 2016) for improving the probability of creative success. This study adds to such research by proposing a configurational approach where professional background and social network structure have a joint effect on an individual's creative performance. The perspective put forward by the present study implies that creativity is the result of informing professional choices with an understanding of one's social position and relationship with collaborators. In this context, choices are not measured in isolation but in a repertoire of interdependent decisions that individuals make throughout their careers regarding one's role in collaborations and type of outcome. In other words, the conceptualization of professional backgrounds offered in this study acknowledges that current choices are bound by one's past choices (Goldstone, 1998; North, 1987). Accordingly, the present study shows that creativity can be achieved through informed decision making over the course of one's career, while acknowledging their choices are interdependent and do not denote absolute freedom or complete foresight. For example, a substantial part of the professionals in the sample consists of specialists. These professionals would benefit from having a cohesive collaboration structure with low degrees of brokerage. As such, they should prioritize collaborating with a group of colleagues that have also collaborated before, perhaps repeating collaboration with the same group. Yet, the findings about expertise reveal a strong combined effect with brokerage, indicating that they can overcome the limitations of focusing on an exclusive role when having a suitable ego-network structure. Such a configurational approach demonstrates that the effects of individual characteristics are interdependent with their social network structures.

While this study provides some valuable insights into the contribution of network position and professional backgrounds to creativity, some of its features provide opportunities for future research. The analysis provided in this study was mainly focused on the effect of networks once an individual has already obtained a certain network position. Future research can synthesize the interaction mechanism found in this study with research on networking strategies (Hallen & Eisenhardt, 2012; Soda et. al, 2018) and explore how individuals' control over their network position may be modified by their specialization or expertise⁸. Moreover, even though team-level factors such as team quality were included in our model, the analysis of this study is limited to individual-level creativity. Additional research is needed to apply the theoretical framework of this study at organizational levels involving teams, projects, or companies.⁹ Furthermore, the theoretical framework put forward in this study was contextualized in a creative industry where the value of novel outcomes is mainly determined through inter-subjective processes and not primarily tied to more objective features, unlike in technological contexts. Therefore, further empirical research is required to link our socio-psychological framework to other contexts, such as technological innovations and their creativity assessment matrices.

⁸ Chapter three of this dissertation particularly looks at the relationship between network evolution and specialization

⁹ Chapter three of this dissertation takes a step towards explaining team dynamics by examining the influence of collaborators on each other's creativity.

APENDIX: FIGURES AND TABLES

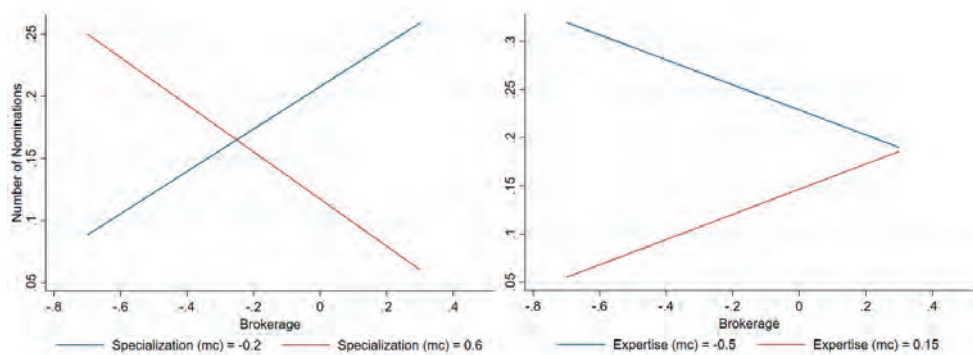


Figure 1- The marginal effects of brokerage on creativity (dy/dx)

Table 1-Descriptive Statistics

	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12
(1) Creativity	0,17	0,81	0	13												
(2) Brokerage	0,7	0,2	-0,13	0,98	0,04											
(3) Specialization	0,29	0,15	0,09	1	-0,04	-0,39										
(4) Expertise	0,85	0,22	0,25	1	-0,11	0,11	0,12									
(5) Experience	8,42	12,56	0	204	0,08	0,42	-0,34	-0,15								
(6) Quality	0,24	1,07	0	18	0,22	0,16	-0,12	-0,09	0,24							
(7) Team Quality	0,5	0,88	0	8,94	0,13	0,10	-0,06	0,00	0,06	0,17						
(8) Sequel	0,18	0,44	0	6	-0,04	0,08	-0,04	-0,07	0,04	-0,01	-0,05					
(9) METASCORE	52,34	17,42	1	100	0,31	0,02	0,01	0,00	0,04	0,13	0,22	-0,08				
(10) Budget (MD)	42	45	0,06	479	0,01	0,10	-0,16	0,00	0,03	0,06	0,15	0,22	0,01			
(11) Genre Confusion	2,49	0,54	1	3	0,00	-0,09	-0,49	0,03	-0,05	0,02	0,03	0,04	-0,01	0,23		
(12) Role Consolidation	1,1	0,31	1	3	0,12	0,02	0,01	-0,49	0,11	0,10	-0,01	0,10	0,06	-0,07	-0,04	
(13) Team Coreness	5,84	1,87	1	29,8	0,02	0,34	-0,05	-0,03	0,06	0,05	0,16	0,12	0,01	0,13	0,03	0,00

Table-2: Random Effects Estimate of Individual Creativity

	Baseline	Brokerage	Interaction
	Model 1	Model 2	Model 3
Brokerage		0.666** (0.274)	0.765*** (0.288)
Expertise x Brokerage			2.493*** (0.875)
Specialization x Brokerage			-3.129** (1.326)
Specialization	-1.057*** (0.393)	-0.661 (0.421)	-0.788* (0.436)
Expertise	-0.754*** (0.254)	-0.767*** (0.254)	-0.898*** (0.251)
Role Consolidation	0.215 (0.132)	0.247* (0.132)	0.190 (0.135)
Experience	0.005* (0.003)	0.004 (0.003)	0.002 (0.003)
Quality	0.062*** (0.021)	0.059*** (0.021)	0.067*** (0.022)
Team Coreness	0.000 (0.016)	-0.008 (0.016)	-0.003 (0.016)
Team quality	0.169*** (0.032)	0.175*** (0.032)	0.176*** (0.031)
Genre Confusion	-0.104 (0.093)	-0.032 (0.098)	-0.009 (0.098)
Sequel	-0.257** (0.105)	-0.252** (0.105)	-0.241** (0.105)
Metascore	0.100*** (0.003)	0.100*** (0.004)	0.100*** (0.004)
Movie budget	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Year Dummies	<i>Included</i>	<i>Included</i>	<i>Included</i>
Genre Dummies	<i>Included</i>	<i>Included</i>	<i>Included</i>
Role Dummies	<i>Included</i>	<i>Included</i>	<i>Included</i>
Constant	-8.972*** (0.360)	-9.019*** (0.360)	-9.145*** (0.359)
Constant	1.496*** (0.210)	1.512*** (0.218)	1.652*** (0.286)
Constant	1.103** (0.434)	1.135** (0.448)	1.436*** (0.526)
Observations	10545	10545	10545

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

CHAPTER 2

EXTERNAL INPUT: EXCHANGING IDEAS ACROSS FIELDS

ABSTRACT

This chapter extends the socio-psychological framework of this dissertation by distinguishing between two sorts of input that activate fundamentally different network mechanisms, namely internal and external input. The previous chapter was primarily focused on the recombination of existing input ideas among collaborators within a professional field. This sort of input, so-called internal input, is a common source of new ideas in any creative context and enters individuals' creative processes through their ego network. In addition to internal input, input adopted from other professional fields can refresh the creative processes of the adopting field, at such a fundamental scale that sometimes instigates breakthroughs. This sort of input, referred to as external input in this dissertation, is not equally accessible to everyone and is mainly reached via individuals at the periphery of a collaboration network. Moreover, external input may not be inherently compatible with the common production methods of the adopting field. This chapter explores the facets of professional background that enable individuals to navigate external input and exploit it in their idea generation processes.

The previous chapter illustrated the interplay of sociological and psychological processes that convert diverse input into novel ideas. The current chapter extends this discussion by further specifying the fundamental types of diverse input that can be utilized to produce novel ideas. This chapter contrasts input sourced from within versus outside a professional field-- by field we refer to a professional domain of activity, such as an industry or any other equivalent that is not labeled as an industry, including athletic, artistic, or academic fields.. A common source of novelty in creative contexts is input rooted within the same field wherein the outcome of creative processes is generated, hereafter referred to as internal input. Since internal input has been specifically exchanged and used within a field, its relevance to field-specific collaborations is already examined by those who previously applied it within that field (Fleming, Mingo, & Chen, 2007). Moreover, new or diverse internal input provides opportunities to enhance creativity, though the availability of such opportunities depends on the extent of one's access to the input flow. Notably, brokers' structure of direct collaborations may eliminate redundancies in the flow of idea exchange and improve the diversity of their input (Ahuja, 2000; Burt, 1997, 2004).

However, collaborators within the same field are not the only source of diverse input ideas (Perry-Smith & Mannucci, 2017). External input, that is, input from sources that lie outside a particular field can also inspire new ideas. In fact, integrating external input into one's professional field is a fundamental way of increasing the input diversity for both the adopting individual and that entire field (Chai, 2017; Fleming, 2007; Perry-Smith & Shalley, 2003; Schilling & Green, 2011; Tellis, 2017). Lighting and cinematography principles imported from painting, or videogames employing the narrative style of feature films are some examples of how ideas move across different fields. Moreover, integrating external input can result in

breakthroughs when it motivates revising the production methods of the adopting field (Fleming, 2001).

However, not all input that originates outside of a particular field is relevant to the creative processes of that field and identifying relevant external input demands interaction with other fields. Therefore, individuals within the same field do not have equal access to external input (Tortoriello et. al, 2015). Moreover, those who try adopting external input may face strong barriers in obtaining the green light from peers and collaborators when this input deviates from field standards (Cattani, 2014). As such, despite its great potential to inspire novelty, the flow of external input is often limited. Therefore, those individuals who can access external input and integrate it into their own field also play an essential part in boosting the idea generation processes of their peers, while benefiting from the opportunities that fresh external input provides (Fleming, 2007; Tortoriello, 2015).

Access to diverse external input has been conventionally studied in relation to the entire network structure rather than one's direct connections (Ibarra, 1993; Tang, 2016; Tsai, 2001). Specifically, past studies link a particular centrality measure, namely coreness, to both advantages and disadvantages for individuals in sourcing external input and suggest a non-linear relationship between coreness and creativity (Cattani & Ferriani, 2008). Accordingly, those at the connected core of a network are often surrounded by others within the same field and rarely establish direct connections outside their professional field. Conversely, those at the periphery are more likely to engage with other fields and have first-hand access to fresh external ideas. However, integrating such unique input often implies highly novel ideas that depart from the accepted norms and standards within a field, and thus face a high entry barrier when peer support or evaluation is necessary (Fleming, 2007). Relatedly, external input may have more

limited compatibility with creative processes that utilize standards and existing ideas within a field. Thus, external input is not often attractive for field-specific collaborations. In this sense, the high level of acceptance that core individuals' ideas receive, due to their regular and extensive exchange with many peers that advance mutual understanding, is conventionally viewed as advantageous for incorporating new ideas (Cattani & Ferriani, 2008).

The theoretical discussion about the core-periphery structure of collaborations has advanced the creativity literature by suggesting a non-linear relationship between coreness and creativity, such that those in between the core and the periphery are deemed most creative. However, this does not provide a clear answer as to which individuals eventually harness the benefits of peripheral positions and how gatekeepers who provide their field with relevant external input overcome the disadvantage of their positions. More precisely, it remains unclear what enables individuals to identify relevant external input and integrate it into their field despite its low compatibility with the field-specific patterns of idea recombination. In order to address this fundamental question, this chapter extends the socio-psychological framework of the present dissertation by explaining the differences in the configurations that specialization and expertise apply to processing external input. In this chapter, we argue that the benefits of accessing external input depend on the extent to which individuals develop versatile expertise by taking different roles in collaborations. Moreover, we contend that specialization may play a complementary role in compensating for the disadvantage that ideas originating from peripheral positions face in raising support among peers. In doing so, this chapter exemplifies whole-network mechanisms that involve all the direct and indirect collaboration ties connecting individuals within a professional field. The resulting hypotheses are tested on more than two decades of collaborations behind the major studios' feature film releases from 1993 to 2015.

Our findings extend the configurational framework proposed in this dissertation by identifying configurations of expertise and specialization that alter the balance of competing mechanisms involving coreness. Consequently, our framework specifies the coreness effect with a predominant benefit or shortcoming for a given combination of specialization and expertise. Moreover, this chapter extends the literature on diverse networks and idea generation by disentangling two main types of input diversity that activate substantially different network mechanisms. Existing research about the interactions between network structure and diversity of network exchanges (Ter Wal, Alexy, Block, & Sandner, 2016) overlooks whether novel outcomes are inspired by social interactions within or across the professional networks of different fields. In comparison with how existing input within a field is processed, this chapter provides theory and empirical evidence to explain how importing input from other fields can lead to novel outcomes. In this way, this chapter also informs the existing social network research of the fundamental differences between creative processes at whole vs. ego-network levels.

INTERNAL VERSUS EXTERNAL INPUT

Interaction among individuals within the same professional field is conventionally considered as a primary driver of creativity (Uzzi & Spiro, 2005). Several studies focus on exchanging ideas among collaborators who work together towards a common outcome (Ahuja, 2000; Fleming et. al, 2007), such as those affiliated with a specific project (Clement, Shipilov, & Galunic, 2018). In creative contexts, collaborators influence each other's idea generation process through various forms of interaction. They usually build upon each others' input during a common project and may continue to exchange ideas even after finishing that project (Bechky, 2006; Caves, 2000; Lampel, Lant, & Shamsie, 2000). Therefore, collaboration ties within a

professional field are likely to convey and foster the exchange of ideas that are relevant to that particular field (Clement et. al, 2018). In this manner, input that is rooted within the same field where the outcome of creative processes is generated, or internal input, is a common source of novelty in creative contexts. This type of input is inherently relevant to all individuals who work within the same field and is therefore the major type of input exchanged among collaborators in creative processes. Consequently, the number and structure of ties to collaborators affect the extent and variety of internal input that individuals receive (Ahuja, 2000; Fleming et. al, 2007). For every individual, direct ties to collaborators form a small network which is a subset of the entire network. This small network is commonly known as the ego-network of that individual. In this case, an ego-network comprises all direct ties to those with whom an individual has collaborated in common projects. In other words, the ego-network can be illustrated without including other individuals who appear in the broader collaboration network but do not directly work with the focal individual.

Figure-1 to be inserted around here

While combining diverse internal input accessed through the ego-network is a common way of generating novel ideas, theory suggests that exchanging ideas within one's professional field is not the only way of achieving creativity. For example, some researchers suggest that at the stages of inception, individuals usually discuss their ideas within their inner circle, which does not necessarily include peers from their professional field (Perry-Smith & Mannucci, 2017). Furthermore, highly novel ideas that substantially refresh the creative process of a field (Perry-Smith & Shalley, 2003; Schilling & Green, 2011) may be produced through interdisciplinary efforts to import fresh input from other fields (Fleming et. al, 2007; Tortoriello, 2015). The remainder of this section as well as the following subsections that contain the

hypotheses of this study focuses on idea generation via integrating external input, that is input from sources that lie outside the collaboration network of a particular field but can inspire new ideas within that field.

