Culture and Networks

Introduction

There is something paradoxical about "culture networks" as a field of study. On the one hand, the area is coherent and visible enough to have been the subject of numerous chapter-length reviews in the last decade or so (Breiger & Puetz, 2015; Mützel & Breiger, 2020; Pachucki & Breiger, 2010; Rule & Bearman, 2015), including programmatic treatments by Paul DiMaggio (2011) and Ann Mische (Mische, 2011) in the previous edition of this handbook.[1] However, it is still being determined what the field of culture and network studies is as a scholarly domain of practice. Some (Breiger & Puetz, 2015, p. 557) refer to it "as a research specialty in its own right"—a somewhat optimistic assessment—but others see it, at least implicitly, more as a cluster of studies united by thematic similarities and substantive emphases across various distinct sub-areas in sociology and the social sciences more generally (DiMaggio, 2011; Mische, 2011; Rule & Bearman, 2015). These include, *inter alia*, studies of artistic, collaboration, civil society, and creative networks, or the formal modeling of certain cultural elements, such as text, practices, language, concepts, narratives, and events, as a network of elements, or the study of the meaningful bases of interaction and relationship formation in social networks via cultural change and the construction of identities and boundaries. Nevertheless, something is missing in these previous treatments: a general sense of whether, beyond *topical* intersections of culture and networks or the study of interesting empirical phenomena, there exists a general *theoretical* or conceptual basis uniting the field.

In this chapter, I argue that the answer to this last question is affirmative. I broadly follow Borgatti & Lopez-Kidwell's (2011) approach—see also Borgatti & Halgin (2011)—in the previous edition of this volume to define the parameters of network theory in the case of

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[1] The field has also been covered in a monograph-length publication by McLean (2016).

the study of culture and networks. I will not review specific pieces of empirical research clustered according to thematic criteria loosely linked to the culture-networks linkage. Instead, I organized particular strands of the literature according to underlying theoretical *ur*-models, explicitly stating their assumptions and critical empirical implications and showing how analysts deploy them for analytic and explanatory purposes. Thus, the chapter's primary goal is to outline the *theoretical foundations* of work linking culture and social networks. As such, my review of specific research will be highly selective; the point is not to exhaustively consider a wide variety of work across the thematic areas mentioned earlier. Instead, I will select specific *exemplars* (in Kuhn's sense) in which the core theoretical imagery is showcased or developed in significant ways.

The central claim is that just like the seemingly cluttered landscape of network theorizing turns out to be organized by a surprisingly small number of underlying theoretical models—only two in Borgatti & Lopez-Kidwell's (2011) accounting—much of the work on the culture-networks linkage is also organized by a surprisingly compact set of theoretical images. Only two in my accounting. First, a vision of the interplay between personal culture and network ties built on the *constructural* imagery (Carley, 1991), in which the continuous exchange of cultural information helps people form, construct, and maintain social connections while defining socio-cultural affinities and boundaries. Second, a vision of the link between people and broader social categories, public culture, groups, cultural objects, genres, knowledge, and the like, animated by the *cultural holes* imagery (Pachucki & Breiger, 2010). Here linkages between people and other social entities in multimode networks define distributions of positions—for people and objects—in dually constituted "socio-cultural" and "culturo-social spaces" (Lee & Martin, 2018; Puetz, 2017). Together, the constructural and cultural holes imageries, as well as their recent developments and refinements, form the theoretical backbone of research in culture and networks.

The rest of the chapter is organized into two major sections, covering the constructural and cultural holes models, their main variations, and core applications. I close with a brief section discussing the argument's implications for future work.

The Constructural Imagery

Constructuralism and Network Ecologies

Carley's Constructural Model

I begin by considering what, to my knowledge, was the first formal theory of the dynamic coupling of culture and networks: Kathleen Carley's (1991) *constructural model*, one of the *ur*-models from which a whole swath of research on culture and networks derives. Because it was initially stated as a formal computational model, we do not need to work too hard to uncover the fundamental premises of the model. In the constructural imagery, agents exchange culture (e.g., facts, information, beliefs, tastes, preferences, and the like) when they interact. As a result of interacting, agents become more culturally similar. Moreover, agents' cultural similarity increases the chance of future interaction as the probability of two actors interacting at any given occasion is a positive function of their shared culture.

There are independent theoretical reasoning and quite a lot of empirical work that supports each constructural model's premises (considering this work, however, is outside the scope of this chapter). The key idea is that the three premises define a positive feedback loop connecting cultural exchange to the "tie strength" between people (Granovetter, 1973; Marsden & Campbell, 1984), which becomes indexed to their relative cultural similarity compared to that they have with other actors in the system. The more people interact, the more their dyadic ties strengthen, which leads to future bouts of interaction and dyadic cultural exchange. As Carley (1991) noted in the initial statement of the theory, a plausible equilibrium, all else equal, is for all actors to reach maximum cultural similarity with one another and thus form a fully connected clique in terms of their interaction probabilities. Of course, complications can be introduced to the model to account for the apparent fact of cultural differentiation and differential probabilities of interaction, inclusive of the capacity for actors to "lose" (e.g., forget) cultural knowledge (Mark, 1998a) and the emergence of

non-interactive "actants" (books or other information archives such as the World Wide Web) from which individuals can extract cultural knowledge not available via face-to-face interaction with others (Carley, 1995). Carley's basic constructural imagery thus provides the basis for several more recent developments in theorizing the link between culture and social networks and linking theory to empirical evidence.

