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Movement-Based Influence: Resource Mobilization, Intense Interaction, and the Rise of Modernist Architecture

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We argue that the long-term influence of actors in fields of cultural production depends on the opportunities for resource mobilization offered by external conditions combined with intense interaction among actors. Using a unique data set of 1,143 architects active between 1890 and 1940, at a time of large-scale socioeconomic transformations and political disruption, we find by multiple regression analysis that exposure to industrialization and political upheaval, and halo effects in an architect's network of collaborators predict greater ultimate impact, while urbanization and professional affiliations do not. Theory of social movements and theory of cultural production thus have important implications for each other.

KEYWORDS: architecture, halo effect; cultural production; networks, professions; social movements.

INTRODUCTION

The sociology of cultural production has deployed resource mobilization theory (McAdam, McCarthy, and Zald 1996; Meyer and Staggenborg 1996) to examine the extent to which artistic movements become influential across space and time. Cultural entrepreneurs face a certain opportunity set that they only exploit if they can generate a shared understanding of the situation, develop a strategy for action, and mobilize resources from key sponsors and organizations (DiMaggio 1982; Jasper 1997).

Jasper (1997) proposed that social movements involve resources, strategy, biography, and culture. Resources include material and intangible support, which in cultural production fields typically come from Maecenas or the state. Strategies are the "choices made by individuals and organizations in their interactions with other players, especially opponents" (Jasper 1997:44). Biography and culture refer to the characteristics of individual participants in the movement and "shared understandings (emotional, moral and cognitive)" (Jasper 1997:44).

In the case of cultural production, finding common cause with other actors and mobilizing resources often takes the form of establishing ties of apprenticeship and collaboration. These ties can be of two kinds. The first involve vertical, intergenerational connections from eminent teachers or mentors to eminent students or protégés, which scholars have documented in fields such as science (Zuckerman 1967), classical music (DeNora 1991), and architecture (Guillén 2006). The second is a horizontal web of close contacts among individuals of the same generation,

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both before they have done their main creative *work* and after becoming prominent in the form of collaborations as exemplified by painters (White 1993; White and White 1965), artists (Anheier, Gerhards, and Romo 1995), poets and novelists (Cheever 2006; Farrell 2001; Watson 1991), Hollywood actors and film producers (Allen and Lincoln 2004; Rossman, Esparza, and Bonacich 2010), and singers, composers, librettists, and set designers (Johnson 2008).

In this article, we provide a quantitative analysis of the case of architecture during a crucial period of large-scale socioeconomic transformations and political disruption stretching from 1890 to 1940. This period coincides with the spread of the Industrial Revolution across Europe, East Asia, and the Americas, with the growth of cities, and with major political discontinuities. These changes disrupted the established order in the field of architecture, thus offering new opportunities for actors to exploit.

INFLUENCE IN CULTURAL PRODUCTION FIELDS

Our aim is to explain which actors in a cultural production field become more influential or impactful. Based on the sociology of social movements and the sociology of symbolic micro-interaction, we argue that the main mechanism allowing for the discovery of new opportunities and the mobilization of resources are the intense interaction rituals among cultural producers (Collins 2004). Overthrowing an established approach to cultural production requires more than the activities of one or a few individuals. Fields are resistant to change (Emirbayer and Johnson 2008), and it typically takes much more than geniuses to shift them in a different direction.

Intense patterns of interaction among individuals enable them to arrive at a shared definition of the problems and the opportunities facing them, and to gain confidence and initiative to launch a different approach, to organize a social movement focused on achieving change (McAdam et al. 1996; Meyer and Staggenborg 1996; Zald and Useem 1987). Social movements are "conscious strategic efforts by groups of people to fashion shared understandings of the world and of themselves that legitimate and motivate collective action" (McAdam et al. 1996:6). We argue that in cultural fields, such shared understandings and collective motivations are developed through strong ties among actors who work closely together before propagating their new style elsewhere. These connections help arrive at collective understandings in the midst of transformations such as industrialization, urbanization, or political upheavals. Typically, change within cultural fields occurs as a separate "segment" or "faction" emerges, one with a distinctive sense of mission and an innovative methodological and technical approach (Bucher and Strauss 1961; Frickel and Gross 2005; Rao, Monin, and Durand 2003). The interactions within the rising faction, and between the movement and any countermovements (Meyer and Staggenborg 1996), contribute to the formation of groupings of artists, which in turn create reputations, channel resources (both material and symbolic), and expand them vertically from one generation to another and horizontally through clusters of peers.

In fields of cultural production, actors do not tend to attain much recognition and exert influence unless they contribute to the transformation of their field—that is, unless they develop a new approach, model, template, or style that goes beyond, or even supplants, the established cultural order. This pattern has been documented for philosophers (Collins 1998), architects (Benevolo 1977 [1960]; Jencks 1973), and painters (White and White 1965), among others. We argue that contextual factors and social interaction enable actors in a field of cultural production to become "cultural entrepreneurs" (DiMaggio 1982), amassing enough resources to break with the prevailing order and make unique, path-breaking contributions that are eventually rewarded with greater recognition or influence, though not mainly, or necessarily, during their lifetime.