In distinction from the structure of an individuals' direct connections that allows them to receive internal input (Lingo & O'Mahony, 2010; Singh & Fleming, 2010; Tortoriello, 2015; Tortoriello et al., 2015), individuals' position within the entire network determines their access to external input. Accordingly, the present chapter's theory focuses on coreness, as a type of social position in the entire professional network of a field (Cattani & Ferriani, 2008; Cattani, Ferriani, & Allison, 2014). Past research suggests that those who integrate external input into their creative processes are commonly found at the periphery of collaboration networks, connecting two or more professional fields (Cattani & Ferriani, 2008). Conversely, those at the connected core of the network are often immersed in the exchange of internal input and face lower chances of receiving fresh external input compared to those at the periphery (Fleming, 2007). In this way, coreness, meaning the proximity of the individual to the most densely connected part of the network, limits individuals in adopting and processing external input.

Occupying a core position in a collaboration network requires one to have engaged in many field-specific collaborations, and become surrounded by densely connected peers who provide an abundance of internal input that focus the core individuals' interactions within the corresponding field (Schilling & Green, 2011). The core individuals' focused efforts on the flow of internal input within the field also immerses them in field-specific production formulae (Cattani, Ferriani, Negro, & Perretti, 2008) as ways to process that input. Consequently, core individuals may become less inclined to develop interactions outside their professional field

(Perry-Smith & Shalley, 2003), whereas identifying and feasibly integrating external input may require exchanging knowledge and ideas with experts in other fields.

By contrast, individuals in peripheral positions face a higher chance of generating novel ideas by utilizing their outreach to external input. In the context of collaborations, holding a peripheral position entails a minimal number of collaborators and interactions. By definition, peripheral positions are occupied by those at the fringe of the network, whose sporadic ties to others in the network are less entrenching (Borgatti & Everett, 2000). In a collaboration network that comprises of project affiliations, those who have fewer affiliation ties to projects and hence appear at the periphery of their collaboration network in that field. However, lack of activity within the focal field may be due to the individual's professional activities in other fields or cross-disciplinary projects that limit their availability to field-specific projects (Cattani & Ferriani, 2008). In other words, those whose collaborations span multiple fields are likely to appear in the periphery of one or more of those fields. Hence, these individuals face an abundance of external input for each field in which they engage. For instance, many renowned composers or writers who introduced novelty into cinema only focused a small portion of their collaborations within the film industry and mainly stayed active within literature or music.

Yet, an individual whose perspective diverges from his collaborators may experience difficulties in mobilizing support to implement these ideas (Perry-Smith & Mannucci, 2017). This lack of support particularly exposes individuals in peripheral positions when they try to gain acceptance for their ideas by insiders in the field (Cattani & Ferriani, 2008; Cattani et. al, 2014). Their ideas face a lower level of approval from their peers compared to those at the connected core of the network and due to their more limited connections, individuals at the

periphery may not have access to alternative collaborators within the field. Therefore, their creative ideas may never be realized.

By contrast, at the core of the network, individuals can efficiently mobilize support and enjoy various options for collaboration (Cattani et. al, 2014).Cattani et. al, 2014 Therefore, coreness results in both advantages and disadvantages for creativity, stemming from the interaction of its negative effect through diminished access to external input and positive effect through support mobilization. Accordingly, the baseline hypothesis of the current study regarding external input predicts that coreness has an inverted-U shaped effect on creativity. This baseline prediction is directly adopted from the theory and findings of past research (Cattani & Ferriani, 2008).

H0: The creativity of individuals will be enhanced by occupying intermediate positions in between the core and periphery of the network.

The role of expertise in adopting external input

External input may have low compatibility with the creative processes of the adopting field since it has been primarily generated for use in its original field. Individuals who obtain diverse expertise by fulfilling various roles in collaborations develop an overarching view of the creative processes in their field that may help in tailoring external input and increasing its compatibility. These individuals can take advantage of their capacity to work with multidisciplinary input and resolve its incompatibilities (Tortoriello, 2015; Tortoriello et al., 2015). From this angle, expertise is a key facet of professional backgrounds in processing diverse external input.

Individuals with diverse expertise are advantaged in two ways when receiving input that originates from a different field than their own. First, individuals who fulfill multiple roles throughout their career can leverage their multidisciplinary understanding to comprehend a wider variety of external input (Kacperczyk & Younkin, 2017; Melero & Palomeras, 2015). These individuals can connect to various fields and develop a comprehensive understanding of each by drawing upon their multiple domains of expertise. In contrast, for those with exclusive expertise in only one role, the understanding of external input is limited by the extent that their particular domain of expertise allows (Fleming, 2007; Tortoriello et al., 2015). Even when their expertise partially matches input from other fields, these individuals' understanding would be limited to certain aspects of input that relate to one particular role. Second, by working across roles, individuals acquire the ability to spot gaps in different roles. Creative outcomes can be advanced in various ways, and each role brings certain aspects into focus. For instance, a composer is more likely to explore forms of music and sound that have not been utilized in filmmaking, while exploring visual effects that have been overlooked but may enhance storytelling and audience engagement are more likely within the expertise of a cinematographer. However, a person who has expertise in cinematography as well as music can identify the possibilities of adopting new input from both visual arts and music. In this sense, familiarity with gaps in a broader variety of roles in a professional field allows individuals to find more relevant areas for applying external input (Tortoriello et al., 2015). Those who do not exclusively focus on one role attain multidisciplinary expertise that makes them capable of spotting gaps and integrating external input in multiple roles. Conversely, individuals focused on one role, mainly comprehend and adopt external input that is relevant to that single role since their expertise is highly limited by the understanding of the role's foundations and technicalities. Accordingly, gatekeepers at the periphery of the collaboration network (Gallo &

Plunket, 2020; Gould & Fernandez, 1989; Singh & Fleming, 2010) who have a diverse professional background in terms of roles, have greater capacity to integrate fresh external input.

The difference made by diverse expertise is also visible when a new feature is adopted in a creative context. For instance, several decades after the advent of color cinematography, many pioneers such as renowned filmmaker Francois Truffaut were still suspicious of using color in films— as color was primarily used for big productions that were not aiming to be novel (Bergan, 2007). In contrast, when color cinematography became accessible in Japan, the Japanese filmmaker Akira Kurosawa benefited from his early career days in visual arts to avail himself of the opportunity and to reinvent his cinema with some of the most inspiring masterpieces of color composition— such as *Ran* (1985) and *Dreams* (1990). As evident in the adoption of color cinematography, every additional domain of expertise opens up a new angle, enabling one to comprehend and make use of the creative value in highly original input that has not yet been explored in a field. Similarly, engaging in different roles within a given field diversifies individuals' expertise in multiple domains, and therefore enhances their capacity to incorporate fresh external input into their field. Moreover, having diverse expertise with multiple roles enhances multidisciplinary understanding, which is crucial in dealing with input from other fields. Therefore, in peripheral positions that provide access to external input, individuals with more versatile expertise are more creative than experts who focus exclusively on one role.

Coreness also tends to benefit those who diversify their roles more than their peers with exclusive expertise. However, the benefits of possessing core positions are manifested differently than peripheral positions. While those who focused their professional background

on a single role may be expected to have advanced expertise in that role, a professional background involving several roles may raise doubts about where the individual's expertise fits and is most relevant (Fleming, 2007). As a result, collaborators may be more hesitant in accepting and supporting ideas produced by those who have worked across several roles. However, core positions are conventionally associated with higher levels of legitimacy and acceptance among peers (Cattani & Ferriani, 2008). Therefore, occupying a core position can to some extent compensate for the adverse effect of an ambiguous professional background in terms of expertise (Baker & Faulkner, 1991; Zuckerman, Kim, Ukanwa, & Von Rittmann, 2003).

In contrast, experts whose background has been devoted to one role benefit from intermediate positions between the core and the periphery of the network. At intermediate positions, individuals are provided with a variety of ideas by those who have already selected relevant external input at the periphery and integrated it into the exchanges within their field. Hence, individuals who occupy intermediate positions receive a variety of fresh external input that has already been curated by individuals in peripheral positions. Experts are more prolific in generating ideas when provided with relevant fresh input that is feasible for integration, rather than in positions that require segregating input and ideas based on (lack of) relevance and feasibility such as at the periphery (Katila, Thatchenkery, Christensen, & Zenios, 2017). Such relevant, new input is accessible in intermediate positions. Those in intermediate positions access external input after its substantial incompatibilities with the creative processes of their field have been resolved through the multidisciplinary endeavors of those at the periphery.

At this stage, high levels of expertise in a single role can help idea generation by fully integrating the fresh input into roles-specific creative processes and fine-tuning the combination

of the fresh and existing input (Fleming, 2007; Katila et. al, 2017). Moreover, in an intermediate position, experts can leverage support through their connections to the core of the network (Cattani & Ferriani, 2008) to engage supportive (or access alternative) collaborators to realize their ideas (Baker & Faulkner, 1991). In this way, experts in intermediate positions can enhance the visibility of the new ideas that are generated via integrating external input and ensure that their ideas often result in outcomes and therefore are less likely to be overlooked (Perry-Smith & Mannucci, 2017). Furthermore, they can maintain their connections to the individuals at the periphery who provide their peers with tailored external input in order to enhance the novelty of their ideas. Consequently, the following hypothesis is expected regarding the interplay of coreness and expertise:

H1: Low level expertise reinforces the benefits of both core and peripheral positions for creativity, whereas high level expertise increases the creativity advantage of those who occupy intermediate positions between the core and periphery of the network.

The role of specialization in adopting external input

In the case of external input, individuals' specialization may not be highly relevant for processing input diversity. Integrating external input into the field is a cross-disciplinary endeavor (Fleming, 2007) since activities within different fields rely on different domains of expertise. However, individuals' specialization in terms of outcome types within their field (such as writer's specialization in various genres or styles of screenplays) has little relevance to their additional expertise in other roles (such as directing, cinematography, or composing). Expertise in different roles requires the understanding of entirely different disciplines and theoretical principles (such as the principles of writing vs musical composition or visual arts).

In this sense, variation in specialization is unlikely to affect one's ability to comprehend external input.

Nevertheless, high levels of specialization compensate for the lack of acceptance associated with peripheral positions. As the baseline hypothesis poses (H0), individuals at the periphery of the network are not viewed as insiders (Cattani et. al, 2014) and thus, suffer from a lack of peer support for their ideas (Cattani & Ferriani, 2008). Since external input may deviate substantially from the standards and methods of the adopting field, collaborators may not find it the most attractive sort of input and initially resist its adoption (Fleming, 2007; Perry-Smith & Mannucci, 2017). Therefore, raising support among peers is crucial for integrating external input, and the lack of support associated with peripheral positions may hinder the adoption process. Moreover, peripheral positions are essentially distinguished from core positions by limited access to alternative collaborators (Borgatti & Everett, 2000).

Individuals who repeat work of the same type develop a more consistent background that increases their shared perspective with collaborators focused on that same type. Similarity in perspective lends specialized individuals a common ground with their collaborators and helps with receiving the green light for implementing their ideas (Kacperczyk & Younkin, 2017; Zuckerman et. al, 2003). On the contrary, generalists who work across genres develop a mixed background that makes it difficult for potential collaborators to evaluate where generalists' ideas best fit. In addition to the weaker support specialists provide to generalists than other specialists, since each generalist may work on a different combination of genres, it may be harder for generalists to find their own group among other generalists too. In this sense, specialists' ideas are more likely than generalists' ideas to receive collaborators' support and acceptance, in order to be realized and subsequently evaluated for creativity.

For core individuals whose ideas already benefit from high acceptance levels but suffer from limited access to fresh external input (Cattani & Ferriani, 2008), specialization decreases creativity by undermining their flexibility towards diverse internal input. As discussed in the previous chapter, specialists are limited in initiating or conceiving interactions with peers who specialize in different types. Consequently, combining a core position and a high level of specialization facilitates neither accessing external input nor processing diverse internal input. Therefore, in core positions, specialist individuals experience minimal access to diverse input. Based on this argument, even though specialization benefits those who occupy peripheral positions in the network, it is likely detrimental to the creativity of core individuals.

H2: Specialization moderates the non-linear effects of coreness on creativity, such that for specialists (generalists), peripheral (core) positions are more beneficial than core (peripheral) positions.

METHODS

The hypotheses of the study are operationalized in the context of the film industry. Film production is highly exposed to input from other fields, due to the various disciplines that it incorporates, such as music, writing, visual and performing arts, and its technological aspects. As such, careers of many film professionals like Stanley Kubrick (photography), Woody Allen (theater), and Abbas Kiarostami (painting and graphic design), started not in the film industry but in a different field. Some of these individuals try to incorporate ideas from one field into another. Even though not all such attempts are necessarily successful, nevertheless, they made the processing of external input a relevant occurrence for their creative context. Moreover, some film professionals remain active across fields, implying they could sometimes appear in the periphery of the film industry collaboration network and that their position may be indicative

of ties to collaboration networks of another field. The same period (1993-2015) as in the previous chapter is used for sampling major film releases in the American film industry, which makes the results of the two chapters longitudinally comparable in addressing the whole vs. ego-network mechanisms. The data for this chapter are retrieved from IMDB.com datasets and METACRITIC.com website.

Network construction

This chapter examines the entire collaboration network of the American film industry across its eight major studios, namely Sony Pictures (also Columbia Pictures, TriStar Pictures), Paramount Pictures (also Miramax), MGM (also Orion Pictures, United Artists), Disney (also 20th Century Studios, Twenty-First Century Fox, Marvel Studios, Lucasfilm, Searchlight Pictures, Regency), Universal, (Dreamworks, Focus Features), Warner Brothers, and Lionsgate as well as all of their affiliated subsidiaries that produce or distribute feature films. This network is also delineated by time and is consisted of five-year rolling windows for each observation year, such that the first window covers 1989 to 1993 and each window advances by one year up to the last window that includes data from 2011 to 2015. The collaboration network for the empirical analysis of the presented hypotheses in this chapter is constructed in its entirety, without reducing calculations into direct connections only.

Measures

The only dependent variable of this chapter, *Creativity*, is measured via a count variable aggregating the number of nominations individuals receive in role-based categories during each five-year observation window, from festivals and peer associations that focus on outcome novelty (Cattani & Ferriani, 2008; Mannucci & Yong, 2018). This is the same measure as explained in the previous chapter.

The dimensions of professional background namely specialization and expertise are calculated based on an HHI index, as per the below formula.

$$HHI = s_1^2 + s_2^2 + s_3^2 + \dots + s_n^2$$

where s_n is the percentage of film titles affiliated to one's professional background that are associated to genre n , expressed as a decimal number. In the case of multiple film genres, each one is weighted equally.

Accordingly, *specialization* sums the squared fraction of a subject's affiliations to films in each genre. Likewise, *expertise* aggregates squared shares of each role among that subject's affiliations to film projects during an observation period.

Coreness has been associated with individual-level access to support and external input as a measure of the subject's position in the entire collaboration network. A continuous core-periphery structure is conventionally used to determine the proximity of each node to the core of the network, i.e., a subgraph with most densely connected nodes. Subsequently, a proximity score can be calculated as coreness of each subject, where a high score signals a core actor while a low score indicates a peripheral one. More precisely, when the n^{th} core of a network refers to a maximum subset of interconnected nodes that each has at least a degree of n , the value of coreness reflects the maximum degree subgraph to which an individual belongs. Borgatti and Everett provide a procedure for estimating coreness (Borgatti & Everett, 2000), which was applied to the affiliation matrices of the subjects in this chapter.