Mark's Cultural Ecology Model

The first model of the culture and networks linkage explicitly built on the constructural imagery is Mark's (2003) network ecology model (NEM)—see also Mark (1998b) for an earlier precursor. Mark departs from the observation that cultural tastes, opinions, and beliefs are segregated into distinct "niches" of socio-demographic space. Here Mark draws on McPherson's (2004) socio-demographic niche theory, which builds on earlier insights from Blau's (1977) macrostructural theory conceptualizing social space as a multidimensional space. People's position in this "Blau space," whose axes are composed of those "dimensions of association," continuous, ordinal, and nominal (such as age, gender, race, occupational prestige, and the like), determine the chances people will form network connections. The basic principle here is that of homophily (McPherson et al., 2001), such that the probability of two being tied in a social network is a function of the number of socio-demographic characteristics they share translates to a distance gradient in Blau space. People close to one another are more likely to be connected.

In the NEM, connectivity is a conduit via which cultural tastes, opinions, and beliefs are transmitted via imitation and social influence. The suggested mechanism is that the acquisition of cultural tastes is best envisioned as a "local bandwagon" process of network-based imitation or contagion. Because the distribution of network ties in Blau space is "lumpy" (with people concentrated along areas that maximize similarity), so will the distribution of tastes, which will concentrate along particular "niches" (particular areas of Blau space). For instance, rock and roll will be more likely to be found in the Blau space area

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marked by relatively high education, occupational prestige, older age, and white ethnoracial identity. Mark's NEM uses the constructural imagery to provide a formal model of how this process of concentration of tastes along socio-demographic can be realized via routine interaction, thus explaining why tastes and opinions cluster in specific "cultural niches," and why at any one moment we are liable to find systematic correlations between socio-demographic position and cultural tastes (Bourdieu, 1979/1984).

More recent work by Dellaposta et al.(2015) uses insights from Mark's network ecology model to explain the association between cultural tastes and practices and presumably (e.g., logically) unrelated attitudes and beliefs such as political liberalism and conservatism. The basic idea is that once relatively small correlations between politics and lifestyle begin to obtain (even if for contingent reasons). Once political ideology becomes a fundamental dimension of association in Blau's sense, arbitrary linkages between politics, tastes, and lifestyle practices can be amplified via the twin mechanisms of homophily and personal influence. Accordingly, local bandwagon processes segregate conservatives and liberals in distinct cultural niches, with the boundaries reified by the standard mechanisms of relational segregation and selective interaction.

Conversion and Matching

Lizardo's Culture Conversion Model

If Mark's cultural ecology model theorized how social structural biases led to the social segregation of cultural tastes (thus relying on one-half of the two-sided dynamic process of conversion emphasized by Carley), Lizardo's (2006) *culture conversion model* (CCM) examined the obverse process; how cultural tastes can lead to the biased formation of social network ties. Lizardo's CCM synthesized three key theoretical strands in the literature that, at the time, had developed separately, despite each addressing critical processes and mechanisms linking culture and social networks. The first was, of course, Carley's constructural theory (Carley, 1991). The second consisted of micro-interactionist approaches to theorizing the

functions of culture consumption in modern artistic classification systems linking cultural consumption to Simmelian sociability and the creation of bounded solidarities via the mobilization of cultural capital in "interaction rituals" (DiMaggio, 1987). The third was Bourdieu's (1986) imagery of the interconvertibility of the three forms of capital (social, economic, and cultural). The basic idea is that cultural resources, particularly the possession of embodied abilities to consume certain forms of culture, should lead people to differentially cumulate and maintain social network ties (such that people with a wide variety of tastes should maintain more extensive social networks). The CMM thus stands in contrast to models postulating a one-directional arrow of causation (or conversion) going exclusively from network ties to cultural tastes, like Mark's NEM.

Moreover, according to the CCM, consumption of "asset-specific" cultural goods (e.g., requiring esoteric or difficult-to-acquire cultural knowledge) should have *restricted conversion value*, leading mainly to creating and maintaining networks of strong ties and local solidarities. On the other hand, consumption of cultural goods that are less asset-specific, such as popular culture with which most people are familiar, should have *generalized conversion value*, leading to the formation and maintenance of ego networks rich in weak ties. "Omnivorous" consumption of both types of culture should lead to more extensive networks containing weak and strong ties. Using data from the culture and network modules of the U.S. General Social Survey (GSS), Lizardo found strong support for the general outlines of the CCM. The more cultural activities people report consuming, the more extensive their reported ego networks are. Highbrow culture—a type of asset-specific culture—increased the volume of strong ties, while consumption of popular culture increased the volume of weak ties. Omnivores who engage in both forms of culture can thus wield complementary resources, enjoying the advantages of bridging (with their weak ties) and bonding (with their strong ties).

Subsequent work has elaborated Lizardo's culture conversion model conceptually while providing partial empirical support for some of its key predictions. For example, Schultz &

Breiger (2010) rework Lizardo's original distinction between "asset-specific" and "non-asset-specific" culture to align with Granovetter's (1973) classic distinction between weak and strong ties. According to Schultz and Breiger, popular culture endowed with generalized conversion can best be considered *weak culture*. Like weak ties in Granovetter's theory, weak culture turns out to be strong because it allows for the formation of social ties, however fleeting, between people in social-structural positions that otherwise would have no basis for connecting. In addition, they show, using U.S. GSS data, that the more mild positive cultural preferences a people have (e.g., "likes" instead of "likes very much"), the more likely it is that they perceive the U.S. to be "united" (rather than divided). In short, weak culture leads to the perception of a potential for interaction across critical social divides, an unexpected implication of the culture-conversion imagery, with critical implications for contemporary issues like cultural and political polarization (DellaPosta et al., 2015).