Although we draw illustrative examples from various fields of cultural production, our theoretical and quantitative empirical focus is on the social transformation of the field of architecture that ultimately became known as the modernist movement. A famous definition of modernist architecture highlights three main aspects: "Emphasis upon volume—space enclosed by thin planes or surfaces as opposed to the suggestion of mass and solidity; regularity as opposed to symmetry or other kinds of obvious balance; and, lastly, dependence on the intrinsic elegance of materials, technical perfection, and fine proportions, as opposed to applied ornament" (Barr 1995:29). The modernist architects reacted against the imitation of the classical canons and rejected the principles of perspective and proportion, the insistence on symmetry, and the pervasive use of ornament. As predicted by resource mobilization (Frickel and Gross 2005) and professionalization (Abbott 1988) theories, the modernists sought to attract resources to their cause.

The modernist architects faced an uphill battle: an entrenched Beaux arts elite controlling the most prestigious architectural institutions in each country, and a rampant eclecticism in practical design that they equated with bad taste. They used gaudy and incisive rhetoric as a weapon to shake the foundations of the established institutions. They launched myriad competing movements, taking advantage of large-scale economic, social, and political transformations. They collaborated among themselves and sought to reform architectural education, basing it on engineering rather than the fine arts. In the sections that follow, we examine each of the factors that shaped the ultimate impact attained by individual architects, including industrialization, urbanization, political upheaval, halo effects through apprenticeship and collaboration, and an engineering education as opposed to one rooted in the Beaux arts. We begin with conditions in the external environment (industrialization, urbanization, political upheaval) and move on to internal conditions specific to architects' careers (collaboration, engineering education).

Industrialization as an Opportunity to Innovate

Sociological theories of change in intellectual fields highlight the importance of the opportunity structure facing actors (Jasper 1997; McAdam et al. 1996). Previous scholarship on modernist architecture highlights industrialization as the

fundamental ideological and practical development (Banham 1980 [1960]; Frampton 1992 [1980]; Giedion 1982 [1941]; Hitchcock 1971 [1958]). The brave new world of machines provided architects with the imagery and the narrative to innovate. It also offered new materials such as steel, glass, and cement; new techniques; and new transportation technologies. Modernism in architecture borrowed from manufacturing a method-driven, standardized, and planned approach to design and the organization of space. An early modernist architect, Peter Behrens, was appointed in 1907 by AEG, one of the world's largest electrical firms at the time, as its chief architect and designer. He promised to work toward the "most intimate union possible between art and industry" (Buddensieg 1984:207–208, 213, 219).

Similarly, Le Corbusier, the famous Swiss-French architect, argued that "in order to BUILD: STANDARDIZE to be able to INDUSTRIALIZE AND TAYLORIZE." "A house is a machine for living in.... An armchair is a machine for sitting in, and so on." Le Corbusier longed for a "'House-Machine,' the mass-production house, healthy... and beautiful in the same way that the working tools and instruments which accompany our existence are beautiful." As a source of aesthetic inspiration, the machine was a "factor of economy, which makes for selection," thus promoting good taste by overcoming the eclecticism of the traditional architectural styles (Le Corbusier 1986 [1923]:1, 4, 19, 95; capitals in the original). Bauhaus founder Walter Gropius argued that "the Bauhaus believes the machine to be our modern medium of design," and that "we want an architecture adapted to our world of machines, radios and fast cars..." (quoted in Curtis 1996 [1982]:193–194). The German expressionist architect Erich Mendelsohn agreed: "The machine, till now the pliable tool of lifeless exploitation, has become the constructive element of a new, living organism" (quoted in Curtis 1996 [1982]:187). In Brazil, Gregori Warchavchik echoed the desire for an industrialized architecture: "If we observe the machines of our times: motor cars, steamers, locomotives, etc., we find in them, along with rationality of construction, a beauty of forms and line.... A house is a machine the technical perfection of which ensures, for instance, a rational distribution of light, heat, cold and hot water, etc...." (quoted in Guillén 2006:99).

Industrial methods and industrial materials enabled the modernist architects to pursue a new concept. In a 1910 memorandum to AEG's top management, Gropius wrote, "To implement the concept of the industrialization of house construction, the company will repeat individual components in all of its designs and hence facilitate mass production, promising low costs and easy rentability [i.e., profitability]" (quoted in Wingler 1969:20). For his part, Ludwig Mies van der Rohe (1971 [1924]:82) wrote about "Industrialized Building," arguing that "industrial production of all the parts can really be rationalized only in the course of the manufacturing process, and work on the site can be entirely a matter of assembly." Gropius and Le Corbusier, among others, proposed to make houses "by machine tools in a factory, assembled as Ford assembles cars" (Banham 1980 [1960]:222). "Building norms and construction times must be worked out, so that building can be transferred to mass-production factories and houses ordered from a catalogue," argued El Lissitzky, the Russian architect (quoted in Lissitzky-Küppers 1967:374). And Lúcio Costa, author of the master plan for the new city of Brasília, argued that "it is vital that industry supports construction, producing, conveniently, all those

elements that it requires, with the same degree of perfection that the coachwork of automobiles shows" (quoted in Deckker 2001:17).

Industrial efficiency mesmerized the modernist architects. "Maximum efficiency and minimum effort," cried the Mexican architect Juan O'Gorman, adding that "a house... will be a tool, just as the automobile is becoming a tool" (quoted in Burian 1997:129). "Maximum comfort for minimum cost," demanded Warchavchik (quoted in Luna Arroyo 1973:271; Fraser 2000:47, 165); "the office building is a house of work, of organization, of clarity, of economy. Bright, wide workrooms, easy to oversee, undivided except as the organism of the undertaking is divided. The maximum effect with the minimum expenditure of means," declared Mies van der Rohe (1971 [1923]:74). "The Futurist house must be like a gigantic machine," declared an Italian architect (Sant'Elia 1973 [1914]:170).