Control Variables. Similar to the previous chapter, relevant factors that influence creativity are included in the model as control factors. *Experience* is measured based on the number of film projects to which a subject has been affiliated, since the level of activity within

the same period of tenure may differ for individuals. *Role consolidation* is measured based on the number of roles an individual takes on in a given film project. Similarly, to control for deviated calculation of specialization levels due to association of single film projects with multiple genres, *genre confusion* was used to control the average number of genres associated with an individual's film titles up to the year of observation. *METASCORE* is included as a proxy for the quality of a film, reflected in its critical reception. A count variable captures the frequency of *sequels* to which a subject was affiliated for a given year. *Quality* reflects the number of individual nominations one has received in the preceding two years. Moreover, *team quality* was measured based on the average number of nominations received by a subject's collaborators during the preceding two years. *Team coreness* controls for the average of coreness degrees among a subject's collaborators. *Budget* information for each film project is also included as a proxy for various sources of quality in a movie that are costly, such as movie-star wages or expensive special effects. The model controls for the variation of production formula per *genre* via inclusion of count variables that capture how many times an individual was affiliated with a film projects in a specific genre during the observation period. Likewise, the frequency of each *Role* fulfilled by an individual was counted per role and included to control the variations of creative processes across the six role categories, namely writers, directors, production designers, cinematographers, editors, and composers.

Analysis

The empirical analysis of this chapter is aimed at modeling a non-linear relationship, particularly the effect of coreness on creativity. To achieve this objective, this analysis follows the guidelines provided in the past literature for testing inverted-U shaped effects (Haans, Pieters, & He, 2016). Accordingly, a U-test is conducted to evaluate whether a turning point

for this effect exists within the range of observations and examine the slope of the effect around the optimum. Moreover, the interactions of this non-linear effect with the linear effects of specialization and expertise are tested via a longitudinal estimation. The results are interpreted using margins plots and followed up with linear tests where the geometrical representation of the interactions is indicative of limitations in the non-linear trend, such as when the trend remains monotonously increasing or decreasing over the majority of observations. In doing so, a natural logarithmic transformation of the coreness measure as well as a winsorized estimation were used, to check for possible deviations in the range or trend of observations respectively. The unbalanced nature of the panel data as well as the overly dispersed distribution of the count dependent variable require a random effects negative binomial estimation. The results were also contrasted with pooled estimations. Moreover, this analysis controlled for year and individual effects. In addition to modeling the hypotheses of this chapter, a final model is estimated including the hypotheses presented in this chapter about coreness and the previous chapter about brokerage, in order to simultaneously compare the theorized interaction effects at the ego and whole network levels.

RESULTS

Table-1 provides the summary statistics for the variables used in this analysis. The distribution of coreness confirms adequate variation in the whole network position among observations. Similarly, there is considerable heterogeneity in professional backgrounds and creativity of individuals. Coreness shows limited correlation with creativity before quadratic transformation ($\beta=0.07$). Only the coefficients for correlation between coreness and brokerage exceed 50 percent ($\beta=0.53$). Moreover, although team coreness for individuals only takes into account the coreness of their collaborators instead of the focal individual, it exhibits an

alarmingly high level of correlation with individual coreness. However, the estimation of variance inflation factors did not reveal high levels of autocorrelation in this regard.

Table-1 to be inserted around here

Table-2 provides the results of panel data analysis. The first model (Model-1) shows the baseline estimation including control variables only, while the main effect of coreness is entered in the second model (Model-2). There is support for the baseline hypothesis of the chapter (H0) stating that “the creativity of individuals will be enhanced by occupying intermediate positions in between the core and periphery of the network.” Coreness squared shows a negative and significant effect ($\beta_{\text{Coreness}^2} = -0.002$, $p < .05$) while the linear effect of coreness is positive and significant ($\beta_{\text{Coreness}} = 0.08$, $p < .01$). The results for the inverted U-test suggests that the overall direction of coreness effect on creativity changes from positive to negative around the value of 23, which is within the range coreness values (min=0, max=42). However, this turning point falls outside the 95 percentile of the observations. These results are also significant (t-value = 1.90, $p < .05$), indicating the overall presence of an inverted-U shaped effect. Figure 2 illustrates the inverted-U shaped effect of coreness on creativity.

Table-2 and Figures 2 and 3 to be inserted around here

The third model of Table-2 (Model-3) exhibits the results for the interaction of coreness with specialization and expertise. Hypothesis 1 stated a moderation effect of expertise on the curvilinear relationship between coreness and creativity, predicting that high expertise levels results in a higher level of creativity only for intermediate coreness levels and a lower level of creativity for the high or low coreness levels (i.e., at the core and at the periphery). Model-3 confirms this hypothesis and indicates a highly significant negative interaction effect between

expertise and the quadratic term of coreness effect ($\beta_{\text{Expertise*Coreness}^2}=-0.019, p<.01$) and a significant positive interaction effect between expertise and the linear term of coreness effect ($\beta_{\text{Expertise*Coreness}}=+0.264, p<.05$). Figure 3 clearly shows that when plotting marginal effects throughout the full range of coreness values, individuals with low levels of expertise have a higher chance of receiving a nomination at both high and low levels of coreness. As predicted, this advantage diminishes in intermediate positions that lie between the two extremes of coreness range. Particularly, individuals located between the 4th to 11th core of the network have a higher chance of nomination when demonstrating a high degree of expertise. This pattern of interaction is fully in line with the H1 that predicted low level expertise reinforces the benefits of both core and peripheral positions for creativity, whereas high level expertise increases the creativity advantage of those who occupy intermediate positions between the core and periphery of the network.

Hypothesis 2 stated a moderation effect of specialization on the curvilinear relationship between coreness and creativity, predicting that low (high) coreness values are more beneficial than (low) high coreness values for specialists (generalists). In this regard, Model-3 of table-2 indicates a highly significant negative interaction effect between specialization and the linear term of coreness effect ($\beta_{\text{Specialization*Coreness}}=-0.410, p<.01$) and a positive but insignificant interaction effect between specialization and the quadratic term of coreness effect ($\beta_{\text{Specialization*Coreness}^2}=+0.013, p>.10$). Figure 3 suggests that for low levels of specialization that characterize generalists, the inverted-U shaped effect of coreness is steeper on the left hand side of the turning point (lower coreness values). Moreover, for highly specialized individuals, a U-shaped effect emerges, with a turning point within the range of coreness values and a steeper slope on the left hand side of this turning point. These results support that specialization

moderates the effect of coreness on creativity such that for specialists (generalists), peripheral (core) positions are more beneficial than core (peripheral) positions.

Moreover, according to Figure 3, the turning point of the U-shaped effects for highly specialized individuals is near the extremes in the range of coreness values, while throughout this range, the relationship between coreness and creativity for highly specialized individuals appears monotonous. These evidence, together with the transformation of the shape of coreness effect for specialists into a U-shaped, motivated additional tests of the shape of coreness when configurations of specialization are taken into account. Several robustness checks were performed to examine the shape of coreness effect on creativity and its interaction with both specialization and expertise. The depicted confidence intervals of marginal values for the joint effect of coreness and specialization (Figure 4) suggest that although this estimation is accurate for over 99 percent of observations, it considerably lacks accuracy for extremely high levels of coreness— due to the highly dispersed distribution of observations. Figure 5 shows that, within the 99 percent of observations, chances of nomination for the highly specialized individuals diminishes in a nearly linear trend as their coreness increases, whereas for individuals with lower levels of specialization, the average number of observed nominations monotonously increases with coreness. When a logged transformation of coreness was used for estimation, the joint effects of logged-coreness with both specialization and expertise remain monotonous for the entire range of coreness values. Moreover, for 99 percent of observations, the direction of these joint effects is similar before and after log transformation of coreness.

Overall, the results provide support for the hypotheses of this chapter. The direction and relative magnitude of all effects are also maintained in the last model of table 2 (Model-4), where all interaction, control, and baseline effects are simultaneously included at the whole and

ego-network levels. Furthermore, as shown in table 3, winsorizing coreness does not produce any considerable changes to the results of the estimation. Table 3 also includes the results of split-sample estimation for all observations that belong to the left-hand side of the optimum in the curvilinear effect of coreness on creativity.

Table-3 and Figures 4 and 5 to be inserted around here

DISCUSSION AND CONCLUSIONS

This chapter explained that diverse input consists of two primary kinds, namely internal and external input, and that disentangling these dimensions has strong implications for network studies of creativity and idea generation. The existing research that showcases interactions between network effects and diversity in the input that is being exchanged within the network (Ter Wal et. al, 2016) overlooks whether novel outcomes are inspired by social interactions within or across professional networks of different fields. The theoretical contention in the current chapter extends diverse network literature by drawing a fundamental contrast between processing input that has been already exchanged within a professional field, namely internal input, and external input, that is, fresh input adopted from a different field. Notably, this chapter hints at important differences between the role of ego vs. whole network positions in explaining creativity. Internal input is commonly accessed through individuals' connections with their collaborators within the same network and therefore, the structure of these direct connections, known as ego-network structure, largely determines access to diverse internal input. While ego-network connections serve as preconditions to recombination of internal input, incorporating fresh input from other networks into one's professional network in a particular field relies on one's position within the entire network of professional collaborations, including all the direct and indirect professional connections. More precisely, a peripheral position within the entire

network provides individuals with the opportunity to renew the creative material exchanged in that network by having access to fresh input that originates from other networks.

Past research (Cattani & Ferriani, 2008) suggests that this unique opportunity also underscores the costs associated with distance from the connected core of a network, where novel ideas are accommodated by peer support and acceptance. However, our findings informs research about coreness by showing that the combination of the discussed advantage in accessing external input and limitation in raising support among peers only applies to an elite group of individuals located at the extreme network positions in terms of coreness. Rather, for most of its range, coreness exhibits a nearly linear effect on creativity. More importantly, modeling coreness via a configurational framework that comprises interactions with specialization and expertise reduces the non-linear effect of coreness into one predominant advantage or limitation with a linear effect.

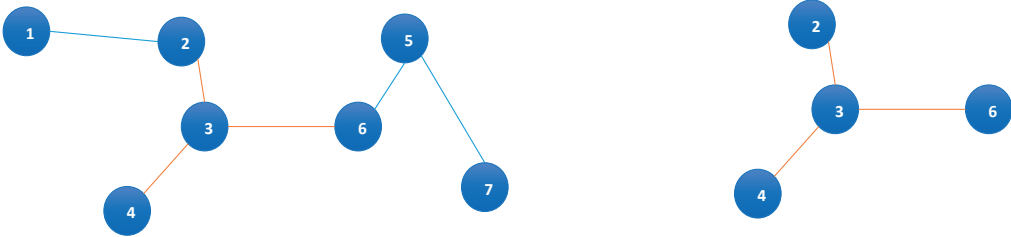
Another fundamental difference between diversity in internal and external input concerns how the interplay of specialization and expertise with network drivers of creativity unfolds during creative processes. The recombination of diverse internal input in a specific field is, to a great extent, determined by the variation of outcome types, including genres, styles, and media within that field. Accordingly, having a more versatile specialization in terms of outcome types plays a vital part in enabling individuals to recognize diversity in internal input, as explained in the previous chapter in this dissertation. By contrast, the present chapter revealed that utilizing external input demands a diverse professional background in terms of expertise that allows for understanding multiple disciplines and interacting with professionals in other fields. Whereas specialization seems only relevant to the extent that it may compensate for the lack of support that peripheral individuals face, for example by conveying a solid identity in a

particular genre and attracting other specialists in that genre. Either way, the mechanisms through which specialization, expertise, and network position interact differ across ego and whole network levels. Accordingly, the findings of this chapter advance the network studies of idea generation and creativity by suggesting that the facets of professional background that are key in processing input vary, depending on whether individuals receive internal or external input. Moreover, it was found that diverse expertise can improve creativity, specifically if individuals have performed different roles within the creative process. However, our results suggest that these individuals are likely to be more creative in peripheral positions that provide them with access to input from other fields.

These findings are limited in several ways and require future research to probe further into the differential impact of ego-network vs. whole network variables. The empirical analysis of this chapter was conducted on a single industry, specifically the same industry that has been tested by previous research about coreness. While using a similar context may lend credibility to the detailed insights about the shape of the coreness effect that had remained overlooked and using a different sample from that context confirmed the overall reproducibility of past findings in this study, future research should clarify to what extent the findings offered in this study may apply in other industries. Likewise, it would be interesting to address the differences between project-based fields that have a pure network organization with industries that are more hierarchical and characterized by long-term affiliations. In addition, the analytical procedure of the present study was limited by the unbalanced structure of its panel data, since individuals are not necessarily observed in every observation window. Consequently, fixed-effects estimation was deemed unfeasible due to an enormous amount of attrition in observations included that makes the estimation unlikely to converge and the potential results unreliable. Even though our

results remained consistent in a pooled estimation, the fixed effect of individuals or studio affiliations remains to be addressed by future research.

APENDIX: FIGURES AND TABLES



(a) An entire network involving seven

(b) The ego network of individual

Figure 1- Whole (a) vs Ego (b) Network

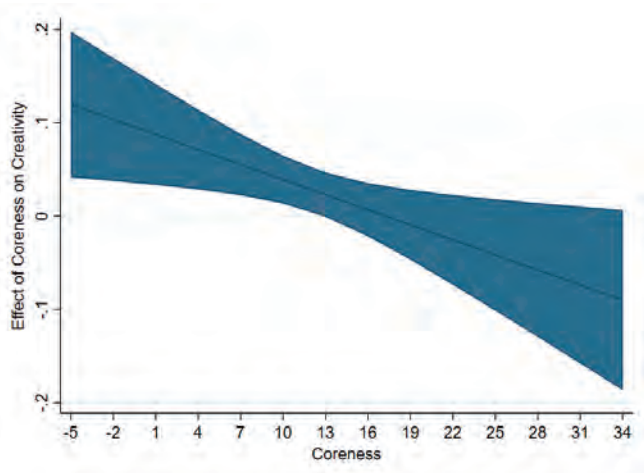


Figure 2- The marginal effects of coreness on creativity (dy/dx)

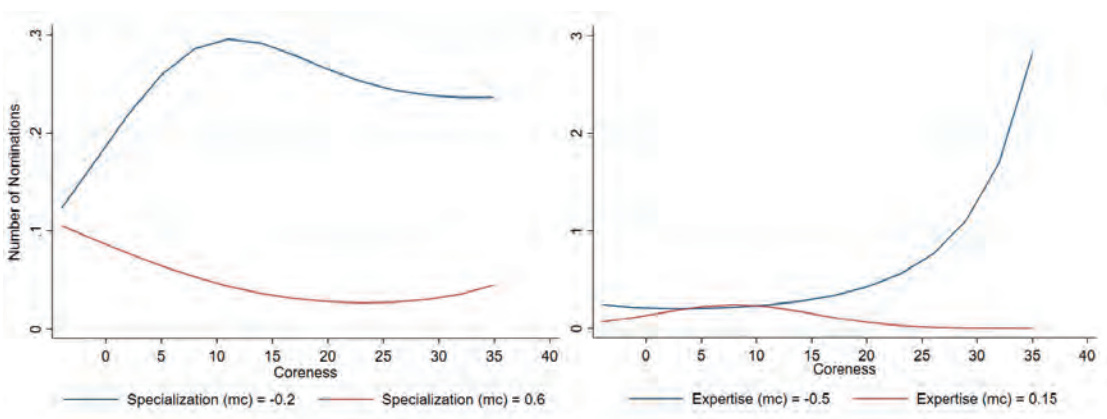


Figure 3- Marginal effects of coreness on creativity, moderated by specialization and expertise