Vaisey and Lizardo's Cultural Matching Model

Vaisey & Lizardo's (2010) *cultural matching model* (CMM) also builds on the constructural imagery linking culture to social network ties. According to the CMM, cultural tastes, values, and preferences affect social networks mainly by serving as the underlying basis for *homophily* (thus reversing the causal arrow postulated by Mark's NEM). In this way, tastes, and other internalized cultural aptitudes, preferences, and practices can have an independent causal effect in shaping social networks because people use the match between their tastes and others to *self-select* into particular social ties (Shalizi & Thomas, 2011). Moreover, the degree of cultural match between two people also determines whether certain social relationships stick over time or instead selectively die off, thus linking cultural matching at the dyadic level with processes of tie-decay at the network level (Burt, 2000; Martin & Yeung, 2006). Using longitudinal data from the U.S. National Study of Youth and Religion, Vaisey and Lizardo find that, compared to those who express more communitarian cultural worldviews, adolescents abiding by individualist-expressivist cultural worldviews are more likely to maintain social ties with other adolescents who engage in substance use. In contrast,

those abiding by a more individualist-utilitarian worldview are more likely to keep social ties with those who volunteer.

Other empirical provides strong empirical support for critical predictions of the CMM. For instance, Friemel (2012/7) shows that shared cultural tastes promote tie-formation among adolescents, with similar results using college-aged populations in the domain of musical taste reported by Lomi and Stadtfeld (2014), Vlegels (2014, p. 71ff) and Hachen et al. (2022). Edelmann and Vaisey (2014), using data from the Cambridge College Network Dataset, a longitudinal sample of graduate students in England, extend the CMM to consider not just substantive matches in terms of tastes and worldviews but also matching in terms of *abstentions* or dislikes. Just like people can match their avowed cultural tastes and practices, they can match according to what they do not or refuse to do; refusals are as important as choices (Bourdieu, 1979/1984). Consistent with the extended CMM, Edelmann & Vaisey find that mutual consumption of the same musical genres and common non-consumption have systematic effects on network ties, increasing the odds that two students will sustain a network connection over time.

Lewis and Kaufman's Generalized Conversion Model

The most sustained elaboration of the conversion and matching models, theoretically and empirically, is that developed by Lewis and Kaufman (2018). Lewis and Kaufman synthesize the conversion and matching ideas into a generalized conversion model (GCM) while also considering variations in the local cultural ecology to specify the notions of weak and strong culture. Lewis and Kaufman's GCM offers various conceptual advances over previous formulations of the link between culture and networks. First, they endogenize Schultz and Breiger's idea of weak and strong culture to what they refer to as the local cultural ecology. Rather than using exogenous criteria to determine what counts as weak or strong culture (e.g., broad labels such as highbrow or popular), they note that what counts as weak or strong culture will depend on the distribution of tastes and aptitudes in the local cultural

environment. Second, they distinguish between different culture conversion and matching mechanisms and show how they can operate in tandem.

First, there is the *dyadic conversion* of cultural into social capital, whereby people exploit commonalities in cultural tastes and aptitudes specific to the focal dyad to form and sustain relationships. Second, there is a *generalized conversion* process, whereby particular forms of taste and cultural consumption lead people to form more ties with others (increasing the acquaintance volume). Finally, there is *cultural matching*, where similarities in cultural profiles—including, following Edelmann and Vaisey, both active engagements and abstentions—increase the chances of people creating social connections with similar others. Using stochastic actor-based models for longitudinal network data on a unique Facebook dataset—the "tastes, ties, and time" data collected during the platform's early days in the U.S. (Lewis et al., 2008)—Lewis & Kaufmann find support for all three conversion mechanisms. Notably, the more tastes two students shared, the more likely they were to become Facebook friends, especially if those tastes were "specialized" to the local cultural ecology. In the same way, individuals who displayed typical tastes in the local cultural ecology were more likely to accumulate a larger volume of acquaintances via the generalized conversion mechanism.

Constructuralism 2.0: associative Diffusion

In a recent paper, Goldberg and Stein (2018) propose an "associative diffusion model" (ADM) of the way culture and networks interact. The ADM's argument is deceptively simple but ultimately far-reaching. According to Goldberg and Stein, culture does not diffuse like a "virus" in social networks; people do not pick up *single* beliefs, attitudes, tastes, or styles from their contacts. Instead, cultural practices, beliefs, and attitudes are embedded in a relational network of meanings. That is, there is a "cultural network" that dictates "what goes with what" that is analytically independent of the network dictating who is tied to whom (a key point of difference with the constructural imagery). In contrast to constructuralism, the ADM uses recent advances in conceptualizing culture as schemas (Goldberg, 2011) and

schemas as an analytically distinct network of *cognitive* associations between cultural items that can differ across people. Thus, there are as many cultural networks as there are agents, and what diffuses between people when they interact are the *relations* between elements. In this way, the ADM can be considered the constructural model 2.0.

Accordingly, we must distinguish the diffusion of cognitive associations between elements (this is what Goldberg and Stein refer to as "associative diffusion") or the cognitive representation of "what goes with what" each agent carries with them from the specific attitudes (e.g., like/dislike, adoption/refusal, endorsement/non-endorsement) specific people take toward the given practice or attitude. If we allow for associations between elements to be the unit of diffusion, then specific attitudes of adoption/non-adoption towards those elements can be derived as a process of soft-constraint optimization on the part of people (formalizing the idea of cognitive consistency between preferences), allowing them to harmonize their attitudes towards particular objects, with the way they believe those cultural elements are linked.