The world of factories and machines not only provided the modernist architects with rhetorical ammunition, methods, and techniques, as predicted by sociological analyses of artistic movements (DiMaggio 1982; Jasper 1997); it also offered lucrative commissions. Companies such as AEG and Siemens in Germany, Renault and Aeroplanes Voisin in France, FIAT and Olivetti in Italy, or the Companhia Constructora de Santos in Brazil, to name but a few, hired the most prominent architects of the time, giving them the resources to experiment with new designs. But most importantly, these connections to industry and the above quotes from the architects' writings suggest that industrialization created a "shared understanding" and a new identity among architects willing to subvert the established order (McAdam et al. 1996; Rao et al. 2003), and invited them to innovate (DiMaggio 1982). In light of the manifold effects of industry on the transformation of architecture at the turn of the twentieth century and beyond, we expect that

> *Hypothesis 1:* The greater the exposure of an architect to industrialization, the greater his or her ultimate impact on the field.

Urbanization and Squalor

During the nineteenth century, the growth of the economy and the division of labor greatly accelerated the growth of cities. Urban areas became service and manufacturing hubs, with millions migrating from small villages hoping to find a better life or being driven out of the land by improvements in technology and changes in ownership. By the turn of the twentieth century, many parts of the largest cities had become chaotic, polluted, and unpleasant, a situation that drew the attention of the order-loving and technocratic modernist architects. As with industrialization, unfettered urban growth created a shared understanding among the modernist architects (McAdam et al. 1996).

Perhaps the earliest example of the modernist dream of a well-planned, efficient metropolis was Tony Garnier's Industrial City, originally formulated as an idea in 1904 but not published until 1918. It was partly put into practice with the large-scale public works at Lyon, France's second largest city, between 1904 and 1914 (Banham 1980 [1960]:35–43). The Italian Futurists were also among the first to

formulate a plan to address the problem of urban squalor. "We must invent and rebuild ex novo our modern city like an immense and tumultuous shipyard, active, mobile, and everywhere dynamic, and the modern building like a gigantic machine," Antonio Sant'Elia wrote in his *Messagio* or manifesto of 1914 (quoted in Curtis 1996 [1982]:109). The Italian rationalist architects were interested in low-cost housing, urban planning, prefabricated construction, and factory architecture (Etlin 1991:226–229, 239). Mies van der Rohe's apartment building at the Weissenhofsiedlung housing project outside of Stuttgart (1927) became the model for other worker housing projects throughout the world.

From Russia to Germany, Spain, and Brazil, the modernist architects sought to improve life in the city. They engaged in large-scale urban planning all the way down to organizing life inside the home. At the International Congress for Modern Architecture of 1928, Gropius and Le Corbusier presented papers discussing how to use time and motion study to arrive at the so-called minimum existence housing unit—that is, the smallest possible apartment that an average family could comfortably inhabit (Mumford 2000:30). Similar proposals were put forward by Moisei Ginzburg in the Soviet Union and by the Italian rationalist architects (Etlin 1991:227–228; Kopp 1985:64). The Mexican government organized in 1932 a competition for the "minimum worker's house" (Fraser 2000:53). Their focus on improving the lives of city dwellers enabled them to create a faction or segment with a view to taking over the entire field (Frickel and Gross 2005; Rao et al. 2003). Given the modernist architects' emphasis on redesigning cities to make them more orderly and efficient, we predict that

> *Hypothesis 2:* The greater the exposure of an architect to urbanization, the greater his or her ultimate impact on the field.

Political Upheaval as an Opportunity to Break With the Past

In the wake of industrialization and urbanization, the turn of the twentieth century brought large-scale sociopolitical transformations, including episodes of acute social and political convulsion, coups d'état, wars, revolutions, counter-revolutions, and the rise of totalitarian regimes. These events provided architects with an opportunity to upend the established professional order, make new proposals, and obtain resources from new regimes striving to gain legitimacy through public works. For instance, Germany experienced military defeat, revolution, counter-revolution, and monetary and economic crises, a level of commotion and change that allowed artists to challenge traditional conceptions and practices (Herf 1984). Thus, political upheaval changed the opportunity set in favor of the architects seeking a transformation of the field (DiMaggio 1982; Jasper 1997; McAdam et al. 1996). For instance, Gropius argued in March 1919, one month before the founding of the Bauhaus, that "political revolution must be used to liberate art from decades of regimentation" (quoted in Hochman 1989:49). In spite of being part of the winning coalition in World War I, Italy was also reaching a critical juncture in the late 1910s. The fascist March on Rome in 1922 provided the Italian avant-garde

architects with a chance to influence industry, politics, and official artistic policies (Bowler 1991).