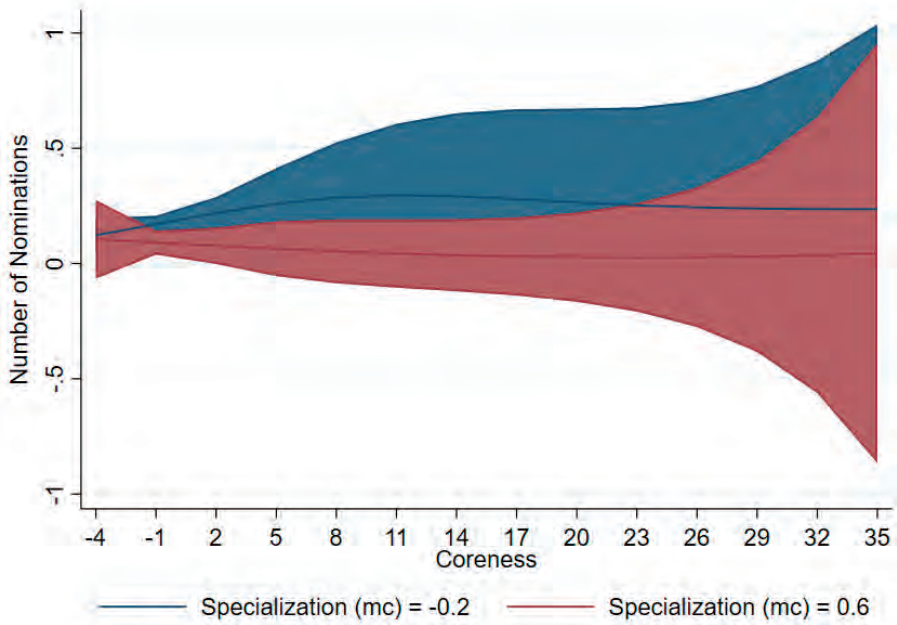


Figure 4- Confidence intervals for the interaction of coreness and specialization

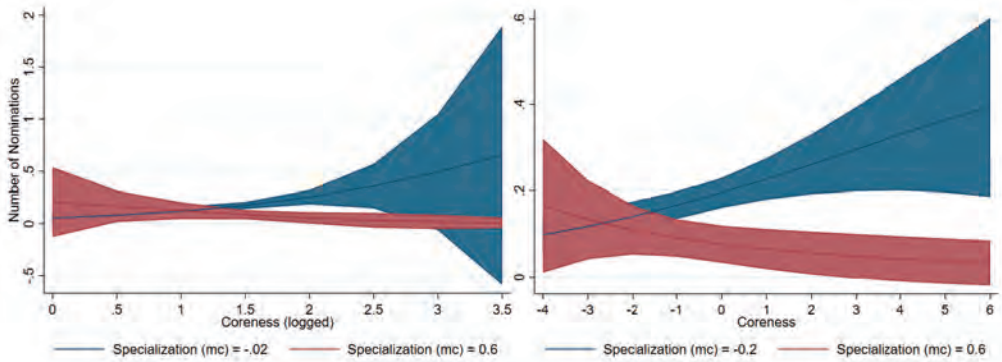


Figure 5- Marginal effects of coreness on creativity moderated by specialization with coreness logged (left) and truncated at 99 percentile (right)

Table 1-Descriptive Statistics

	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13
(1) Creativity	0,17	0,81	0	13													
(2) Brokerage	0,7	0,2	-0,13	0,98	0,04												
(3) Coreness	5,37	2,29	0	42	0,07	0,53											
(4) Specialization	0,29	0,15	0,09	1	-0,04	-0,39	-0,18										
(5) Expertise	0,85	0,22	0,25	1	-0,11	-0,11	-0,12	0,12									
(6) Experience	8,42	12,56	0	204	0,08	0,42	0,23	-0,34	-0,15								
(7) Quality	0,24	1,07	0	18	0,22	0,16	0,16	-0,12	-0,09	0,24							
(8) Team Quality	0,5	0,88	0	8,94	0,13	0,10	0,06	-0,06	0,00	0,06	0,17						
(9) Sequel	0,18	0,44	0	6	-0,04	0,08	0,14	-0,04	-0,07	0,04	-0,01	-0,05					
(10) Metascore	52,34	17,42	1	100	0,31	0,02	-0,01	0,01	0,00	0,04	0,13	0,22	-0,08				
(11) Budget (MD)	42	45	0,06	479	0,01	0,10	0,10	-0,16	0,00	0,03	0,06	0,15	0,22	0,01			
(12) Genre Confusion	2,49	0,54	1	3	0,00	-0,09	-0,01	-0,49	0,03	-0,05	0,02	0,03	0,04	-0,01	0,23		
(13) Role Consolidation	1,1	0,31	1	3	0,12	0,02	0,04	0,01	-0,49	0,11	0,10	-0,01	0,10	0,06	-0,07	-0,04	
(14) Team Coreness	5,84	1,87	1	29,8	0,02	0,34	0,49	-0,05	-0,03	0,06	0,05	0,16	0,12	0,01	0,13	0,03	0,00

Table-2: Random Effects Estimate of Individual Creativity

	Baseline	Coreness	Interaction	All Effects
	Model 1	Model 2	Model 3	Model 4
Brokerage				0.446 (0.381)
Coreness		0.080*** (0.030)	0.085** (0.034)	0.055 (0.046)
Coreness Squared		-0.002** (0.001)	-0.006** (0.003)	-0.004 (0.003)
Expertise x Coreness			0.264** (0.106)	0.024 (0.154)
Expertise x Coreness Squared			-0.019*** (0.007)	-0.009 (0.008)
Specialization x Coreness			-0.410** (0.196)	-0.151 (0.306)
Specialization x Coreness Squared			0.013 (0.013)	0.003 (0.016)
Specialization	-1.057*** (0.393)	-0.843** (0.397)	-1.087** (0.427)	-0.853* (0.444)
Expertise	-0.754*** (0.254)	-0.757*** (0.253)	-0.739*** (0.250)	-0.859*** (0.254)
Role Consolidation	0.215 (0.132)	0.237* (0.132)	0.202 (0.133)	0.188 (0.135)
Experience	0.005* (0.003)	0.004 (0.003)	0.003 (0.003)	0.002 (0.003)
Quality	0.062*** (0.021)	0.060*** (0.022)	0.067*** (0.022)	0.067*** (0.022)
Team Coreness	0.000 (0.016)	-0.013 (0.017)	-0.009 (0.017)	-0.007 (0.017)
Team quality	0.169*** (0.032)	0.180*** (0.032)	0.175*** (0.032)	0.177*** (0.032)
Genre Confusion	-0.104 (0.093)	-0.073 (0.094)	-0.073 (0.093)	-0.026 (0.099)
Sequel	-0.257** (0.105)	-0.265** (0.105)	-0.254** (0.105)	-0.250** (0.105)
Metascore	0.100*** (0.003)	0.100*** (0.004)	0.100*** (0.003)	0.100*** (0.004)
Movie budget	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Year Dummies	Included	Included	Included	Included
Genre Dummies	Included	Included	Included	Included
Role Dummies	Included	Included	Included	Included
Constant	-8.972*** (0.360)	-9.038*** (0.361)	-9.160*** (0.358)	-9.170*** (0.359)
Constant	1.496***	1.559***	1.699***	1.694***

ln_s	(0.210)	(0.240)	(0.306)	(0.304)
Constant	1.103**	1.221**	1.509***	1.502***
	(0.434)	(0.480)	(0.551)	(0.546)
Observations	10545	10545	10545	10545
Standard errors in parentheses			* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$	

Table-3: Sample Split, Logged, and Winsorized Estimations

	Left	Logged	Winsorized
Coreness	0.077***		0.104***
	(0.028)		(0.035)
Coreness Squared			-0.027**
			(0.013)
Expertise x Coreness			0.264**
			(0.112)
Expertise x Coreness Squared			-0.088**
			(0.039)
Specialization x Coreness			-0.515**
			(0.241)
Specialization x Coreness Squared			0.025
			(0.072)
Coreness (logged)		0.782	
		(0.710)	
Expertise x Coreness Squared (logged)		2.260	
		(2.112)	
Specialization x Coreness Squared (logged)		-0.837	
		(1.989)	
Coreness Squared (logged)		-0.124	-1.189***
		(0.216)	(0.446)
Specialization x Coreness Squared (logged)		-0.389	-1.189***
		(0.827)	(0.446)
Expertise x Coreness Squared (logged)		-0.364	-0.364
		(0.630)	(0.630)
Expertise		-3.459*	-0.580**
		(1.822)	(0.261)
Specialization		1.311	-1.189***
		(1.441)	(0.446)
Role Consolidation	0.390***	0.223*	0.221*
	(0.130)	(0.133)	(0.132)
Experience	0.006*	0.003	0.002
	(0.003)	(0.003)	(0.003)
Quality	0.076**	0.065***	0.071***
	(0.024)	(0.022)	(0.021)
Team Coreness	-0.020	-0.007	-0.006
	(0.018)	(0.017)	(0.016)
Team quality	0.167***	0.160***	0.157***
	(0.033)	(0.032)	(0.032)

Genre Confusion	-0.010 (0.082)	-0.075 (0.093)	-0.067 (0.093)
Sequel	-0.281*** (0.106)	-0.296*** (0.106)	-0.290*** (0.107)
Metascore	0.101*** (0.004)	0.101*** (0.003)	0.101*** (0.003)
Movie budget	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Year Dummies	<i>Included</i>	<i>Included</i>	<i>Included</i>
Genre Dummies	<i>Included</i>	<i>Included</i>	<i>Included</i>
Role Dummies	<i>Included</i>	<i>Included</i>	<i>Included</i>
Constant	-8.972*** (0.360)	-9.019*** (0.360)	-9.038*** (0.361)
ln_r			
Constant	1.496*** (0.210)	1.512*** (0.218)	1.559*** (0.240)
ln_s			
Constant	1.103** (0.434)	1.135** (0.448)	1.221** (0.480)
Observations	10545	10545	10545
Standard errors in parentheses		* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$	

CHAPTER 3

CREATIVE COLLABORATIONS: THE INTERPLAY OF AGENCY AND STRUCTURE

ABSTRACT

This chapter probes into the fundamental question of whether networks drive creativity or vice versa. In doing so, the study conducted in this chapter utilizes a powerful and relatively new method (SIENA) that can simultaneously model the co-evolution of networks and behavior. The findings of the study provide support to the hypotheses that predict while social interactions drive creativity, an individual's demonstrated capability in producing novel ideas also affects the evolution of collaborations networks. These findings contribute to research on agency vs. structure as well as network externalities.

Past research has established social networks as a fundamental predictor of innovation (Ahuja, 2000; Burt, 2004; Carnabuci & Diószegi, 2015; Obstfeld, 2005) and creativity (Cattani & Ferriani, 2008; Lingo & O'Mahony, 2010; Perry-Smith & Mannucci, 2017; Uzzi & Spiro, 2005). While the majority of network studies provide abundant evidence that supports the effect of social position on various facets of creativity such as idea generation (Fleming, Mingo, & Chen, 2007; Uzzi & Spiro, 2005), selection (Perry-Smith & Mannucci, 2017), and evaluation (Delmestri, Montanari, & Usai, 2005), some still pose the question of whether social network drives creativity or vice versa. In particular, individual past performance in terms of idea generation has been proposed as an antecedent, rather than a consequence of social position (Lee, 2010). This seemingly simple finding carries substantial theoretical significance as it implies that excelling in creativity does not depend on social interaction but rather creative individuals may benefit from agency to the extent that allows them to shape social interactions desirably. Such an implication strongly contrasts the *raison d'être* for network studies of innovation and creativity that primarily rely on the assumption that creativity is achieved through exchanging ideas as a form of social interaction (Godart, Shipilov, & Claes, 2014; Uzzi & Spiro, 2005).

Moreover, most of the research about the effect of networks on innovation and creativity concentrates on the benefits and advantages of occupying a particular position, rather than the effect of this position on those surrounding them, known as the network externalities of that position (Galunic, Ertug, & Gargiulo, 2012). Clement and colleagues (2018) show that such externalities can be in fact negative for the creativity of those neighboring a particular type of brokerage position (Clement, Shipilov, & Galunic, 2018), though this position substantially enhances the creativity of the broker (Ahuja, 2000; Fleming et. al, 2007). This finding prompts

an additional question as to whether highly creative individuals generally inspire those around them to produce more novel ideas or, to the contrary, benefit at the loss of their peers.

This chapter adopts a unique research design in innovation research that allows to concurrently address “*How do collaboration ties to others within the same network affect creativity?*” and “*to what extent does creativity shape the network?*”. These questions are approached via advancing the application of a relatively new methodology in organizational settings, so-called SIENA (Simulation Investigation for Empirical Network Analysis), that allows for simultaneous modeling of social influence, selection, and popularity mechanisms (Snijders, 2012; Snijders, Van de Bunt, & Steglich, 2010). To this end, SIENA addresses two dependent variables, namely the network dependent variable that characterizes the formation of ties, and the behavioral dependent variable that represents the performance or behavior that is affected by network and other explanatory factors. Accordingly, this study theorizes and operationalizes how similar reputation among peers based on past creative performance as well as similar specialization levels increase the likelihood of their selection to become collaborators in the same project.

Prior research suggests that those with a reputation for producing novel ideas in the past do not necessarily maintain the same level of creativity over time (Mannucci & Yong, 2018; Caves, 2003). The present study distinguishes between reputation for creativity as a predictor of tie formation and the individuals’ (current level of) creativity as the behavioral dependent variable of the study. Subsequently, additional hypotheses are developed to predict individuals’ creativity as the behavioral dependent variable of the study and tested while controlling for the network evolution mechanisms, including selection based on similar reputation levels. Particularly, the hypotheses that predict creativity focus on the collaborators’ creative influence

on each other. Furthermore, creative influence is interacted with developing similar specialization levels among collaborators, to examine whether assimilation in specialization levels increases the creative influence of collaborators on each other.

The hypotheses of the study are tested over multiple models that cover eight years of panel data (2010-2017) of live-action feature film releases by all major American film studios. Our study confirms that individual's creativity is driven by social mechanisms that direct collaborators' creative influence on each other through their ties. Our findings imply that individual agency in shaping a collaboration network (Lee, 2010) is limited. More precisely, even though building a reputation for creativity provides individuals with more chances to exchange ideas with collaborators who are more creative, excelling in creativity to build such a reputation is itself bound by structural mechanisms that direct collaborators' creative influence.

This chapter extends the existing research about tie formation in creative contexts by theorizing that similar levels of reputation and specialization increase the likelihood of individuals to collaborate on the same project. Furthermore, the chapter expands on the notion of network externality that had been mainly related to brokerage positions in past research (Clement et. al, 2018; Galunic et. al, 2012), to show that network interdependencies by which one's performance or behavior is tied to others' performance broadly apply to exchanging ideas in a collaboration network. More precisely, this chapter explains how, after forming a collaboration tie, collaborators substantially influence each others' creativity via formal and informal exchange of ideas as well as building on intermediate outcomes that they produce towards the end product. Accordingly, this study provides a more complete answer to ambiguities regarding whether networks drive creativity or vice versa and reveals that while

similar levels of creativity drive tie formation, the exchange of ideas in a collaboration network remains to be a major antecedent of creativity. To this end, this study also advances the epistemology of innovation and creativity studies by introducing a design that allows for systematically contrasting selection mechanisms and network influences, while retaining the bimodal order of organizational affiliations (Benton, 2016) that reflects the structure of professional relationships in project-based, network organization (Powell, 1990).