For instance, a person knows that caviar is connected to champagne, which in turn is connected to foie gras, while having a negative attitude toward the latter and a favorable preference for the first two. What diffuses via social networks are the pairwise links between these elements, and these links are strengthened (reinforced) the more people are exposed to these associations (e.g., caviar and champagne) when interacting with others (alternatively, associations that are not reinforced in interaction decay over time). Each time a person is exposed to a given cultural association, the strength between the two is "updated" in the cultural network, meaning people harmonize their attitudes towards the things they think are related, much like people need to "balance" their sentiments across triadic structures in interpersonal sentiment networks. Thus, the person who thinks caviar is strongly related to both champagne and foie gras but who hates foie gras must either start liking foie gras more or liking champagne and caviar less.

The ADM thus links the idea of schemas as a network of cultural elements to interaction, social construction, and learning processes and implements this dynamic in an elegant computer simulation. One payoff is that the ADM can show that the core phenomenon that those who study diffusion believe requires structural segregation at the network level (attitude or taste polarization) can emerge via associative diffusion mechanisms even when social structures are not segregated (e.g., fully connected or high-density networks), a situation where "virus-type" diffusion models—such as Mark's network ecology model—would predict convergence rather than cultural niche divergence. This is a significant result because it attests to the robustness of the cultural polarization phenomenon even in the face of structural conditions that network ecology models would predict would make it impossible, while also showing that a critical boundary condition of these models—pre-existing relational segregation—is not necessary for the emergence of cultural differentiation. The ADM also complicates "network-based" solutions to the polarization issue premised on creating links or increasing exposure between people with opposed attitudes and worldviews, as suggested in recent empirical work (Bail et al., 2018)

The Cultural Holes Imagery

As DiMaggio (2011) noted, more than a decade ago, research on "cultural networks" has become a central organizing hub linking work on creativity, collaboration, group identity, symbolic boundaries, and the relational constitution of meanings in the sociology of culture, and network imagery is a natural way to unify this otherwise disparate array of work on a variety of substantive areas. Mützel & Breiger (2020) note that much of this work was united by the *duality* between two or more entities in (multimode) cultural networks. Nevertheless, while hinting at an underlying theoretical model, the overall idea of cultural networks and the more specific idea of duality are more like general frameworks helpful in organizing a variety of empirical around loosely related thematic areas. Is there an underlying theoretical model

that can be seen as doing the bulk of the explanatory work? I propose that there is such a model centered on the notion of *cultural holes* (Pachucki & Breiger, 2010).

Cultural Holes as a Model for Cultural Networks

In contrast to the constructural (or associative diffusion) model, there has never been a formalization of the cultural holes model.[2] However, surveying the use of the idea in recent work is not difficult. The cultural holes argument can be seen as a steady-state macro-level implication of the constructural mode but applicable to social systems at scale. In this case, differentiation and insulation generate discontinuities in the cultural distribution of knowledge across people (Reay, 2010), thus creating "gaps" in the cultural structure, represented by "patterned absences of relations" among cultural items (Breiger, 2010, p. 39). This contrasts with the small group, where the steady-state equilibrium of the constructural process is for everyone to end up knowing everything everyone else knows. Second, as Carley (1991) noted, there is a link between this imagery and that of duality since the cultural distribution of knowledge can be modeled as a two-mode network of people by "pieces" of cultural information. Projecting the network into a person-by-person one-mode weighted network in the way proposed by Breiger (1974), we end up with the cultural similarity between people, as discussed earlier (see section 2.1).

Projecting the original two-mode network into an item-by-item one-mode network gives us the cultural relatedness of the items, such that two cultural items are strongly related if they are likely to be known by the same people and weakly related if they are unlikely to be known by the same people. We can thus define a "cultural ego-network" at the agent level, with the person connected to all the cultural items they know. The link between the items being the weight of their linkage in their respective one-mode network projection—perhaps suitable corrected for the statistical likelihood of observing a weighted link of a specific size (Neal, 2014). Computing Burt's (1992/2009) ego-network efficiency among the "alters"

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[2] Of course, Breiger (1974) formalized the idea of *duality* in his classic paper, which is central to the cultural holes argument.

(cultural items) of the cultural ego-network gives us—one way—of measuring the extent to which agents bridge cultural holes (Lizardo, 2014).

In essence, the cultural holes argument links the cultural distribution of pieces of cultural knowledge in a given social system to define the "position" of a given agent in the "socio-cultural" structure (Lee & Martin, 2018). Most research using this approach links the positional status of agents or items to various outcomes, much like previous work linked soci0metric position to various outcomes (Burt, 2004). Note, however, that this "agent-centric" approach to studying cultural holes, although natural and intuitive, is not the only one we can take. Given duality, it is possible to be interested in the item-by-item "culturo-social structure" itself (Lee & Martin, 2018) and study cultural holes from a "culture-centric" perspective, for instance, by looking at which cultural items are likely to be "bridges" (e.g., mediating between clusters of weakly connected items). In this respect, the cultural holes argument presupposes a "mutual alignment" between agent and culture-centric perspectives (Puetz, 2017). Accordingly, analysts have taken both agent and culture-centric routes in analyzing cultural holes; we review exemplary work in each strand next.