In the Soviet Union, the October Revolution removed the entrenched traditional power structures in the arts that were preventing a variety of avant-garde movements from flourishing. Revolution and civil war offered architects and other artists an exposure to revolutionary ideology as well as experience in political agitation and in the management of artistic enterprises (Lodder 1983). In Germany, Russia, and Italy, political turmoil created ample opportunities for the renewal of architectural teaching and practice, as predicted by theories of social movements emphasizing the importance of the structure of political opportunities and constraints for the emergence of collective action (McAdam et al. 1996). A similar dynamic occurred in Mexico in the wake of the 1910–1917 revolution, and in Brazil under President Getúlio Vargas's "New State" (Guillén 2006). Given the opportunities that political upheaval created for the inception of a new approach to architecture, we expect that

> *Hypothesis 3:* The greater the exposure of an architect to political upheaval, the greater his or her ultimate impact on the field.

Exploiting Opportunities Through Apprenticeship and Collaboration

The opportunity space made so wide open by industrialization, urbanization, and sociopolitical turmoil spurred a flurry of artistic activity, including a bewildering diversity of movements, many of them short lived. This kind of hyperactivity in social movements has been documented and theorized in sociology (Meyer and Staggenborg 1996). Architects launched new, and oftentimes competing, visions, apprenticing followers and collaborating among themselves as well as working with all sorts of organizations, public and private. Ultimately, these webs of interconnections provided opportunities for resource mobilization, for advancing their cause and their careers, as documented in sociological studies of intellectual and artistic careers (Anheier et al. 1995; Collins 1998; Rossman et al. 2010; White 1993; White and White 1965).

Artistic movements do not always draw precise boundaries separating insiders from outsiders (Crane 1989) and thus generate conflicts that get negotiated through relationships (Kadushin 1976). The engine of change is the constant struggles among factions, groups, movements, and countermovements for defining the dominant approach, model, template, or style in the field (Guillén 2006; Jencks 1973). Likewise, in the field of philosophy, warring factions and schools provided the impetus for change (Ansell 2001; Collins 1998).

Collins (1998) argued that "the network is the actor on the stage"; it is the activity of the field as a whole within and across generations doing the work that becomes summarized in the reputations of the various actors, with a few of them becoming stars, either during their lifetimes or in posterity. The reputation of Aristotle, for instance, was shaped decades, even centuries, after he passed away by the kinds of collaborations he had, the disciples he nurtured, and the followers that

reinterpreted and developed his key ideas. Padgett (1997) proposed that action capacity, skill, or talent resides in the individual, but they are activated by interaction with other actors. As White and White (1965) showed, the impressionist painters and its successors formed an expanding network, which also emphasized breaks with the past both in genre and technique.

The extent to which the long-term influence of one actor influences another's, and in turn the influence of the latter's own contacts, is called a halo effect, which operates through the web of relationships. The influence of a particular actor gives influence to those who are linked to him or her. Hence, an actor's influence, or halo, is defined by the influence of those linked to it, following a pattern of "concatenated eminence" (Collins and Guillén 2012). This effect is a variation on Merton's (1988) classic "cumulative recognition" theory. As Rossman, Esparza, and Bonacich (2010:36) found in the world of cinema, "actors who collaborate with elite peers are more likely to have their own contributions consecrated with an Oscar nomination."

Halo effects stand in contrast to the common observation in the sociological literature that conventions of folk wisdom attribute creative innovations to genius-heroes (DeNora 1991; Merton 1973; Padgett and Ansell 1993; Padgett and McLean 2006; Uzzi and Spiro 2005). Likewise, academic histories of cultural fields tend to focus on the role of the stars in the field, who are assumed to be high-status actors with the legitimacy to offer an alternative approach, model, template, or style. If the halo effect is present, however, how exactly influence percolates throughout the social network may matter as much, if not more, than the perceived quality of the actor in the network. A famous example is that of Gregori Warchavchik, the Russian-born architect who migrated to Brazil and helped spur one of the most vigorous and internationally connected movements of modernist architecture, although he himself did not produce many outstanding buildings or designs, a fact that did not prevent him from becoming famous (Guillén 2006).

Structural halo effects have microlevel foundations. Actors who take part in successful interaction rituals become intensely committed to group symbols (such as new artifacts or styles), which for them are Durkheimian sacred objects; and they are filled with emotional energy—confidence and initiative—that enables them to do enthusiastic work and attract new members to the group (Collins 2004; Jasper 1997). A network generates differential success, not only through the structural status, brokerage, or power that it creates, but also by additional micro-interactional mechanisms that generate motivations and emotions, build reputations, and form collective movements that in cultural production fields are known as styles or schools such as impressionism or modernism.

The halo effect is all about success tied to success. Above and beyond the impact of status orderings or structural centrality, actors in cultural production fields are seen not as individual careerists but as contributors to social movements, even if ultimately an individual may reap most of the fame emanating from the movement. Successful individuals in cultural production fields concatenate ties among the eminent. Eminent teachers and pupils tend to occur repeatedly across generations, and the successful of one period can often trace their lineage to eminent great-grandteachers and even further back in time. Together with the horizontal

links of collaboration within each generation, the amount of surrounding eminence in an actor's network accumulates across several links; the more eminent the actor, the greater the concatenation of eminence in its network. Thus, we will operationalize the halo effect by the combined impact scores of the individuals immediately connected to each focal actor.

Perhaps the best illustrations of the halo effect are the modernist architects Behrens and Perret. While they were responsible for canonical buildings during the early modernist period, their ultimate fame is primarily due to the fact that they apprenticed other even more famous architects and hence came to be seen as key precursors or pioneers. Thus, Behrens apprenticed Gropius, Mies van der Rohe, and Le Corbusier, who would eventually become the three most famous European modernists (Anderson 2000; Buddensieg 1984). Perret's ulterior fame is also due to the fact that Le Corbusier spent time working with him.