NETWORK EVOLUTION AND CREATIVE INFLUENCE

The level of creativity that individuals have demonstrated in the past can influence their selection for collaborating in future projects. Broadly speaking, predicting and managing the novelty of project outcomes is a complicated task as several facets of creative projects unfold gradually, in unique ways that were not always originally intended (Caves, 2003). The overall ambiguity about processes that lead to producing novel outcomes, combined with exceptional degrees of freedom that creative decision-makers demand for crafting unique outcomes make the creative processes difficult to monitor (Tomaselli, Ebbers, & Torluccio, 2021). Especially in project-based contexts that rely on network organization (Powell, 1990), the unique composition of each project in terms of the intended outcome and participating collaborators strictly limits the basis for predicting individuals' creativity. Nevertheless, the success of projects in innovative contexts depends on the creativity of individuals who provide input into the project and orchestrate that input throughout their collaboration (Caves, 2000). Hence, the recruitment of collaborators is perhaps the most critical decision among the very few that can be made upfront in a project (Pirola-Merlo & Mann, 2004). Moreover, resources allocated to a creative project rarely undergo major adjustments after the start of production in a project. Therefore, choosing individuals capable of producing novel outcomes from the committed

resources becomes a crucial component of managing creative projects towards success, and those already known for demonstrated creativity may appeal to project recruiters. Consequently, reputation for creativity is considered by recruiters among the more reliable indicators of an individual's capability to contribute fresh ideas.

Reputation based on past performance (Ebbers & Wijnberg, 2010) in producing novel ideas is commonly considered among the criteria that projects use for identifying and selecting creative individuals (Delmestri et. al, 2005; Tasselli, Kilduff, & Menges, 2015). Peer assessment is a consequential convention for project selection in creative contexts and individuals with a reputation for creativity among their peers -demonstrated through the novelty of their past ideas- benefit from a track record that proves they can access and provide fresh input or process their input in novel ways (Becker, 1982; Currid, 2007; Godart et. al, 2014). Individuals who have demonstrated high levels of creativity in the past form attractive targets for recruitment in projects aimed at distinctive levels of novelty since identifying creative individuals is crucial for these projects. For example, the film industry is known for discriminative recruitment based on an A-list that contains reputable professionals and B-list that includes others (Caves, 2003). Projects that are more selective tend to hire from the A-list and those in the B-list remain to be recruited by others.

The projects that persistently seek reputable individuals may as well become attractive for those individuals whose reputation and aspirations seem to match the project objectives in producing novelty. Since their reputation matches the project's recruitment criteria, those with a reputation for creativity may find considerable bargaining power for their creative freedom, financial demands, or other conditions to join the project (Kackovic, Bun, Weinberg, Ebbers, & Wijnberg, 2020). Moreover, reputable individuals prefer being affiliated with other reputable

individuals. This inclination may go beyond personal consequence, as the ultimate success of every project that incorporates some novel input would depend on all individuals meeting a certain standard in processing novelty and reducing its incompatibility with various features of the end product - Caves (2003) refers to this condition as O-ring property, inspired by the failure of one part leading to the explosion of an entire space-shuttle.

By contrast, repeated work with low reputation collaborators may affect the social position of reputable individuals to the extent that it takes their time and attention away from interaction with other reputable individuals. Moreover, working with low-reputation collaborators might be conceived as a negative quality signal by other peers. Over time, extending ties to low-reputation collaborators can embed these individuals in a low reputation group of peers, who may not be able to match the capabilities of the reputable person or attract additional resources into their projects due to their low bargaining power. Since working with lower reputation collaborators brings the fear of losing status (Tasselli et. al, 2015), failure, or an unreciprocated relationship (Gould, 2002) over the long run, reputable individuals may tend to decline joining projects that involve many others with lower reputations (Ebbers & Wijnberg, 2010).

As more reputable individuals join a selective set of projects that prioritize novelty and recruitment of reputable individuals, other peers may remain to be selected for projects that do not actively seek highly reputable individuals. Moreover, projects that have no agenda for producing original outcomes are more likely to disregard reputation for creativity and recruit merely based on the candidate's commercial success only (Delmestri et. al, 2005; Ebbers & Wijnberg, 2010). For instance, in the film industry, those who have a better commercial reputation than artistic may be selected into franchise films or other bigger productions that

merely seek box office performance, while those who lack both sorts of reputation, most likely end up in B-movies that exploit the preferences of a small segment of the audience. Consequently, we hypothesize that:

H1- Individuals with similar levels of reputation for creativity are more likely to collaborate.

Another primary signal about the professional background of individuals is specialization. Individuals who produce only one type of outcome, such as those who specialize in one genre, are viewed differently than those with a diverse background during selection processes. Generalists who work across multiple genres may have intended to do so, due to perhaps their extensive affinity with more than one genre. However, for recruiters who want to select individuals for their projects, it may be unsure which generalists failed to commit to one genre due to a lack of the necessary capabilities and which advanced their career as intended originally (Zuckerman, Kim, Ukanwa, & Von Rittmann, 2003). Especially, recruiters who seek individuals for genre-specific production are likely to favor the specialist's focused background that facilitates their valuation by the recruiters. Furthermore, innovation research suggests that specialists show high resistance to including non-specialists or their ideas (Rhee & Leonardi, 2018; Taylor & Greve, 2006; Tortoriello, 2015), making them less likely to desire such collaborations. Consequently, selecting specialists makes projects less inviting for those with diverse backgrounds since they bring a different viewpoint (Rhee & Leonardi, 2018) and therefore may struggle to achieve other's confirmation and support (Coleman, 1988; Tortoriello, 2015).

Therefore, generalists are likely to be selected for different projects than specialists. It is known that combining ideas of various types is a primary way to achieve novelty as

specialists' massive and continuous exploration of genre-specific ideas makes it increasingly difficult to find new combinations of ideas existing within genres, and that the abundance of ideas encompassed in multiple genres provides additional room for idea recombination (Lampel, Lant, & Shamsie, 2000; Mannucci & Yong, 2018; Perretti & Negro, 2007). In this sense, specialists may face creativity barriers in projects that combine genres. Moreover, generalists who find inspiration from working across genres (Mannucci & Yong, 2018) may also seek this capability in their collaborators, interpreting it as a sign of creativity. Consequently, a project that recruits individuals with versatile backgrounds becomes increasingly attractive to other generalists since their similar backgrounds with the recruited collaborators lays a great foundation for shared understanding (Taylor & Greve, 2006).

In particular, genre-specific projects are likely to demand high levels of specialization in that genre as an advantage, therefore involve recruitment activities that are concentrated on attracting and selecting highly specialized individuals (Fleming, 2007). This inclination would, in turn, lead to the selection of more homogenous groups that specialists find accommodating for exchanging ideas or raising their collaborators' support for implementing ideas. Favoring specialists for selection in many projects creates an entry barrier for generalists who want to build their careers (Zuckerman et. al, 2003). Yet, exploratory projects that pursue broader idea combinations may benefit from selecting individuals who have experience with working across outcome types and demonstrated capability for matching and combining highly diverse input in a novel way (Fleming, 2007; Perretti & Negro, 2007; Taylor & Greve, 2006). Overall, specialists are likely to be selected for separate projects than the ones that attract generalists. Consequently, we hypothesize that:

H2- Collaboration is more likely among individuals with similar specialization levels.

Once individuals are selected to work on the same project as collaborators, they form ties that conduct ideas and thus, influence each others' creativity. During a project, collaborators influence each other's creativity in a number of ways. First, collaborators build on each others' ideas and contribute different expertise to achieve the project's ultimate outcome (Bechky, 2006). More precisely, that ultimate outcome is preceded by several intermediate outcomes in which one or more features of the final product are advanced. These intermediate outcomes function as valuable input that helps collaborators build on each other's ideas without having expertise in all roles or understanding all the technical details at every stage of a project. For instance, in a film project, the novel outcome is achieved when the input from the screenwriter adequately guides the creativity of the director, editor, and composer (Caves, 2000).

In this sense, intermediate outcomes are, similar to prototypes in technological contexts, a sort of boundary object (Carlile, 2002; Star & Griesemer, 1989) that exemplify the various features that each role needs to advance in a particular project. Therefore, these intermediate outcomes serve as an important basis for clear communication across the boundaries of various domains of expertise that are involved in the project (Carlile, 2004). Moreover, in creative contexts, individuals have to overcome the boundaries across various domains of expertise not only to develop a shared understanding with collaborators about the established functions of different roles, but also to explore new possibilities that their novel ideas inspire in various aspects of the ultimate outcome (Carlile, 2004; Jones & Massa, 2013). Intermediate outcomes are particularly important in contexts where collaborators face the additional challenge of creating novelty in various aspects of the end product, in addition to the communication across boundaries in various domains of expertise that sets their roles apart. In these circumstances, intermediate outcomes provide an accessible object that illustrates the novel features of the

expected final product in a way that collaborators in various roles can probe and process (Jones & Massa, 2013; Star & Griesemer, 1989). Consequently, when one collaborator brings forward a novel input, the same input may invoke additional novel ideas among others as they apply it to different aspects of the project (Hargadon & Sutton, 2000).

There are several examples in the film industry that illustrate how individuals build upon each others ideas. The timeline of the story in *Memento* (2000) that uses a reverse order via flashbacks to unfold the past events that occurred to the main character, also inspired the editing of its unique opening titles, in which a shooting scene is displayed in rewind. Likewise, the outstanding rhythm of storytelling in *Shoplifters* (2018) that increases gradually throughout the film to reach a fast pace and high tempo from a considerably slow opening has also inspired a unique film score as well as aesthetics of the closing credits– the score transitions from many moments of silence to dense melodies and the gaps in between credits text decrease in an unusual manner. Even though the ideas in each example share the same basis (that is timeline in the case of *Memento* and rhythm in the case of *Shoplifters*), processing that common basis has resulted in multiple novel contributions from individuals who crafted different aspects of each film. In this sense, the above examples illustrate how exchanging the same input among collaborators in different roles can inspire each one of them to create novelty, that have become increasingly important in many other creative industries too.

Second, in addition to building on each other's work, collaborators are also likely to directly exchange ideas in conversations during a project (Clement et. al, 2018). Conducting formal meetings between collaborators in various key creative roles (such as production meetings in the film industry that all major crew members usually attend) is a popular practice in multidisciplinary projects that require coordination of ideas and creating synergy between

various creative processes of the project (DeFillippi & Arthur, 1998; Hobday, 2000; Sydow, Lindkvist, & DeFillippi, 2004). Besides formal meetings among collaborators, exchanging ideas can also occur during informal conversations (Perry-Smith & Mannucci, 2017; Whitley, 2006). It is reasonable to assume that individuals get to know each other during collaboration and may refer to each other for evaluating or exchanging ideas (Clement et. al, 2018). Hence, collaborators may have a substantial influence on each others' creativity over time. Through these influences, those who collaborate with more creative individuals are likely to receive a higher quality input and inspiration than those working with less creative collaborators. We therefore hypothesize that:

H3- Collaborators influence each other's creativity, such that working with collaborators who are more (less) creative enhances (hampers) one's creativity.

The extent to which individuals may benefit from the creative influence of their collaborators depends on their capacity to make use of their interactions with collaborators. For example, benefiting from the diversity in input that has already been exchanged among collaborators is highly depends on one's specialization level as suggested in prior research (Mannucci & Yong, 2018) and further clarified in the first chapter of this dissertation. In addition to a focal individual's specialization level, the difference in collaborators' specialization levels can also affect their intake from exchanging ideas.

Since specialization concerns outcome types, particularly genres, standard ways in which production is organized for every genre play a key part in the interactions between generalists and specialists. Genres have certain conventions and standards. Specialists often focus on exchanging input that adds value to the production based on these genre-specific standards (Fleming, 2007; Hsu & Hannan, 2005). As a result, specialists develop their focus,

experience, and capabilities around the standards of a single genre. On the contrary, generalists who work across multiple genres may bring input from a different genre than their collaborators' specialization. Moreover, they may offer input that borrows elements from multiple genres. Hence, specialists may face difficulties in processing generalists' input since it deviates from the standard production with which specialists are used to work. Furthermore, since input from other genres may offer little insight to genre specific production that interests specialists, specialists may not find it rewarding to commit themselves into dealing with generalists' input.

Moreover, from an audience perspective, specialists may not be able to recognize if generalists' ideas appeal to an audience's particular preferences (Hsu, 2006; Melero & Palomeras, 2015). For instance, the ideas that emotionally engage the audience of comedy may be completely different from what evokes fear or excitement in the mystery genre. However, generalists may not necessarily aim at the conventional criteria of a particular genre. Therefore, specialists can become suspicious about the relevance of generalist' ideas for their audience. The disagreement between specialists and generalists concerning what would engage their audience the most, may hamper their exchange of ideas.

Consequently, one might expect that collaborators' creative influence becomes stronger if they reduce the difference in their specialization levels over time. Individuals can increase shared understanding and support if they assimilate with their collaborators in terms of specialization levels (Fleming, 2007; Tortoriello, McEvily, & Krackhardt, 2015). On the one hand, generalists who increase their focus on a particular genre familiarize themselves with ways in which genre standards guide idea generation and excel at calibrating their input based on these standards so that it engages their specialist collaborators. On the other hand, specialists

who open their perspective to other genres would obtain a deeper appreciation of alternative ways to engage their audience and develop a capacity to process ideas that are not specific to their genre of specialization. As a result, collaborators find a common ground that helps them to more thoroughly conceive and build on each others' ideas. Once collaborators engage themselves in exchanging of ideas with less reservations, it is more likely that one's input would inspire another collaborator to produce a novel idea. Therefore, developing similar specialization levels is expected to enhance collaborators' creative influence on each other.

H4- Creative influence among collaborators is stronger when individuals assimilate with their collaborators in terms of specialization levels.

METHODS

Empirical Context

The film industry provides a unique setting that exemplifies both network-based organization (Powell, 2003) and a creative context (Perry-Smith & Mannucci, 2017). Each product in the film industry is a unique outcome and relies on a temporary collaboration that often involves a different group of individuals. As a result, the collaboration network changes continuously, providing a valuable setting for longitudinal analysis of network evolution in the context of creativity (Caves, 2000; Ebbers & Wijnberg, 2010; Ebbers & Wijnberg, 2017). Particularly, we focus on the most recent era that precedes the consolidation of production and distribution processes by streaming companies, which have obscured the scale and standards of both TV and feature film production in favor of a subscription-based distribution. In these platforms, attracting an audience for every product is unnecessary, as few original products that meet preferences are sufficient for the audience to pay the premium for accessing all other

products on the same platform. By focusing on an earlier period, the study sample in this chapter consists of the most recent years in which the film industry was aimed at qualities, such as novelty, that are essential for attracting an audience for every theatrical release.