Agent-Centric Approaches to the Study of Cultural Holes

Cultural Holes, omnivorousness, and taste

A natural application of the cultural holes argument from an agent-centric perspective is to *specify* phenomena that have been recalcitrant to analytic treatment in other fields. One particularly promising arena is the sociological study of cultural taste and consumption (Bourdieu, 1979/1984). This area has come to be populated by a host of concepts meant to denote "openness" and "cosmopolitanism" as a modern marker of being a "tolerant" person with a taste for diversity and varieties of cultural experiences (Ollivier, 2008). These include, in addition to the eponymous "cosmopolitanism," such constructs as "cultural omnivorousness" (Peterson & Kern, 1996). For example, suppose we view cultural taste as

"pieces" of cultural knowledge. In that case, the natural thing is to see the cosmopolitan "cultural omnivore" as one who bridges cultural holes via their consumption choices.

Lizardo (2014) follows this approach, noting that the cultural omnivore can be considered an agent with an "efficient" cultural ego network relative to cultural tastes. That is, omnivores select non-redundant genres, with redundancy defined as the extent to which the audiences of any one genre chosen overlaps with that of other genres also chosen—building on the logic of Burt's structural holes argument. From this perspective, omnivorousness refers to bridging cultural holes in a space defined by cultural genres by choosing sets of genres whose audiences display relatively low overlap. After proposing an intuitive way to capture this tendency, combining Breiger's (1974) approach with a variation of Burt's metrics for structural holes, Lizardo shows that the socio-demographic markers traditionally associated with cultural omnivorousness when measured as the sheer quantity of choices differ in systematic ways from those linked to omnivorousness when measured in terms of bridging cultural holes. In more recent work, Puetz (2021) extends the cultural holes argument concerning aesthetic engagement to the realm of friendship preferences, showing that people who bridge cultural holes when it comes to their musical taste choices (measured as described) are also more likely to express a preference for friends who are "creative" and "cultured" as compared to people who make cultural choices that commonly go together.

Cultural Holes and the Categorical Imperative

Silver et al. (2022) deploy the cultural holes argument to shed light on the "categorical imperative," namely, the often-noted phenomenon that actors (both individual and corporate) who cross categorical boundaries are penalized in market settings. Like the above, this work shows that recent work on "categories" in organization and management studies (Goldberg, Hannan, et al., 2016; Kovacs & Hannan, 2015) can most profitably be specified with the cultural holes framework. The basic idea is that when audiences (regulators, critics, customers) are faced with actors who present themselves in multiple categories (e.g., a

brewery that is also an ice creamery), they are confused and presume that a "jack of all trades is probably master of none," or more accurately not as masterful as one with a focused (e.g., singular) identity (Hannan, 2010). From this perspective, bridging cultural holes in a category system is likely to be deleterious to actors in competitive fields. By contrast, Silver et al. (2022) argue that rather than an unconditional negative link, the connection between cultural hole-spanning, creativity, and success is likely to take something closer to an inverted u-shape, especially in fields that reward innovation and creativity. Too much focus on a single genre category (lack of cultural hole bridging) is seen by audiences hungry for novelty as conventional and boring. However, spanning cultural holes across considerable categorical distances is likely to trigger the various deleterious mechanisms, with audiences left befuddled at bizarre or non-standard genre combinations.

To test their proposal, Silver et al. examined data from close to three million bands listed in my space in the late aughts. They use the self-selected music genre categories selected by each band and compute the categorical distance between genre labels based on co-occurrence patterns from the one-mode (genre-by-genre) projection of the original band-by-genre two-mode network—using Lizardo's (2014) measurement approach. They find that indeed, across three musical "worlds"—high-level clusters of genres labeled "Rock," "Hip Hop," and "Niche" (see also Silver et al., 2016)—there is an inverted u-relationship between cultural hole bridging and popularity (as measured by the number of views, fans, and digital "plays" of their music). Bands with highly focused identities (failing to bridge cultural holes) and bands who span cultural holes across very distant categories are less popular than bands who combine categories at a moderate distance from one another. Thus, *moderate* cultural hole bridging is the key to success in this empirical case. While this is the predominant tendency in the data, Silver et al. also find systematic variation in this empirical pattern by musical world.[3] In some musical worlds, like Hip Hop, the predominant pattern is closer to a "dual innovation" model, with peaks in popularity at both a moderate and an

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[3] See https://unconventionality.github.io/

extreme label of cultural hole bridging. Some musical worlds reward creativity and unconventionality, but most follow the tendency to reward cultural-hole bridging up to a point, after which the "categorical imperative" kicks in.[4]

Cultural Holes versus Structural Holes

Silver et al.'s work proposes a systematic link between cultural-hole bridging, creativity, and success; Choi's (2018) recent work examines this issue directly. Choi uses the cultural holes argument to study the origins of ideational creativity among members of the IT department of a medium-sized tech company in South Korea. The topic of "good ideas" has been studied before using sociometric network models like Burt's structural holes (Burt, 2004). The primary finding here is that people who bridge sociometric structural holes are likelier to have "good ideas" than those who live in social worlds in which their contacts are connected. The presumed mechanism is that structural holes provide the potential to access otherwise disconnected ideas by others. Thus, structural brokers are better positioned to synthesize these separate pieces of information into more original and creative insights.