Actors linked to influential others—across generations or within the same generation—are in a better position to mobilize resources and engage in a transformation of the field and hence more likely to accumulate influence themselves (Collins 1998; Collins and Guillén 2012). Therefore, we predict that

> *Hypothesis 4:* The greater the impact of the architects connected to the focal architect, the greater his or her own ultimate impact on the field.

Professional Affiliations

Educational traditions and professional affiliations played a key role in making relationships coalesce into movements. Professional groups provide actors with legitimacy (DiMaggio and Powell 1983). The professions are a formidable agent of change because of their focus on framing problems and devising solutions in ways consistent with their expert knowledge (Abbott 1988; Freidson 1986). Much of the modernist transformation in the field of architecture during the early twentieth century, for instance, was driven by artists and architects trained in, or at least exposed to, engineering (Guillén 2006). The modernist architects developed a new professional conception that made technology the basis of a new approach to design. The modernists had to establish a legitimate claim over some area of expert knowledge (Freidson 1986) and in such a way that they would become different than other groups such as mere constructors or builders (Abbott 1988).

The historiography shows that the first designers to take advantage of the principles of machine production and of such new construction materials as steel, glass, cement, and plastics were not architects but engineers (Banham 1980; Benevolo 1977:219–250; Curtis 1996; Jencks 1973). "The engineer is the hero of our age," stated the Behrens in the early 1900s, who had a degree in engineering. The "engineer-architects" were central to the rise of modernism. They were not only "'modern' in their thought and actions," taking "novel building tasks" or "working and experimenting with iron, glass and concrete." They were "modern because [they] considered [their] discipline to be part of a whole, as a means to create structures of culture and social utility" (Pfammatter 2000:12). Engineers started to design and build not just industrial or transportation infrastructure but dwellings and public

buildings as well. Being engineers and practicing engineering when doing architectural work, they were able to mobilize resources, launch artistic movements, and advance their careers in ways that displaced from the spotlight architects not trained in engineering (Bucher and Strauss 1961; Frickel and Gross 2005; Rao et al. 2003).

The influence of engineering concepts was crucial at the turn of the twentieth century, and its impact was to be long lasting. In her book, *Architects and Firms*, Judith Blau (1984:66–67, 80–81) reported that the New York City architects she surveyed in the 1970s overwhelmingly subscribed to the key ideas of engineering as applied to architecture. More than 80% agreed with architect Louis Sullivan's aphorism, "form follows function," and about 60% with Mies van der Rohe's "less is more." By contrast, only 23% endorsed Robert Venturi's jibe, "less is a bore!" Adherence to the principles proposed by engineers became not only legitimate but also to be expected. Architects with training in engineering rose to the pinnacle of the field of architecture, accumulating high levels of impact. Given the crucial role played by a specific professional group in the transformation of a field of cultural production such as architecture, we expect that

> *Hypothesis 5:* An architect's belonging to a professional group promoting successful new models, templates, or styles results in greater ultimate impact for the architect.

RESEARCH SETTING, DATA, AND METHOD

Our research setting for testing the hypotheses is the cultural field of architecture. We chose to focus on the period during which modernist architecture became the dominant template after displacing several strands of neoclassical revivals so that we could observe the dynamic transformation of the field and the implications for the influence of the actors involved decades after they made their contributions (Banham 1980; Benevolo 1977; Guillén 2006). We built a unique data set comprising architects who were active between 1890 and 1940 worldwide, the period during which the shift toward modernist architecture took place. In order to obtain a census of architects active during the modernist period, we used the most extensive encyclopedia of architecture, *The Macmillan Encyclopedia of Architects* (Placzek 1982). To determine which architects were active during the relevant period, we excluded those who died before 1890 or were born after 1920. These criteria yielded a list of 1,208 architects from 42 different countries. The five countries with the largest numbers of architects were the United States (294), United Kingdom (185), Germany (99), Italy (89), and France (65). It is important to note that we included all listed architects regardless of their participation in, opposition to, or indifference toward the modernist movement.[3]

[3] Nevertheless, high prestige in this population of architects is highly related to leadership in the modernist movement. According to an in-depth study of a smaller sample of architects (N = 100), among the 19 architects who received top prestige scores of 10 or 9, 18 advocated "mechanization and standardization in architecture" (Guillen 2006:149–156). The only extremely famous architect of this period who was ambiguous about modernism was Antoni Gaudí.

We avoided sampling on the dependent variable by including all architects regardless of their impact or eminence. For each architect, we counted two kinds of ties to other architects—namely, apprenticeship and collaboration. We included data when two or more architects collaborated on a building or design, or when they established a partnership. Exactly 430 of the 1,208 actors are isolates (37.5%)—that is, had no apprenticeship or collaboration ties to others in the data set. We also collected biographical data on each architect, including country of birth, years of birth and death, and whether he or she received a degree in architecture or in engineering. Casewise deletion of missing data on the variables described below reduced the sample to 1,143 architects.