Moreover, the film industry is a collaborative context where, as described in the theory section, individuals build upon the intermediate outcomes that their collaborators produce. The following can be considered as a simplified description of the flow of intermediate outcomes in filmmaking. The screenplay encapsulates the story, dialogues, and some information about how each sequence (such as interior or exterior, day or night, and so on) and is complemented with the director of photography (DP) and director's more fine-grained input in the shot-list that includes all the necessary information for shooting each sequence. During the production, raw visual and sound footage (known as daily rushes) is produced based on the screenplay and shot list. Subsequently, the editor processes raw footage to produce a rough cut and moves the project towards the final product in collaboration with the director.

Data

The hypotheses of this study were tested over eight years of panel data (2010-2017) of live-action feature film releases by all major American film studios, including Sony Pictures (also Columbia Pictures, TriStar Pictures), Paramount Pictures (also Miramax), MGM (also Orion Pictures, United Artists), Disney (also 20th Century Studios, Twenty-First Century Fox, Marvel Studios, Lucasfilm, Searchlight Pictures, Regency), Universal, (Dreamworks, Focus Features), Warner Brothers, and Lionsgate as well as all of their affiliated subsidiaries that produce or distribute feature films. The data used in the analysis of this study was obtained from the Internet Movie Database (IMDB), the largest available database which documents the entire history of the film industry as well as other related contexts such as TV and video-game

production. IMDB data for feature films has been cross-validated with other sources in past studies (e.g. Cattani and Ferriani, 2008) and includes a rich set of data about each released or upcoming film project. For each variable certain data was collected from IMDB. Production credits, particularly crew members of each project were used for affiliations of individuals to projects. Nominations data for individuals were input to calculations for measuring creativity and reputation for past creative performance. Genres of each movie, also included in IMDB data, were used as input for genre dummies and specialization. Moreover, individuals' names and country of origin were used for finding their sex, using the Gender package in R, which uses the Social Security Administration data in the United States. For start year that required information from the individual' activity prior to this period, the complete range of industry data up to the date of analyzed observations was processed. On IMDB, the release date of the oldest feature film, *The Story of the Kelly Gang*, is 1906.

Network Construction

The network analyzed in this study is an affiliation network that represents the ties between two separate node sets of individuals and film projects. The network is delineated by time and place: major studio releases of the American feature film industry during 2013-2017. Each tie denotes the affiliation of one individual to one film project and corresponds to the title-individual data observations. The network is constructed based on the affiliations to film projects of core crew members who manage the creative aspects throughout a project, namely writers, directors, production designers, cinematographers, editors, and composers (Mathieu & Strandvad, 2009; Cattani & Ferriani, 2008; Caves, 2000). The data used in the analysis comprises 2021 individual-title observations, depicting the affiliations of 1206 individuals to 670 feature film projects.

Ties are represented in a two-dimensional adjacency matrix of the affiliation network, where columns represent film projects, rows represent individuals, the value of one indicates an affiliation and zero denotes none. Even though every data point can be considered as an individual-project observation that comprises data from one film title corresponding to one individual, the hypothesized selection and influence mechanisms are separately analyzed in transitions between three waves of data¹⁰. Each single wave covers three years preceding and including 2015, 2016, or 2017, respectively¹¹. Hence, for the main model, wave one covers the years 2013, 2014, and 2015, wave two covers the years 2014, 2015, and 2016, and wave three covers the years 2015, 2016, and 2017. For each three-year wave, to maintain an ongoing foundation for structural effects such as selection and influence mechanisms, only active individuals who are observed in every wave of the sample are considered. This sampling allows to control selection effects for the same individuals for whom network influences are estimated, rather than estimating selection and influence effects for different samples. Moreover, it allows the study to account for the duration that collaboration ties may remain active for exchanging of ideas, referrals, or other mid-term processes.

¹⁰ Overlapping waves are the equivalent of rolling windows in econometric studies (Shamsie, Martin, & Miller, 2009).

¹¹ A comparison model with 6-year waves is also discussed in the Robustness Test subsection of the Results section in this paper.

Measures

The (behavioral) dependent variable of the study, *Creativity* is measured for every individual based on a count measure of the number of the artistic award nominations in individual role-based categories (such as best screenplay, best film score, etc.), which critics or peers grant to film professionals for a given wave. As discussed in the previous chapters, this measure is directly in line with the conceptual definition of creativity, which relies on experts' inter-subjective assessment of novelty in production. We adhere to Cattani and Ferriani's validated list of most relevant nominations to individual creativity, which include those granted by Academy Awards, Directors Guild of America, Writers Guild of America, American Society of Cinematographers, American Cinema Editors, Golden Globes, National Board of Review, New York Film Critics Circle, and Los Angeles Film Critics Association.

Reputation for creativity was described as the demonstrated past creativity and is calculated based on total award nominations that individuals received in the (four) recent years prior to each wave. It is crucial that when several observations of each individual are aggregated, the values of the dependent variable (for example, whether an individual will be affiliated with a particular project) at a focal point in time should not be estimated based on the values of reputation in later observations. Otherwise, the dependent variable may be modeled based on values of explanatory factors that have not yet been realized, even if they occur within the same wave of data. In order to avoid linking the project affiliations with the future reputation of individuals, the values for this variable remain constant within a wave and are updated in transition periods between every two waves of data.

Specialization can be operationalized via Herfindahl–Hirschman Index (HHI), ranging from 0 (extremely diverse background in terms of genres) to 1 (extremely focused background).

Accordingly, specialization in the context of this study indicates the sum of the squared shares for every genre of a individual's activity within the initial and two immediately preceding years of a given wave. Similar to reputation, in order to avoid linking the project affiliations with the future level of individuals' specialization within the same wave, specialization is calculated based on the initial and all preceding years of each wave. Share in this HHI ratio refers to the fraction of an individual's activity in terms of the number of film titles that belong to a specific genre:

$$HHI = s_1^2 + s_2^2 + s_3^2 + \dots + s_n^2$$

where s_n is the percentage of film titles affiliated to one's professional background which are associated to genre n , expressed as a decimal number. In the case of multiple film genres, each one is weighted equally.

Control Variables. We also control for several other factors that affect individuals' selection or creativity. To account for tenure, the year in which a individual joined feature film production for the first time was captured by processing the entire range of IMDB datasets for feature films. *Start year* was entered as a control covariate since, for example, newcomers to a professional field are reported to make a better impression on evaluators compared to incumbents with the same level of creativity (Cattani & Ferriani, 2008). Start year also signifies cohort, for instance, if the selection of individuals is driven by the extent to which they entered the industry around the same time.

Sex diversity has been the source of extensive debate in innovation literature and other branches of management research. A dummy variable captures the sex of the observed individual s in this study as a constant covariate. We analyze whether individuals' sex or

average dyadic sex similarity affects the chances of project affiliation and if sex has a systematic effect on receiving a nomination.

We also control for the effect of *Genre* via a set of variables that denote the frequency of a individual 's activity within each genre. To disentangle similar specialization levels from similar specialization in terms of working in the same genre, we control for the similarity of individual's activity across Comedy, Action, and Drama as three primary genres for feature film projects.

Similarly, a set of variables capturing the frequency of a individual 's activity across *Roles* were included to control the variations of creative processes which apply to each one of the six role categories in which the individual s may have worked, namely writers, directors, production designers, cinematographers, editors, and composers. Individuals in different roles are not involved in film projects by the same frequency within a certain period. For example, directors may be affiliated with a lower number of projects as they are also involved in all stages of every project. On the other hand, production designers are more involved in the early stages of the project, while editors and composers are most active during post-production.

Analytical Approach

This study employs an analytical approach, so-called Stochastic Actor Oriented Modeling (SAOM). SAOM relies on modeling every individual action in forming, dissolving, or maintaining ties and their other behavior -such as generating novel ideas- over time. The particular method used to operationalize this approach is called SIENA (Simulation Investigation for Empirical Network Analysis), which simulates thousands of increments in individual action across multiple time windows, namely waves. The transition between each pair of successive waves is called a period. That is, changes to the network from wave-1 to

wave-2 happen during the first transitional period and from wave-2 to wave-3 during the second period. As described in the data section, this study utilizes three such waves, hence two periods, as required for modeling behavioral variables by SIENA in addition to structural changes (Snijders, 2005).

SIENA utilizes these two different periods to separate structural and behavioral mechanisms. More precisely, SIENA separates selection and social influence across two periods. In the first period, consisting of the transition between the first wave of the data to the second wave, SIENA estimates selection mechanisms based on dyad level similarities among individuals while controlling for other structural effects. The model behind this estimation is called *the selection model*. During the second period, SIENA estimates the extent of individuals' influence on each others' behavior -for example, by inspiring their peers to generate novel ideas- while controlling for selection processes that may have matched them based on similar creativity levels. The model for estimations of the second period is called *the influence model*. As a result, this method addresses selection effect as well as reverse causality between creativity and network effects as two critical biases that may characterize endogenous relationships¹². Accordingly, utilizing SIENA in this study provided a robust design for approaching the agency vs. structure dilemma, addressing whether individuals' creativity is

¹² Reverse causality is addressed since similarity effects of the lagged values for the behavioral dependent variable, namely number of nominations, is specified via the effects that involve reputation in the selection model.

merely determined by their network or that their inspirational progress affects their social network too.

Almost all organizational studies that used SIENA to this date have followed a unipartite specification, in which only one type of node exists. Benton (2016) suggests that such a unipartite approach may result in biased estimations since most organizational appointments are based on bilateral recruitment contracts (Benton, 2016). In such a reciprocal arrangement, individuals are affiliated to an organizational unit, forming two distinctive types of nodes. The current study extends Benton's (2016) formulation of organizational networks by simultaneously modeling selection and social influence mechanisms within a bipartite design suitable for applying SIENA to network organization (Powell, 1990). Furthermore, by operationalizing the concept of specialization as a concentration of an individual's background concerning types of outcome (e.g. genres, media, and styles) the current study creates a history for the behavioral mechanisms that are modeled with SIENA. By default, the influence phase of SIENA follows a method of moments approach that assumes no path dependence in the behavior of social actors (Snijders, 2005). By adding covariates that link individuals' current behavior to their background, a behavioral history is created for the study individual s.

To account for the various types of behavioral and structural mechanisms by which explanatory or control variables may change the estimation of dependent variables, researchers have developed numerous dedicated controls for SIENA, often referred to as effects. For example, the creativity of an individual (ego), a focal peer (alter), or the dyad level similarity among the two in terms of creativity drive three different mechanisms in explaining whether an individual would have a joint affiliation with a particular peer in a given project. The effects dedicated to the selection and influence models differ and are commonly known as *selection*

effects and *influence effects*, respectively. SIENA has a dedicated software package in R programming language (RSIENA), including all the available effects and specifications. We utilized RSIENA version 1.2.33 and the RSIENA manual (Ripley, Snijders, Boda, Vos, & Preciado, 2021).

Selection Effects. The control and explanatory variables were modeled via several mechanisms to estimate the formation of additional affiliation ties as a dependent variable.

Reputation similarity is operationalized by the sum of centered similarity scores between a individual 's reputation and all of his collaborators' reputation. The similarity score is a function of differences between the individual 's and pertaining alter's creativity ($|v_i - v_j|$), as well as the maximum value of these differences ($\Delta = \max_{ij} |v_i - v_j|$). Reputation similarity can be calculated as follows in an affiliation network:

$$sim_{ij}^v = \frac{\Delta - |v_i - v_j|}{\Delta}$$

Likewise, *Specialization similarity* is calculated in an identical procedure to the similarity in creativity. The only exception is that the calculations for specialization similarity are based on the difference between a individual 's and affiliated alter's specialization (rather than creativity) level in a given observation wave.

Some other effects are also included in the model to control for additional structural mechanisms. *Alter creativity* accounts for the effect of a individual 's collaborators' average creativity on the selection of that individual for an additional project. *Start year similarity*, on the other hand, would indicate individuals of the same cohort are selected for collaboration in similar projects. *Sex similarity* would reveal systematic sex homophily during recruitment for

film projects. The selection model also controls the ego effect of one's *role* category as well as *genre similarity* with collaborators for each affiliation.

Network mechanisms are also accounted for when estimating tie formation. *Four cycles* characterize referral mechanisms, in which two individuals who share a common collaborator but have not yet directly worked together may be selected for the same film project and includes the referral of two individuals by a common collaborator to each other. *Outdegree* (density) characterizes the popularity in the form of the number of projects for which an individual has been selected up to the point of observation.

Influence Effects. *Creative influence* measures the extent to which the average creativity of collaborators affects one's creativity during a wave. For example, the extent to which working with more creative collaborators inspires an individual to produce original ideas and receive additional nominations is captured via creative influence. Creative influence is calculated based on the individual's creativity multiplied by average creativity for the individual's collaborators.

Likewise, *Specialization Assimilation* measures the extent to which the average specialization level of collaborators affects one's specialization level during a wave. For example, the extent to which working with many specialists (generalists) influences an individual to develop a higher (lower) level of specialization is estimated via specialization assimilation. Specialization Assimilation is calculated based on the individual's specialization multiplied by average specialization for the individual's collaborators.

Popularity indicates a individual 's total number of collaborators for a given window, and in the context of an affiliation network, equals the total number of collaborators in all projects to which a individual is affiliated.

Alter popularity controls collaborators' popularity, defined as the average number of affiliations for a individual 's collaborators.

Procedure. Both selection and influence models of SIENA were estimated in this study, using a bimodal specification that processed ties among two sets of nodes: individual crew members and the film projects to which they were affiliated. Changes in the composition of the network across the observed waves were controlled using the method of Huisman and Snijders (2003). The extent of difference across observed network waves was assessed by both Jaccard and Hamming indices.

As previously mentioned in this paper, our SIENA design addresses selection effects and reverse causality by including ego and similarity effects of creativity in the selection model. At the same time, SIENA accounts for other mechanisms that may bias an estimation, including social influence, network-autocorrelations¹³ (Leenders, 2002) and in general, the dynamic evolution of the network.

¹³ Not to be confused with autocorrelation in conventional econometric models

It is important to note that while projects mark important observation units for tie formation, SIENA processes data based on waves. For instance, the creative influence effect compares the average creativity of collaborators for all individuals in the sample and estimates if those with collaborators who were more creative in the second wave, experience an increase (or a decrease) in their creativity between the second and third waves. Likewise, specialization assimilation estimates the increase (or decrease) in individual's specialization between the second and third waves, based on collaborator's average specialization during the second wave of simulation. Consequently, the interaction between specialization assimilation and creative influence evaluates the following: whether those whose specialization change between waves two and three to get closer to their collaborator's specialization in wave two, experience a stronger influence from their collaborator's creativity in the second wave on how their own creativity evolves between the two waves?

RESULTS

Table 1 concisely describes the three waves of data¹⁴. The results show that the network under study evolves gradually across the three waves of the data. Jaccard index of both periods remains near 0.70 for 3-year waves. The values for these indices are well above the required threshold (0.30) that is considered compatible with SIENA, suggesting optimal compatibility

¹⁴ For a discussion of six-year windows please refer to the Robustness Test subsection below.

(Snijders, et. al, 2010). The average degree of 1.27 to roughly around 1.31 suggests that most individuals participate in one project during each wave, while some take on additional projects. Similar to the Jaccard indexes for both periods of network data, degree values are highly consistent across all three waves for each sample. Given the large size of the network and limited scale of feasible affiliation ties, the average density of the network is very low, which is negligible (Ripley et. al, 2021). Moreover, average creativity remains fairly consistent across the three waves (0.14, 0.12, 0.13 for 3-year waves), suggesting that the total number of nominations has been proportional to the number of individuals included in each wave. Overall, both the network and individuals' behavior seem to evolve gradually.