Choi (2018) reasons that the structural holes model is an indirect "one step removed" version of a more basic cultural holes model. That is, structural brokers have better ideas because they are *cultural brokers*; the direct operative mechanism concerns not the position of the person in a sociometric network of personal relations but a people's position in a cultural network composed of local ideational frames. Regarding creativity, the cultural holes argument partially supersedes the structural holes one (or, at the very least, provides a complementary mechanism leading to the same outcome). To test this hypothesis, Choi first measured the most prevalent local frames in the company using a free-text elicitation strategy from which higher-level frames were coded and extracted, then used an "idea tournament" approach based on the Salganik's wikisurvey method (Salganik & Levy, 2015).[5]

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[4] Socio-demographic and political-economic characteristics of the metro area also moderate the strength of the inverted-u relationship between cultural hole bridging and success without violating the general pattern.

[5] See https://www.allourideas.org/

In this setup, participants anonymously submitted ideas to improve the company. Then, the ideas were (also anonymously) rated by others using pairwise comparisons between two randomly selected ideas at a time. Ideas that were more likely to "win" when compared to other randomly selected ideas were deemed the most creative. The frame extraction approach resulted in a two-mode network of people by cultural frames. Cultural brokers are thus people who hold cultural frames not likely to be held by the same others. Choi found that, indeed, cultural brokers, as measured using Lizardo's (2014) approach, are more likely to have ideas considered creative by others, even after adjusting for sociometric brokerage (which also leads to ideas being considered more creative) and relative cultural fit (the likelihood of holding frames that are also likely to be held by others).

Choi's finding that bridging cultural holes has a direct effect on creativity *even after statistically adjusting* for bridging sociometric structural holes is consistent with recent work arguing and showing that sociometric bridging (structural holes) is analytically distinct from cultural bridging (cultural holes) and thus have independent effects on key outcomes. For instance, Graham et al. (2022) analyze large-scale scientific co-authorship data across twenty-five scientific fields. They use computational linguistic techniques to measure each scientist's diversity of information based on the terms and concepts used in their publication's title, abstract, and keywords and the articles they cite in their work. They find only weak correlations between sociometric position in the co-authorship network and ego's direct and indirect access to information diversity, showing that bridging structural holes does not automatically translate into bridging cultural holes.

Graham et al.'s findings dovetail with those of Goldberg et al. (2016), who also use computational linguistic techniques to measure the extent to which people exhibit "culturally fit" (e.g., use language that is similar to their communication partners in a directed email network) within an organization. They find that bridging structural holes and having a high cultural fit lead to more beneficial outcomes (e.g., better performance reviews and lower chances of involuntary exit) when considered independently. However, precisely because the link between position in the cultural network and the sociometric is relatively weak, the two

dimensions can also be considered *jointly* (e.g., one effect moderating the other). When this is done, the results indicate that structural holes help but only for those who culturally fit the organization ("assimilated brokers"). Notably, the results suggest that bridging cultural holes is *sufficient* for experiencing comparatively successful outcomes. People with high levels of sociometric constraint but who stand out culturally from others in the organization—integrated non-conformists—do systematically betters than those who have access to structural holes but do not bridge cultural holes ("disembedded actors").

Finally, work by de Vaan et al. (2015) shows that the argument distinguishing cultural from structural bridging extends beyond individuals to explain the creative success of teams. While previous work on creative teams (e.g., Uzzi & Spiro, 2005) focuses mainly on structural network position—thus forced to infer cultural bridging from structural bridging—de Vaan et al. develop separate measures of each for creative teams of video game developers. Furthermore, they show that it is a combination, in this case, it is a combination of structural and cultural bridging, that best explains creative success—as measured by critical acclaim Teams composed of groups (defined as subsets of creators who have worked together in the past) that share members with other groups within the team ("structural folding") *and* groups that bridge cultural holes by spanning large distances in categorical product space relative to other groups (as defined by the distance in product space of previously created games created) are the most likely to come up with both novel (category-atypical products compared to previous entries) *and* acclaimed cultural products.

Culture-Centric Approaches to the Study of Cultural Holes

Cultural Consumption Networks

Sokolova and Sokolov (2020) set out to study cultural holes by building a culture-centric network of literary authors based on patterns of fiction books co-borrowing from the municipal library network in St. Petersburg, Russia. Authors are strongly connected to the extent that there is significant overlap between the sets of people who read them. Sokolova

and Sokolov's primary goal is to ascertain whether institutionally consecrated objects (or objects consumed by high-status people)—which in Lizardo's original definition would count as "asset specific" or "strong" culture in Schultz & Breiger's (2010) sense—can themselves bridge cultural holes in a culture-centric network. They find, contrary to the idea that institutional consecration renders high-status cultural goods "niche," that the most consecrate authors are also the ones most likely to bridge cultural holes—as given by Burt's constraint measure and betweenness centrality—and the same goes for authors more likely to be read by college-educated audiences. These results are consistent with Lewis & Kaufman's (2018) warnings regarding the *relativity* of exogenous markers of the status of cultural goods, as the latter have no logical link to whether they serve as strong or weak culture since these last speak to *formal properties* of such goods within a local ecology. Sokolova and Sokolov's study show that in a context where consecrated and high-status works are generally valued, they behave very much like we would expect "popular culture" would; as bridges within the cultural network.