The dependent variable in our analysis is the architect's long-term or ultimate impact on the field. In most cases, the influence of cultural producers is ambiguous for a generation or more after they do their own work. Collins (1998) argued that in the case of text-producing intellectuals such as philosophers, the creativity, impact, and reputation of a particular individual cannot be assessed until several generations after that individual's death. This is the case because the implications of the ideas are not yet worked out, and the reasons for paying greater or lesser attention to that upstream individual have not been fully developed. We believe that the ultimate impact of an architect also needs to be assessed several generations later. For instance, the true stature of two of the initial innovators in the modernist movement, the British William Morris and the American Dankmar Adler, could not have been accurately assessed at the time of their death in 1896 and 1900, respectively. Left to themselves, their work would be considered ambiguously modernist, steps in the direction of what later became modern architecture, but at the time, not a decisive break with the past.

We measured the dependent variable—that is, each architect's long-term impact—by the number of nine key encyclopedias or histories of architecture in which they are given an entry or cited, all of them published decades after the modernist movement came to an end (Banham 1980 [1960]; Benevolo 1977 [1960]; Curtis 1996 [1982]; Hitchcock 1971 [1958]; Lampugnani 1986 [1964]; Midant 1996; Muriel 1994 [1980]; Sharp 1981 [1967]; Weston 1996). Thus, our measure ranges from 0 to 9. In our sample, 354 (31%) of the architects were not discussed in any of the nine sources, and thus were assigned an impact score of zero. About half of the architects with a zero score were isolates in the network, and only 15 isolates scored 6 or higher on impact. The correlation between isolation and impact in the sample was –0.29.

We measured industrialization with the miles of railway track per square mile of territory, obtained from the Cross-National Time-Series Data Archive (Banks and Wilson 2016). We constructed this measure specific to each architect, taking into consideration the country where the architect mainly worked, and averaging over the years corresponding to the period at the time he or she was between 25 and 49 years old (unless the architect passed away prior to the 49th birthday). For the overwhelming majority of the architects, the time period between their 25th and 49th birthdays was their most creative. Changing the time period of reference did not alter the results reported below. We measured urbanization as the percentage of

the population living in cities using the same source and procedure. We measured political upheaval with the standard deviation of the Polity IV measure of democracy and autocracy, which oscillates between –10 and 10 using the same procedure (Marshall and Cole 2014). A large standard deviation denotes sudden change in political conditions, normally as a result of wars, revolutions, or coups d'état. These three variables are specific to each architect given that they worked in different countries and during different, if overlapping, time periods. Two architects would only have the same value for any of them if they had been active in the same country and born in the same year.

In order to capture the structural halo effect, we used the measure proposed by Collins and Guillén (2012), calculated as the symmetrical square matrix with zeros and ones denoting ties between actors algebraically multiplied by the column vector of impact scores for each architect. This measure captures the structural halo effect of the concatenated influence of other actors tied to the focal actor, and it can theoretically range between zero (for an isolated focal actor) to N – 1 (the total number of actors minus the focal actor) multiplied by the highest impact score (if the focal actor is linked to each other actor and all of them have the highest impact score). In our sample, it ranges between zero and 193. We also calculated a two-step halo measure taking into account connections through an intermediary. This measure ranged between zero and 671. We included the eigenvector centrality score for each architect calculated with UCINET to address the potential alternative interpretation that our structural halo measures capture centrality as opposed to concatenated impact (Bonacich 1987; Borgatti, Everett, and Freeman 2002).

We measured professional affiliation in the field of engineering by examining the educational background of each architect. In our sample, 846 had a degree only in architecture (73.4%), 64 only in engineering (5.6%), and 41 in both architecture and engineering (3.6%). The remaining 201 (17.4%) were apprenticed, self-taught, or had a degree in another field. We used a dummy variable denoting actors with an engineering degree.

There are two characteristics of the data that shaped our decision as to the statistical model to test the hypotheses. First, the dependent variable is a non-negative count with overdispersion. And second, three hypothesized variables are likely endogenous: the two halo measures and the engineering degree dummy. In order to address these two features, we report results using a two-stage negative binomial count model, and we implemented it with the generalized method of moments (GMM) in Stata (Hilbe 2011: section 13.2.3). To predict each of the endogenous variables, we used the following instruments: isolate (whether the actor is not connected to any other actor), year of birth (to account for cohort effects), gender (there are 18 women in our sample), and a set of dummies accounting for country of birth (using the United States as the reference category). We believe these instruments identify the regression model because an actor in the network can choose the country in which to work and which academic degree, apprenticeships, and collaborations to pursue, but has no say over the country of birth, year of birth, and gender.

Table I. Sample Statistics and Correlations (N = 1,143)

Variable	Mean	SD	Min	Max
1. Impact	2.14	2.36	0	9
2. Industrialization (rail track miles per sq mile)	914.22	691.44	0	4,170.42
3. Urbanization (% total population)	.19	.09	0	.49
4. Political upheaval (SD of democracy-autocracy)	1.64	2.23	0	9.72
5. One-step halo	7.68	12.71	0	193
6. Two-step halo	32.27	65.62	0	671
7. Engineer	.09	.29	0	1
8. Eigenvector centrality	–.0068	.0288	–.5290	0
9. Isolate	.37	.48	0	1
10. Year of birth	1,873.73	25.86	1,803	1,921
11. Male	.98	.12	0	1

Variable	1	2	3	4	5	6	7	8	9	10
1. Impact										
2. Industrialization	.27									
3. Urbanization	.15	.48								
4. Political upheaval	.20	.16	–.08							
5. One-step halo	.54	.15	.09	.08						
6. Two-step halo	.44	.13	.11	.12	.85					
7. Engineer	–.01	–.04	–.05	–.00	–.03	–.02				
8. Eigenvector centrality	–.26	–.03	–.06	–.09	–.65	–.82	–.01			
9. Isolate	–.29	–.09	–.06	–.02	–.46	–.38	.02	.18		
10. Year of birth	.25	.25	.45	.28	.16	.22	–.01	–.16	–.04	
11. Male	.05	–.04	–.09	.03	.04	. –4	.01	–.02	–.05	–.09

Note: Correlations above .09 in absolute value result in $p < .001$.