Tables 1 and 2 to be inserted around here

Table-2 shows the results for SIENA models with 3-year wavelengths, split into two parts representing the results of the selection model on top (Model 1), followed by the results of the influence model (Model 2). The estimations have converged with an overall maximum convergence ratio of 0.20, which is below the required threshold of 0.25 and indicative of a good fit. Moreover, the estimation of every effect has adequately converged as all convergence ratios fall under 0.09, which is below the required threshold of 0.10. Below, we provide our key findings for selection and influence estimations in the main model (3-year wavelengths) followed by the robustness checks conducted, including a brief discussion of comparison model (6-year wavelengths).

Selection Model

As conventionally expected, the negative and highly significant coefficient of outdegree ($\beta_{\text{Outdegree}} = -4.26, p < .001$) suggests that popular individuals tend to avoid additional connections as the number of projects in which a single person can be involved is evidently

limited by that individual's available time, energy, costs and other capacities. On the contrary, referral shows a highly significant positive effect ($\beta_{\text{Four Cycles}} = 0.80, p < .001$) on adding ties among individuals. However, sex or sex similarity did not emerge as a significant predictor of project affiliation. Interestingly, tenure and other factors stemming from the start-year of individuals' careers in feature film production exhibit a substantial impact on tie formation, such that start year has a negative and significant effect ($\beta_{\text{Start Year}} = -0.02, p < .01$) and start year similarity has a positive and significant effect ($\beta_{\text{Start Year Similarity}} = 1.88, p < .05$).

As expected, individual's reputation has a (marginally) significant positive association with forming additional ties ($\beta_{\text{Reputation}} = 0.31, p < .10$). This finding suggests that individuals whose creativity has been demonstrated via nomination for distinctive awards may be more often selected for projects than their peers with no or fewer nominations. Even more so than the reputation of the focal individual itself, the average reputation of existing collaborators in every wave increases the chances of an individual to be selected for additional projects ($\beta_{\text{Reputation Alter}} = 0.67, p < .05$). Genres per se did not have a significant effect on selection, however, genre similarity for both genres of Comedy ($\beta_{\text{Comedy Similarity}} = 4.46, p < .001$) and Drama ($\beta_{\text{Drama Similarity}} = 5.62, p < .001$) has a strong positive effect on selection for projects. In addition, none of the roles showed a significant effect. Thus, role categories do not seem to play an essential part in the selection processes of our sample.

The first hypothesis of the study (H1) predicted that "collaboration is more likely among individuals with similar levels of reputation for creativity." Reputation similarity exhibited a positive effect on selection of individuals for the same project that is only (marginally) significant at a 0.1 cut off point for p-value ($\beta_{\text{Reputation Similarity}} = 5.58, p < .10$). Thus, our results provide marginal support for this relationship and the hypothesis concerning the effect of

similar reputation on common project affiliations were not completely corroborated. However, this result lends stronger support to the effect of similar reputation than findings of earlier studies that used a different sample (Ebbers & Wijnberg, 2010).

The second hypothesis (H2) of this paper predicted that “collaboration is more likely among individuals with similar specialization levels.” Similar specialization also stands out as a strong predictor of the selection model, with a highly significant positive effect that has the second-largest magnitude among all the modeled variables ($\beta_{\text{Similar Specialization}}=4.07$, $p<.001$). Consequently, the second hypothesis (H2) of the study was also confirmed showing that individuals with similar specialization levels are systematically selected as collaborators for the same project.

Influence Model

SIENA continues to control for the structural mechanisms that specify the selection model from the first period in the estimation of behavioral influence during the second period. In addition, we entered a few control variables into the influence model. According to the influence model results, neither of the added covariates seems to have direct effects on creativity. Therefore, our findings suggest that both behavioral and structural mechanisms primarily explain the evolution of professional ties and network structure rather than creativity. Both of the estimations concerning the notion of popularity resulted in insignificant effects. Individuals’ popularity ($\beta_{\text{Popularity}}= 0.21$, $p>.1$) and collaborators’ popularity ($\beta_{\text{Popularity Alter}}= 0.13$, $p>.1$) exhibited a positive but insignificant effect on their creativity. Hence, neither individual nor alter popularity seem to systematically increase the chances of demonstrating a level of creativity worth a distinctive nomination.

Creative influence, however, emerged as a strong exception among the predictors of the influence model. The third hypothesis (H3) predicted that “collaborators influence each other’s creativity, such that working with more (less) creative collaborators enhances (hampers) one’s creativity.” Creative influence shows a strong, positive, and highly significant effect on individual creativity ($\beta_{\text{Creative Influence}} = 2.52, p < .05$). This finding corroborates the third hypothesis (H3) of this study that predicted more creative collaborators inspire individuals to generate more creative ideas.

The last hypothesis of the study (H4) predicted a positive moderation effect of specialization assimilation ($\beta_{\text{Specialization Assimilation} \times \text{Creative Influence}} = 2.80, p > .1$) on the positive effect of collaborators’ creative influence on an individual’s creativity. However, the estimations regarding this hypothesis exhibited a positive but insignificant effect on their creativity. Hence, there was not enough evidence in our sample that would suggest reducing the distance among collaborators’ specialization levels would enhance their creative influence on each other.

Robustness Tests

To evaluate the effects of various mechanisms that may affect the accuracy of estimation based on the scope and structure of the network, such as inflated connectivity, increased clustering effects, and possible exchanges via old professional ties, a comparison model with 6-year wavelengths was further tested. This comparison model also allows us to observe if various other sampling consequences, such as wavelength, production timeline of movies, long-term influence of nominations on project affiliations (Kackovic et. al, 2020), or more inclusive treatment of inactive individuals make any considerable difference to the robustness of our estimations.

For six-year waves, the data used in the analysis comprises 3661 individual-title observations, depicting the affiliations of 2085 individuals to 1041 feature film projects. Table-1 includes descriptive statistics of the network constructed with 6-year windows. Average creativity was 0.16, 0.15, 0.15 for the 6-year waves, and the Jaccard index of both periods remains near 0.85 for 6-year waves. The average degree increases above 1.44 for the first two waves of the sample with 6-year windows.

The discussed results of the main model are highly robust to increasing wavelengths as increasing the wavelength from 3-year to 6-year did not produce any considerable changes that alters the conclusions. All three supported hypotheses of the study are strongly supported in the comparison model too. In the selection phase, both reputation similarity and specialization similarity maintain significance and direction, demonstrating strong positive effects on project affiliation ($\beta_{\text{Reputation similarity}}=5.99, p<.05$ and $\beta_{\text{Specialization similarity}}=4.57, p<.001$). In the influence phase, creative influence remained the dominant effect with a strong positive effect on creativity ($\beta_{\text{Creative Influence}}=2.07, p<.01$). Notably, reputation similarity has a more significant effect in the comparison model ($p<0.05$) than the main model ($p<0.10$). The significance of creative influence also slightly increases from moderate to high ($p<0.05$ to $p<0.01$) compared to the main model.. Both of the popularity effects remained insignificant in the comparison model.

Tables 3 to be inserted around here

DISCUSSION AND CONCLUSIONS

The present paper theorized and tested several hypotheses in answering whether and how professional network determines creativity (Uzzi & Spiro, 2005) and evolves as a result of creativity (Lee, 2010). Our findings suggest that creativity is both a strong antecedent and

consequence of network organization within the film industry¹⁵. Moreover, we find that in addition to their gains from a professional network, the impact of individuals on those surrounding them plays an important part in exposing the reciprocal effect of network factors and creativity. Interestingly, even though we find strong evidence for creative influence among the collaborators as well as the importance of similar creativity for the realization of collaborations, we do not find evidence of other social mechanisms, such as popularity affecting the peer assessment of one's creativity. This contrast indicate that even in absence of systematic evidence for social influences on the evaluation of novel ideas, social interactions still play a major role in determining creativity through creative influence among collaborators. As such, our findings highlight the importance of social interaction and exchanging ideas for research about creativity and innovation (Ahuja, 2000; Cattani & Ferriani, 2008; Fleming et. al, 2007; Uzzi & Spiro, 2005). Furthermore, we did not find support for an interaction between assimilation of specialization levels and creative influence in determining individual creativity. This finding could imply that there is no universal way in which similar or diverse specialization levels benefit the exchange of ideas or that each team composition in terms of specialization could be consequential depending on other configurations that were not observed in this study. Overall, the findings of this study suggest that while individuals' creativity is a function of their network, the extent to which they form a desirable network also depends on their creativity.

¹⁵ Powell (1990) provides a more in-depth overview of the differences between such network-based organization and other organizational structures.

Particularly, we find that more creative individuals receive more attractive offers to form collaboration ties that enrich their exchange of ideas and therefore enable the generation of novel ideas.

The present chapter extends the existing theories of creativity in three fundamental ways. Firstly, it addresses questions posed by earlier research on the effect of networks on innovative performance, for instance in technological contexts (Lee, 2010), examining if occupying a particular network position is not an antecedent, but a consequence of creativity. The latter possibility has its roots in the argument that individuals “with superior track records [in producing novel outcomes] are more apt to situating themselves” (Lee, 2010) at particular positions. This study explicitly separates two competing explanations for the association between network positions and creativity. One mechanism, namely creative influence, concerns the collaborators’ influence on each others’ creativity, whereas the other mechanism, so-called selection, comprises structural processes in which individuals with similar reputation based on past creative performance¹⁶ are more likely to collaborate in the same project. As a result of

¹⁶ This particular sort of reputation should be distinguished from concepts such as status. Status may result from power (Magee & Galinsky, 2008) or distinctive endorsements (such as awards for distinctive creative or cultural contributions) that follow a different process than nominations (e.g. for those awards). While nominations characterize the entire pool of legitimate candidates who qualify for competing over distinction based on adequately meeting a standard, awards concern the outcome of that competition where often a single nominee should be exemplified based on its distinction from other nominees (Zuckerman, 1999). In this sense, even though all those who offer a novel idea will likely gain a reputation for their creativity via the nominations that are recognized among peers, most of them will face a

this distinction, our findings contrast the extent of agency that individuals who excelled at creativity obtain -in the form of additional opportunities to benefit from more creative collaborators- with the degree to which the structure of their professional network determines their creativity.

Secondly, the discussed approach to creative influence contributes to the emerging research on network externalities or the extent to which network positions can also have secondary effects on those in the vicinity, in addition to the occupying persons (Galunic et. al, 2012). While various network studies explain how particular social positions benefit the performance of the occupying individual, little is known about how individuals affect each other in a network. Early studies suggest the presence of both negative and positive influences on alter performance (Burt, 2007, 2010; Fernandez-Mateo, 2007; Galunic et. al, , 2012). For example, a recent study finds that individuals in a particular type of brokerage position reduce the efficiency of their neighbors as a result of extending themselves over many projects, whereas other neighbors whose role emphasizes creativity may still benefit (Clement et. al, 2018). This paper revisits the assumptions of network externalities in the context of creativity, addressing whether individuals who collaborate in the same project generally influence each other's creativity and find that working with more (less) creative collaborators elevates

substantial difference in status with the awarded nominee, even if the award has been symbolically bestowed upon one despite a nearly equal competition among all nominees.

(hampers) one's creativity. These findings offer another fundamental implication for studies of creativity by clarifying the extent and direction to which collaborators' creative influence determines creativity.

To this end, the study further refines the collaborators' influence by empirically disentangling creative influence from other ways in which individuals influence each other's creativity. According to the theoretical discussion of this chapter, creative influence occurs when interaction with collaborators inspires an individual to generate more novel ideas. Regardless of creative influence, however, the social structure of collaborations may still affect the level of creativity associated with an individual in other ways. One fundamental competing mechanism to creative influence is the effect of popularity among peers in terms of having collaborated with many others in the same field. This paper controls for the effect of popularity to examine if peers may overlook highly novel ideas (as well as limitations in the work) of less popular individuals during idea evaluation (Cattani & Ferriani, 2008; Perry-Smith & Mannucci, 2017), so that a popular individual may take more credit for their creative ideas or additional discredit for replicating existing ideas and standards. These evaluation processes are integral to the concept of creativity: while novelty sets creativity apart from other dimensions of performance such as quality or efficiency (Clement et al., 2018), no outcome can be regarded as creative unless its novel value is recognized by knowledgeable audience (Loewenstein & Mueller, 2016), such as experts (Uzzi & Spiro, 2005) or peers (Cattani & Ferriani, 2008). Even though some studies of creativity offer rare theoretical insights into both creative influence and popularity mechanisms (e.g. Cattani & Ferriani, 2008), none has yet systematically disentangled the two. The current study presents the first empirical test that distinguishes between popularity effect and creative influence in the context of creativity and operationalizes each of these two mechanisms separately. Hence, this study further refines our understanding

of creative influence within collaborations by empirically disentangling the highly creative collaborators' role in influencing each other to produce novelty vs the effects of popularity, such as the amount of attention that one's novel ideas may receive due to popularity among collaborators.

Finally, the present chapter contributes to the existing knowledge of tie formation by further clarifying the role of agency in professional collaborations within creative contexts. In particular, the study reveals that highly creative individuals may face opportunities to collaborate with more creative peers, but forming such collaboration ties is also contingent upon similarity in specialization levels among the collaborators. This finding expands the existing knowledge about tie formation, which had only examined individual level specialization (Zuckerman et. al, 2003) rather than dyadic similarities. In doing so, the role of project affiliations in the similarity selection of individuals to become collaborators is emphasized and empirically tested via a bipartite network. Moreover, this chapter probes further into creative influence via dyad level configurations of specialization in order to examine developing similar specialization levels increases the creative influence of two creative individuals on each other. This configurational argument, however, was not supported in the context of the study.

Future research should interpret these results with caution as the film industry that was the empirical context of the present study is a pure example of network organization characterized by high levels of mobility and creative freedom (Powell, 1990). It should be noted that this study assumes individuals in creative roles are recruited by other parties who represent the commercial aspects of projects, such as producers. Therefore, the individuals discussed in our hypotheses do not have absolute freedom in joining any project they desire, but have agency in accepting or declining a recruitment offer as these offers are not coerced. Naturally, the extent

of their agency increases as a result of receiving more recruitment offers from project representatives that allows (or binds) them to turn down some offers in favor of other offers. Such circumstances are not different from prior studies that examine individuals' agency in shaping their network, such as network of inventors who are hired by companies (Lee, 2010). Moreover, we find that although similar creativity is a primary precondition for joint affiliation among collaborators, other mechanisms, such as similarity in specialization or genre homophily also pose important conditions for a collaboration to be realized. Furthermore, we did not find a systematic sex bias in the selection or idea evaluation mechanisms for crew members of film projects. However, we find that the year in which they enter the industry is a critical exogenous factor in determining professional affiliations, but not creativity. Moreover, we only looked into the affiliations of individuals with primary creative roles in projects, and more particularly, those who have been active across all waves of data. For our comparison model with six-year wavelengths, this particular focus leaves out only rare cases of individuals who were last observed in 2010 but stopped working or had a six-year gap until subsequent observation out of our sample¹⁷. However, our results remain the same despite excluding additional inactive individuals in our main model with three-year wavelengths. Overall, these results were robust against controlling for changes in network composition or wavelength.