Cultural Holes in Text Networks

Perhaps the most exciting recent advance in the culture-centric analysis of cultural holes is Stoltz & Taylor's (2019) proposal to measure "discursive holes" in-text similarity networks. The recent rise of computational social science has brought a slew of techniques to analyze large-scale text data. However, almost all the now well-established methods yield some weighted text-to-text network where the edge weight is based on the similarities—and by implication, the distances—between each pair of texts. Although each analytic technique—e.g., topic models, word-vector embeddings—produces a different criterion for similarity, every text analyst deals with such a network. For instance, Stoltz & Taylor note that topic models yield a two-mode matrix of texts by topic, where the row entry for text is the probability that text i engages topic j (with the probabilities summing to one row-wise). This argument can be generalized to the analysis of two-mode network data more generally beyond texts since every one-mode projection is, in fact, a potential similarity (or distance)

matrix across the nodes in each mode (Everett & Borgatti, 2013). Following this insight, Stoltz & Taylor use a measurement strategy developed for agent-centric cultural analysis (e.g., Lizardo, 2014) but deploy it in the culture-centric level of texts in discursive fields. They thus propose a measure of "textual spanning" (cultural-hole bridging) for particular texts based on a simple idea: Within a discursive field defined by a textual similarity space, *texts bridge cultural (discursive) holes when they are similar to texts that are themselves dissimilar*. Stoltz & Taylor go on to show that this approach to measure cultural-hole spanning generates insights about the positionality of texts in discursive space that are occluded by using standard "medial" or "radial" centrality measures based on the weighted path distance (like betweenness and closeness).

Cultural Holes, Atypicality, and Categorical Diversity

While not couched in explicit network terms, Goldberg et al.'s (2016) approach to analyzing cultural boundaries is based on the fundamental cultural holes imagery. Importantly, their approach can be interpreted as engaging in agent and culture-centric analysis simultaneously by defining agent-centric properties relevant to cultural hole bridging using culture-centric ones.[6] The critical difference is that rather than departing from a *two*-mode network of people by cultural objects chosen, they develop concepts and metrics linked to a *three*-mode network of people, objects, and the *category labels* applied to those objects (e.g., by audiences like critics, consumers, or websites). The key observation from the perspective of the cultural holes model is that sets of objects in a given cultural domain (e.g., movies, cuisines, art, and the like) and sets of labels (Action, Cambodian, Cubist, and the like) can bridge cultural holes by spanning wide distances in label space. People, in turn, can bridge cultural holes by choosing categorically distinct objects *or* objects that bridge across category labels.

For instance, we can begin by constructing a two-mode object-by-label two-mode network—where object *i* is linked to label *j* if that label is applied to that object (Kovacs &

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[6] See Kovacs (2010) and Lizardo (2018) for related approaches.

Hannan, 2015). We can then use variations of the Breiger (1974) projection approach to define a one-mode label-by-label network (Everett & Borgatti, 2013). In this network, strongly related labels have significant overlaps between the set of objects each label is applied. On the other hand, category labels are weakly related when the overlap between the label sets is relatively small (Silver et al., 2022). In this way, the weighted label-to-label network encodes the relative *similarity* of each pair of labels. By implication, this network also encodes inter-label distance since, as Hannan and Kovacs (2015) note, similarities between labels are an inverse function of distance in some conceptual space (Gardenfors, 2014). Strongly related labels are close, while weakly related labels are far. Accordingly, we can construct a derivative label-to-label network where the weighted links are given by pairwise distances, using some suitable mathematical transformation of the original pairwise similarities.

Given that each object is assigned a set of labels, we can then aggregate or average the pairwise distances of the labels assigned to each object. According to this metric, atypical objects will receive high scores, while typical objects will receive lower scores. This is another way of saying that *atypical objects bridge cultural holes across labels*. We can also use the inter-label distance information to define an object-by-object network. The weighted link between objects is given by the average similarity between the two sets of labels assigned to the objects incident to each edge. The inter-object network thus encodes the relative *categorical distinctiveness* between each pair of objects, with categorically non-distinct objects clustering together and categorically distinct objects falling in separate communities. As with labels, we can generate a derivative inter-object network by transforming inter-object similarities into distances.

With this information in hand, we can loop back to the agent's perspective and define a person's *taste for atypicality* by aggregating or averaging the atypicality scores of the objects they choose (as encoded in a two-mode network of people by objects chosen).[7] Thus, *agents*

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[7] Goldberg et al. (2016) distinguish "sampling" an object from "liking" an object (technically defining a two-mode multigraph with "sampling" and "liking" edges between people and objects), but that is a complication that is not relevant to our purposes.

can bridge cultural holes by selecting atypical objects, namely, objects bridging culture holes in label space.[8] However, there is a second way to define an agent's penchant for bridging cultural holes in their consumption choices. Similarly, we can define a person's *taste for variety* by aggregating or averaging the pairwise distances of the objects they choose. Thus, *agents can bridge cultural holes by selecting categorically distinct (sets of) objects*. As Goldberg et al. (2016) show, these two agent-centric ways of bridging cultural holes are conceptually and empirically distinct, as the atypicality of an object relative to the set of labels it is assigned is not definitionally linked to its categorical distinctiveness relative to other objects.

Importantly, tastes for variety and atypicality are empirically distinct from the sheer numerical *quantity* of objects chosen—what has been referred to in the literature as "omnivorousness by volume" (Lizardo, 2014). In the case of atypicality, for instance, a person can bridge cultural holes even when selecting a single (e.g., highly atypical) object—"univores" are therefore capable of bridging cultural holes. Alternatively, a person can select many categorically non-distinct objects, thus failing to bridge in the variety sense—quantitative "omnivores" are therefore not guaranteed to bridge cultural holes. Because they are distinct, agents may have a high or low taste for atypicality combined with a high or low taste for variety, yielding three ways to bridge cultural holes. For instance, people can choose (or like) categorically a small set of indistinct atypical objects ("mono-mixer"), a large set of categorically distinct typical objects ("poly-purist"), or a large set of categorically distinct atypical objects ("poly-mixer").