Table I shows the sample statistics and correlations. The only pairs of variables exhibiting a high correlation involve the two measures of structural halo and eigenvector centrality. We enter one-step and two-step halo separately in the regressions to test for robustness. We report models with and without centrality to check for robustness as well.

RESULTS

Table II reports the regression results. Model A lends support to three of our hypotheses: industrialization (H1), political upheaval (H3), and the one-step structural halo effect (H4) significantly increase impact, while urbanization (H2) and engineer (H5) do not. As a robustness check, in model B we enter the two-step halo effect instead of the one-step halo effect, which are intercorrelated at 0.85. We find the same pattern of results in support of H1, H3, and H4.

In model C, we add the control for eigenvector centrality to model A. The results are robust to the inclusion of this additional variable, which is positive and significant. Comparing model A to model C, and model B to model D, we observe that our hypothesized variables are robust predictors of impact, indicating that the inclusion of eigenvector centrality as a control variable does not affect the

Table II. Generalized Method of Moments Negative Binomial Count Models With Endogenous Regressors Predicting Impact (N = 1,143)

Variable	A	B	C	D
H1 (+)	.2508***	.3523***	.2833***	.3207***
Industrialization (×1,000)	(.0592)	(.0619)	(.0633)	(.0661)
H2 (+)	.3859	–.1104	.3401	–.1169
Urbanization	(.4683)	(.5334)	(.4460)	(.5036)
H3 (+)	.1321***	.0730**	.1052***	.0363
Political upheaval	(.0182)	(.0218)	(.0202)	(.0208)
H4 (+)	.0230***		.0393***	
One-step halo	(.0038)		(.0039)	
H4 (+)		.0057***		.0097***
Two-step halo		(.0007)		(.0012)
H5 (+)	–1.1834	.2440	–.2274	.8308**
Engineer	(.9835)	(.3959)	(.5859)	(.2864)
Eigenvector centrality			7.5209**	8.2390**
			(2.2663)	(3.1084)
Constant	–.1074	–.1380	–.2431	–.2290*
	(.0940)	(.1093)	(.0934)	(.0994)
Final Q(b)	.1056***	.0922***	.0934***	.0693***

Note: Endogenous variables (one-step halo, two-step halo, and engineer) instrumented with isolate, year of birth, gender, and a set of 37 dummy variables accounting for country of birth (United States excluded).
***$p < .001$, **$p < .01$, *$p < .05$.

magnitude of the estimated parameters or their statistical significance. The only difference in the results is that in model D we obtain support for engineer (H5), though not for political upheaval (H3, $p = .08$).

The effects of the statistically significant hypothesized variables are large in magnitude. Using the estimates from model C, a change of one standard deviation in industrialization (H1) leads to a change in impact that is equivalent to 51.5% of the standard deviation of the impact score. The effect is equivalent to 53.6% of the standard deviation of impact in the case of political upheaval (H3). The biggest effects are for structural halo and engineer (H4 and H5): 69.8% for one-step halo (model C), 68.7% for two-step halo (model D), and 97.3% for architects with an engineering degree relative to architects without it (model D).

METHODOLOGICAL AND EMPIRICAL LIMITATIONS

Our study is not free from limitations. First, our measure of impact is based on citations to specific architects in the main histories and encyclopedias. This is an indirect measure of eminence, filtered as it is through the interpretation of key gatekeepers in the field. Alternative measures could be constructed using data on architectural commissions or on the reaction of the public to the buildings themselves, although they are not available for a large sample of architects across the 12 countries included in this study. Second, while our model can account for the circulation of influence across a web of architects, it cannot explain the ultimate source of the success, whether it is individually or organizationally based. A suggestion is that

collaborations among architects involve sharing details of technique as well as the new aesthetic sensibility, such that downstream collaborators expand on the style of their predecessors. Creativity comes from both reproducing the style recognized as "modernist" and from finding new variants adapted to new settings for buildings. These limitations invite additional empirical research, both with more elaborate quantitative data, and with detailed accounts of particular collaborations and careers.

THEORETICAL CONTRIBUTION AND FUTURE DIRECTIONS

Our analysis of the emergence of modernism as the dominant approach in the cultural field of architecture at the turn of the twentieth century illustrates the importance of resources, strategy, biography, and culture (Jasper 1997). Our empirical analysis provided evidence as to the explanatory power of variables that measured the opportunities for resource mobilization (industrialization and political upheaval), the effect of ties of apprenticeship and collaboration, and the relevance of an engineering education. We thus corroborate some of the arguments made over the decades by historians of architecture (e.g., Banham 1980 [1960]; Benevolo 1977 [1960]; Frampton 1992 [1980]; Giedion 1982 [1941]; Jencks 1973; Scully 1974 [1961]) and sociologists of culture (e.g., Gartman 2009).