¹⁷ individuals who worked between 2012-2015 are not filtered in this way as a result of the overlap between the data waves

Future research can build on our findings by extending the research design of the present study into the project level. While this study suggests that creative collaborators can elevate each other's creativity, and even though their creativity is the primary factor behind the novelty of the ultimate outcome (Cattani & Ferriani, 2008; Caves, 2003; Clement et. al, 2018), further research should reveal the other influences that mediate or moderate the novelty of input provided by collaborators. This objective can be achieved via further specifying project nodes in the bimodal approach of the present paper into analyzing network and behavioral evolution. Moreover, the primary focus of the study was on novelty and creativity, whereas sustaining creative endeavors rely on a functional commercial ecosystem in most creative contexts. Future research can make use of the research design provided in this study to address alternative behavioral dependent variables, such as the commercial success of the individuals. Furthermore, it is critical to assess the type of influence that individuals in creative and commercial roles have on each other (Clement et. al, 2018), as these roles follow different priorities that sometimes contradict each other. Moreover, in order to better expose the reciprocity in the effect of networks on creativity and vice versa, future research should pay attention to the impact of individuals on those surrounding them in addition to their gains from a professional network.

APPENDIX: TABLES

Table 1 - Descriptive Statistics

Sample with Three Year Waves			
	Wave-1	Wave-2	Wave-3
Density	<i>0.003</i>	<i>0.003</i>	<i>0.003</i>
Average degree	<i>1.308</i>	<i>1.315</i>	<i>1.273</i>
Number of ties	<i>930</i>	<i>935</i>	<i>905</i>
Average Creativity	<i>0.143</i>	<i>0.118</i>	<i>0.128</i>
	Distance	Jaccard	Missing
First Period	<i>305</i>	<i>0.719</i>	<i>0 (0%)</i>
Second Period	<i>336</i>	<i>0.691</i>	<i>0 (0%)</i>
<i>The total average degree is 1.299.</i>			
<i>The total average creativity is 0.13.</i>			
Sample with Six Year Waves			
	Wave-1	Wave-2	Wave-3
Density	<i>0.001</i>	<i>0.001</i>	<i>0.001</i>
Average degree	<i>1.440</i>	<i>1.442</i>	<i>1.429</i>
Number of ties	<i>3146</i>	<i>3151</i>	<i>3123</i>
Average Creativity	<i>0.163</i>	<i>0.152</i>	<i>0.151</i>
	Distance	Jaccard	Missing
First Period	<i>529</i>	<i>0.845</i>	<i>0 (0%)</i>
Second Period	<i>524</i>	<i>0.846</i>	<i>0 (0%)</i>
<i>The total average degree is 1.437.</i>			
<i>The total average creativity is 0.156.</i>			

Table2 - Estimations of Main Model

Effect	par.	(s.e.)	t stat.
Selection Effects (Model 1)			
constant rate (period 1)	0.488	(0.031)	.
constant rate (period 2)	0.546	(0.034)	.
Outdegree	-4.258***	(0.386)	-11.031
Four Cycles	0.799***	(0.142)	5.628
Start-year	-0.016**	(0.005)	-3.415
Start-year similarity	1.881*	(0.651)	2.888
Sex	0.371	(0.423)	0.878
Sex similarity	-0.097	(0.477)	-0.204
Reputation	0.312†	(0.184)	1.700
Reputation alter	0.666*	(0.276)	2.416
Reputation similarity	5.579†	(2.956)	1.887
Specialization similarity	4.070***	(0.959)	4.242
Comedy similarity	4.457***	(0.705)	6.318
Drama similarity	5.622***	(0.835)	6.736
Genres	<i>Included but not significant</i>		
Roles	<i>Included but not significant</i>		
Influence Effects (Model 2)			
rate (period 1)	0.645	(0.131)	.
rate (period 2)	0.864	(0.179)	.
Creativity linear shape	-5.949**	(1.949)	-3.052
Creativity quadratic shape	0.639	(0.398)	1.605
Popularity	0.214	(0.590)	0.363
Popularity alter	0.127	(0.116)	1.093
Creative Influence	2.517*	(1.232)	2.042
Start-Year	0.018	(0.030)	0.608
Gender	0.394	(1.507)	0.261
Specialization assimilation x Creative influence	2.800	(2.486)	1.126

† $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$;

All convergence t ratios < 0.09.

Overall maximum convergence ratio 0.20.

Table 3 - Estimations of Comparison Model (6-Year Windows)

Effect	par.	(s.e.)	t stat.
Selection Effects (Model 1)			
constant rate (period 1)	0.476	(0.030)	.
constant rate (period 2)	0.531	(0.031)	.
Outdegree	-3.445***	(0.349)	-9.875
Four Cycles	0.911***	(0.150)	6.084
Start-year	-0.013**	(0.004)	-3.167
Start-year similarity	1.590**	(0.617)	2.580
Sex	0.124	(0.410)	0.304
Sex similarity	0.051	(0.478)	0.106
Reputation	0.329*	(0.150)	2.197
Reputation alter	0.590**	(0.220)	2.682
Reputation similarity	5.986*	(2.412)	2.482
Specialization similarity	4.568***	(0.943)	4.844
Comedy	-0.169*	(0.078)	-2.172
Influence Effects (Model 2)			
rate (period 1)	0.678	(0.166)	.
rate (period 2)	0.893	(0.156)	.
Creativity linear shape	-4.715**	(1.474)	-3.198
Creativity quadratic shape	0.164	(0.140)	1.170
Popularity	-0.029	(0.693)	-0.042
Popularity alter	0.140	(0.126)	1.110
Creative Influence	2.073**	(0.663)	3.128
Start-Year	0.011	(0.026)	0.417
Gender	0.101	(1.146)	0.088
Specialization assimilation x Creative influence	5.164	(6.049)	0.854

† $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$;

All convergence t ratios < 0.09 .

Overall maximum convergence ratio 0.15.

CONCLUSION

This dissertation addressed a broad question about creativity: *“how do structural and individual-level factors jointly determine creativity?”*. This question was approached in three separate studies that provided answers to related questions. Chapter one examined “how do an individual’s specialization and expertise affect the processing of input that they directly receive from their collaborators?”. To answer this question, the first chapter introduced a socio-psychological approach that synthesizes structural and individual level explanations of creativity. Particularly, this chapter introduced a configurational approach that suggests structural factors are associated with opportunities to produce novel outcomes whereas individuals’ professional background determines their motivation and ability to take advantage of the opportunities. Following its socio-psychological approach, the first chapter contributed a configurational framework for studying the interplay of collaboration structure in relation to two primary dimensions of professional background, namely specialization and expertise. Specialization in outcome types -such as genres- determines individuals’ inclination to thoroughly navigate their opportunities for accessing diverse or new input, while expertise concerning roles in collaboration defines individuals’ ability to take advantage of these opportunities. Furthermore, disentangling these two dimensions of professional background revealed that while for low levels of specialization and high levels of expertise, brokerage benefits creativity, highly specialized individuals and those with diverse expertise in multiple roles exhibit lower creativity when they possess a brokerage position. This finding informs both creativity and brokerage literatures by indicating separate career trajectories in terms of developing specialization and expertise that benefit the creativity of brokers versus other individuals.

The socio-psychological approach provided in this chapter, that links structural and individual factors to opportunity, motivation, and ability, can be utilized in unfolding the nuances of additional network effects beyond brokerage and their interaction with individual level factors. As discussed in this chapter, psychology, organizational behavior, and sociology provide a diverse range of factors that affect creativity. However, without understanding the configurations that apply to these effects, the same factor that only benefits one group of individuals but hampers others may be presumed to be universally beneficial or harmful for creativity. Using a configurational approach would clarify which group of individuals can benefit from each of the factors that have been associated with creativity, as this chapter illustrated how brokerage benefits one group of individuals and limits others, depending on their professional backgrounds. Moreover, future research can apply this framework to other consequences of brokerage. For instance, recent research suggests that the same network positions may have different consequences for creativity and other dimensions of performance, such as commercial success-- as hubs who occupy positions in between communities in a network benefit their collaborators in creative roles and hamper the performance of collaborators in efficiency-based roles (Clement, Shipilov, & Galunic, 2018). Further research is needed to explore whether the interplay of specialization and expertise with brokerage have implications for commercial success too and whether the predictors of creativity and efficiency remain contradictory for all groups of individuals if they are grouped based on their expertise and specialization.

Chapter two explains “how does the processing of input from outside one’s professional field differ from input that collaborators exchange within the same field?”. Earlier research suggests that input that is exchanged within networks can be redundant or diverse (Ter Wal, Alexy, Block, & Sandner, 2016). However, the sorts of diversity that may exist within a network

have remained largely overlooked. The second chapter contributes to diverse networks literature by disentangling two sorts of input. Internal input that is sourced from the existing exchanges within a field, and external input, that is adopted from sources outside that field. Subsequently, this chapter illustrates the difference between the creative processes that involve internal and external input. Particularly, while generating novel outcomes from diverse internal input requires attention to a broad range of genres that is often associated with generalist (rather than specialists), fresh external input demands the understanding of various roles that is best utilized by those who benefit from a diverse expertise, even though they have a lower level of expertise in each of their multiple roles. Accordingly, this chapter separates the role of ego and whole-network mechanisms that correspond respectively to internal and external sources of input. Following this approach the second chapter contributed to research on network studies of creativity by revealing configurations that specialization and expertise impose on the effect of coreness, a primary whole network factor in determining creativity (Cattani & Ferriani, 2008). These configurations affect the balance of competing mechanisms that result in the overall inverted-U shaped effect of coreness on creativity and turn it to one primary (dis)advantage, depending on one's expertise and specialization.

Future research can further expand on the differences between external and internal input by exploring, for example, what other processes are necessary for external input to become a source of breakthroughs that emanate many novel ideas. Importing input from another professional field into one's own is a fundamental way of increasing the input diversity for both the adopting individual and entire field (Cattani & Ferriani, 2008; Fleming, 2007). However, while there is some knowledge in the existing literature about cross-disciplinary work that inspires breakthrough innovations, further research is necessary for clarifying the constraints and contingencies that characterize multidisciplinary endeavors. In general, breakthroughs

seem to result from highly creative processes that evade systematic and predictable decision-making (Fleming, 2007). However, identifying the interplay of the structural and behavioral factors that explain breakthroughs would be a step forward towards understanding processes that drive or constrain breakthrough innovations. In this chapter, we address network and individual-level factors that enrich the flow of idea exchanging within a professional field by integrating external input into its creative processes. Future research can tap into additional influences that make some imported input more likely to diffuse in the network and spread many novel ideas, such as prolific patents in terms of citations. In doing so, future research can also clarify the boundaries our framework in dealing with feasibility criteria that go beyond intersubjective evaluation by peers, such as in technological contexts where an invention should initially qualify based on objective functionality, before reaching the stage of evaluation by peers or experts.

Chapter three examined “whether and how individual-level factors such as creativity and specialization affect the network drivers of creativity?” as well as “how do individuals influence each other’s creativity during collaboration?”. These fundamental questions tease out some of the assumptions behind the theoretical contention in previous chapters. At the most profound level, this chapter contributes to studies of idea generation and creativity by clarifying that the individual level factors discussed in this dissertation, such as creativity and specialization, are both outcomes as well as predictors of network effects. These findings resolve the ambiguities in prior research about whether networks affect creativity or vice versa (Lee, 2010). Particularly, our findings suggest that even though similarity in individual level factors, such as specialization or reputation for creativity, affect the selection of individuals into projects and therefore the structure of their collaboration network, social interactions that are conducted within that network remain a strong predictor of creativity, specifically through the

creative influence of collaborators on each other. In doing so, the study underscores the importance of collaboration ties, suggesting one fundamental form of exchanging ideas occur as collaborators build upon the outcome of each other's work, as the intermediate outcomes produced at different stages of a creative project materialize the ideas of various collaborator and guide them towards producing the end product. Moreover, the findings of chapter three extend the literature on network externalities by showing that dyad level influences on creative performance are not limited to a particular position (such as brokerage or a hub) and are generally present in a collaboration network. In addition, this chapter extends current knowledge of tie formation in creative contexts by addressing a substantial selection effect based on similar specialization levels.

Future studies can expand the application of the bimodal research design this chapter introduced to also capture the evolution of creativity at the project level. This study focused on dyad level influences between collaborators and it remained unclear how and to what extent collaborators' creative influence would affect the novelty of the project level outcome rather than each individual's creativity. While dyad level interdependencies among collaborators are major influences that affect project level creativity, various project level dynamics such as power structure or coordination processes across the various stages of the project interact with these dyad level influences in producing a novel product. Likewise, the company level strategy in launching or monitoring projects (such as in studios giving the greenlight to plots and ideas during pitch meetings or preproduction) can have substantial implications for the creative processes conducted within projects. Even though the third chapter focused on dyad level influences between collaborators, it introduced a bipartite research design that allows for simultaneously modeling the coevolution of structure and creativity in networks with multiple node sets. Future research can advance the application of this design to explore the influences

between projects and individual or studios as different nodesets in the network. Moreover, the dyad level influences of expertise on selection processes remain for future studies to explore. Given that projects usually involve individuals in different roles, future research can explore, for example, whether projects aimed at breakthrough innovation are more likely to hire individuals who each have versatile expertise in different roles or recruit a diverse team in terms of expertise levels.

In summary, the present dissertation addressed various facets of idea generation, using an overarching, socio-psychological approach that allows for capturing the interplay of several factors that determine creativity. Following its socio-psychological approach, this dissertation provided several contributions to network studies and the literature on idea generation. Firstly, this dissertation introduced a configurational framework that situates structural and behavioral factors based on individuals' opportunity to access diverse input through their structural positions as well as motivation to navigate and ability to integrate this input that demand individuals' specialization and expertise, respectively. Secondly, this research extended network studies of idea generation by distinguishing between overlooked types of diversity in input that determine the primary network mechanisms and facets of individual background for generating novel ideas. More precisely, individuals rely on their specialization and direct ties to navigate diverse input that is commonly exchanged among collaborators within their professional field, while they use their social position within the entire collaboration network and heavily rely on their expertise to incorporate input from another field. Thirdly, this dissertation informs network studies by suggesting that specialization and expertise strongly alter the effect of popular network constructs, such as brokerage and coreness, to the extent that the same position that benefits some individuals can hinder others' creativity, depending on the occupant's specialization and expertise levels. Fourthly, this research finds that while network

mechanisms drive creativity, individuals' reputation for their past creative performance as well as specialization are primary factors in shaping their network, hence structural influences and moderate levels of individual agency can coexist in a creative context. Finally, this dissertation confirms that social interactions and exchange of ideas within networks, especially collaborators' creative influence on each other, remains as a fundamental driver of creativity, even after controlling for past creative success or other attributes that affect tie formation.

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This dissertation explores the interplay of individuals' specialization, expertise, and position within the collaboration network in determining creativity. In this regard, each of the three chapters that constitute this dissertation provides a key finding. The first chapter reveals that the same network position can enhance or hamper an individual's creativity, depending on that individual's specialization and expertise. The second chapter provides different configurations of specialization, expertise, and network positions that enable the processes of importing new ideas from another field, rather than recombining ideas existing within the same professional field. The third chapter demonstrates that the exchange of ideas through social interaction, especially in the form of collaborators' creative influence on each other, remains to be a fundamental driver of creativity even after accounting for factors that shape the collaboration network, such as similar reputation or past creative success among collaborators.

Following his BSc in Industrial Engineering and Systems Analysis, Joobin Ordoobody (1987) earned a Master of Business Administration degree from the University of Tehran and a Research Master's (RM) degree in Strategy and Organization from Tilburg University. Prior to his RM, Joobin also completed two years of doctoral studies in International Business and Organization at the University of Victoria, Canada.

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