While being a poly-mixer may seem like the ultimate way to bridge cultural holes, Goldberg et al. (2016) provide suggestive evidence that the "high-status" omnivore who populates much work in the sociology of taste (see Jarness & Friedman, 2017) is a person who bridges cultural holes in the variety sense, but who *refuses* to do so in the atypicality sense. These poly-purist omnivores decide instead to "police" categorical boundaries (e.g., by

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[8] In the same way, community detection on the inter-object network yields clusters of categorically similar objects separated from other sets of categorically dissimilar ones.

downgrading atypical objects), thus sharpening the typicality of objects and increasing opportunities for cultural hole spanning.

Concluding Remarks

We opened the chapter by considering whether "culture and networks" is a research specialty, a research cluster, or something else. I noted that the answer to these questions depends on the degree of unity we seek. On the one hand, we can be content with a rather superficial thematic unity based on topics and substantive emphases. On the other hand, we can seek a deeper unity based on the underlying theoretical models—or, more loosely, as referred to here, "imageries"—analysts rely on to develop theories, formalization, measures, and hypotheses in their work. I argue that such underlying unity does exist in the field and is centered around two underlying *ur*-models: constructuralism and cultural holes. I showed how research using this imagery has progressed by addressing a coherent set of problems and issues and by extending theoretical models and claims to speak to the limitations of previous formulations.

Constructuralism

For instance, regarding constructuralism, Mark built his network ecology model on partial constructuralist insights, and Lizardo's conversion model developed the constructuralist strand left behind in the network ecology formulation. Subsequently, Lewis and Kaufman responded to weaknesses in the conversion approach, generalizing and distinguishing between various conversion mechanisms while linking to the larger cultural ecology. Finally, Goldberg and Stein's associative diffusion model develops the somewhat rudimentary cognitive foundations of original constructuralism by incorporating insights from the schematic construction of cultural meaning while incorporating cognitive consistency mechanisms into the interactionist constructionist imagery. The ADM thus moves beyond the limitations of network ecology, constructural, and conversion Models, all of which are tied to limiting conceptions of piece-meal cultural diffusion. The cutting-edge of future work in this area thus

lies in further integration between social network, interactionist, cultural, and cognitive mechanisms in processes of cultural creation, transmission, and diffusion and in generating observable patterns of cultural niche creation, maintenance, and dissolution—e.g., in the vein of Fuhse (2021), Goldberg & Stein (2018) and de Vaan et al. (2015). Importantly, this will require more sophisticated models of how culture is internalized and processed by people embedded in social network structures and subject to interactional constraints and asymmetries (Arseniev-Koehler & Foster, 2020; Foster, 2018; Lizardo, 2021). Additionally, we will have to keep firmly in sight the double emphasis of constructuralism as both a theory of what networks *do* and a theory of *where networks come from*.[9]

Cultural Holes

Research on cultural holes has also developed rapidly since Pachucki & Breiger (2010) introduced the idea, with accompanying innovations in measures, formalization, and the range of substantive applications. I argued here, however, that behind the thematic unity of the various studies, and even above and beyond the underlying conception of "duality," there is an underlying theoretical imagery, linking agents and cultural objects (broadly defined) to mutually defining positions in a field (Puetz, 2017). As we saw, the cultural holes models can even be seen as a positional, comparative-statics-cousin to constructuralism's cognitive interactionism since both models share a common strand in Breiger's (1974) duality idea.

Accordingly, the cultural holes argument relates the agent's and object's position in socio-cultural and cultural-social structures to various substantive outcomes (e.g., creativity, spanning, cosmopolitanism, vision) of interest to the analyst. In this particular way, the cultural holes argument has been interpreted and used similarly to its sociometric "structural holes" cousin. As we saw, however, a key implication of recent work in this area is that cultural and structural hole bridging must be kept analytically distinct; one cannot be inferred from the other as has been the practice of assuming that structural brokers are also cultural

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[9] That is, constructuralism functions as both a "network theory" and a "network theory of networks" in Borgatti and Halgin's (2011) sense.

brokers (Goldberg, Srivastava, et al., 2016; Graham et al., 2022). The cultural holes model is distinct from its sociometric cousin because it conceives the "position" people occupy in socio-cultural space as driven by analytically distinct (but coupled) dynamics from those driving the construction and the dissolution of sociometric ties. Recent advances in measuring culture from free-form text data using computational linguistic techniques have thus helped clarify the empirical contribution that people's position in the cultural information space has on key outcomes, as distinct from their "structural" position in a network of social ties.

Another advantage of treating the idea of cultural holes as an underlying *ur*-model is that we can then integrate work that, while not nominally claiming to belong to this camp, *formally* does so, like work on categories, cognition, and category-spanning in organization and management studies (Goldberg, Hannan, et al., 2016; Hannan et al., 2019; Silver et al., 2022), this is something that would have been impossible had we remained at the more surface level of commonalities based on explicit concepts or formal modeling procedures. Nevertheless, as work using the cultural holes imagery moves forward, more explicit formalization of the cultural holes argument, perhaps a *deepening* of the idea of cultural holes in a more dynamic vein (e.g., toward temporal two-mode networks), such as by more explicit use of dynamic computational models and simulation—a la constructuralism and associative diffusion—seems to be called for, since most work in the cultural holes approach uses static measures of position. In the same way, an *extension* of the cultural holes imagery outside of fields where it has been exploited the most (e.g., cultural production and consumption), such as knowledge production in science (Vilhena et al., 2014), or entrepreneurship and innovation—as with Choi's study mentioned earlier—would help stretch the paradigm, and lead to further conceptual and empirical development.

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