Our theoretical model combining insights drawn from theories of resource mobilization (McAdam et al. 1996; Meyer and Staggenborg 1996; Jasper 1997) and symbolic micro-interaction (Collins 2004) provides an answer to the question of how actors can bring about change in highly institutionalized fields of cultural production in which power structures are entrenched and inertia is rampant (Emirbayer and Johnson 2008). It takes a contextually embedded mix of biographical pathways, material and intangible resources, rhetorical repertoires, strategies, organizational capabilities, and entrepreneurship to change the course of a field of cultural production (DiMaggio 1982; Jasper 1997). This theoretical approach can also be used to ascertain when a movement runs out of steam and gives way to others within a certain field. Artistic movements in particular tend to fade away not only when new movements or countermovements displace them, but also when the shared understandings and the resources that gave rise to them erode or disappear (Meyer and Staggenborg 1996). This was clearly the case of the demise of modernist architecture in Germany, Italy, and Russia in the wake of political changes, especially during the 1930s (Bowler 1991; Guillén 2006; Herf 1984; Kopp 1985).

Our analysis and findings resonate with previous work on science (Zuckerman 1967), classical music (DeNora 1991), impressionist painters (White 1993; White and White 1965), artists (Anheier et al. 1995), poets and novelists (Cheever 2006; Farrell 2001; Watson 1991), and Hollywood actors and film producers (Allen and Lincoln 2004; Rossman et al. 2010), which found a similar mix of biographical, contextual, and structural factors at play when it came to explaining innovation in cultural fields.

Our empirical findings also relate to recent work regarding the impact on the prestige and influence of academic departments of the ties linking departments that

produce PhDs to those employing them (Burris 2004) and to the analysis by Uzzi and Spiro (2005) of collaboration in the Broadway musical field between 1945 and 1990, who found that the financial performance of musicals and favorable critics' reviews increased with connectedness up to the point at which the overall network becomes too saturated and stifling.

To summarize our contribution, the combination of material/organizational conditions with ideological/emotional trajectory is what we have attempted to show in the modernist movement in architecture. Architecture needs particularly strong material resources, compared to other social and cultural movements. Architects make their careers and propagate new styles by constructing buildings, and these require large material and financial inputs. To a much greater extent than painters or writers, architects need someone to pay the bills; that is why shifts in economic and political conditions providing the opportunities for new sources of funding go along with shifts in building styles. And the material resources that architects mobilize are at the center of what they do. Modernist architecture embraced the new mass-produced materials of iron and steel girders, reinforced concrete, and sheet glass that fed into a new way of organizing construction and differed sharply from the craft mode of building in older styles based on stone-cutting, brick-laying, and masonry. That is why modernist architecture was prominent in countries of rapid industrialization and political upheaval, whether capitalist or socialist.

But modernist architects were not merely dry technicians responding to new materials. They were a movement of enthusiasts, who wrote eloquently (sometimes with utopian claims) about how the new architecture would transform the world. Architects such as Le Corbusier, Gropius, Wright, and Sant'Elia were writers and propagandists, even before their buildings became their own best propaganda. From the point of view of the sociology of interaction, enthusiasms build up in groups in close face-to-face interaction (Collins 2004; Lawler, Thye, and Yoon 2009).

The explanatory power of our measure of the halo effect is not merely a technical detail; these are ties of apprenticeship or collaboration, architects who worked together on buildings. These are ties far more intense than the conventional definition of "strong ties" of intimate friendship; we might call them "intense ties" because they involve tightly focused joint activity, striving toward a shared goal. It was in such an atmosphere at Behrens's office, at the Bauhaus, and in the world-circling collaborations of Le Corbusier and his protégés that the project of creating a new modernity through architecture was created and propagated.

A social or cultural movement is not a static network but a trajectory—simultaneously recruiting adherents and supporters and giving them a collective project for their immediate future. Intense ties propagate more than ties with little emotional content. Enthusiasts generate enthusiasts. Architects generate this especially well, because their projects call for long periods of work at closely shared tasks, and a completed building in their new style becomes a monument both to celebrate the builders and to spread the visibility of the style. Thus, networks of enthusiasts, leaving a trail of buildings behind them, are simultaneously the best way to recruit a movement and for individuals to become famous. Our measure of "halo effects" captures the point: having intensely involved creative architects both upstream

(those who recruited you) and downstream from oneself (those whom you recruited) affects how famous you will become. Creative individuals are not isolated geniuses but enthusiastic propagators of a movement (Frickel and Gross 2005). The more creative individuals you can link with at the beginning of your career, and the more you can recruit to become creative later on, the more fame one acquires in a field such as architecture. This is why we find that two-step halo (both your own intense ties and the intense ties one further link away) has the strongest effect of any of our variables on the architects' ultimate impact. People who work together in an expanding network reflect each other's influence.

At least, this is how it operates in architecture, during the takeoff of the modernist movement. We suggest that similar cascades of enthusiastic recruitment through intense ties have generated the famous names in other periods of great architecture and in related fields such as landscape gardening. Whether the production of fame and influence operates the same way in cultural fields such as painting and music remains to be seen. Outside of the area of cultural production movements, social movements may not share all these characteristics. Political and religious movements tend toward a monopoly of fame by their peak leaders, and the success of those at the top may eclipse those around them, rather than reflecting glory on each other. These questions await further development through comparative studies, as we see further cross-fertilization of theories in social movements and in cultural production.

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