Omnivorousness as the Bridging of Cultural Holes: A Measurement Strategy[1]

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Abstract

Recent research and theory at the intersection of cultural sociology and network analysis has converged around the notion of *cultural holes*: patterns of cultural choice that position the person as a bridge not between other persons but between cultural worlds. This is an approach that promises to open up new vistas in our conceptualization of the relationship between social position and cultural taste, but which so far lacks operational grounding. In this paper, I draw on Breiger's (1974) formalization of the idea of the duality of persons and groups along with classical formalizations of brokerage for sociometric networks (Burt 1992) to suggest that the "cultural ego network" of a typical survey respondent can be reconstructed from patterns of audience overlap among the cultural items that are chosen by each respondent. This leads to a formalization of the notion of omnivorousness as relatively low levels of clustering in the cultural network: namely, omnivorousness as *cultural network efficiency*. I show how this metric overcomes the difficulties that have plagued previous attempts to produce ordinal indicators of omnivorousness from simple counts of the number of cultural choices, while providing novel substantive (and sometime counter-intuitive) insights into the relationship between socio-demographic status markers and patterns of cultural choice in the contemporary United States.

1 Introduction

In this paper, I develop an analytic framework for the conceptualization and measurement of "omnivorousness" that draws on recent theoretical developments in the sociology of culture around the notion of *cultural holes*: patterns of cultural choice that position the person as a bridge not between two disconnected persons but between disconnected cultural forms. The proposed framework draws on several theoretical and methodological sources: (1) Breiger's (1974) formalization of the idea of the duality of persons and groups; (2) DiMaggio's (1987) extension of the two-mode network imagery for defining genres as clusters of relations between persons and cultural forms; (3) recent calls to extend theoretical notions first developed in a sociometric context to the connection between persons and cultural forms (Pachucki and Breiger 2010); and (4) recent developments in social network analysis and network science that extend and develop metrics for the analysis of ego-network and two-mode network data (Burt 1992; Everett and Borgatti 2005; Latapy et al. 2008; Hidalgo and Hausmann 2009; Faust 1997).

I use these analytic tools to suggest that the "cultural ego network" of a typical survey respondent—including the extent to which their cultural choices are connected to one another—can be reconstructed from patterns of *audience overlap* among the cultural genres that the respondent chooses, information that is readily available in the usual arts participation survey. From there, it is straightforward to construct analogues of network efficiency—see e.g., Burt (1992) for the definitive formalization—for each individual in the data set. This quantity can give us an intuitive index of the extent to which a person's cultural choices allow her to bridge across cultural worlds that are only weakly connected to another or constrain her in a cultural network composed of redundant attachment to cultural forms with overlapping audiences. I argue that this is the most natural empirical specification of the concept of omnivorousness, one that transcends the limitations of other measurement strategies and provide a natural link to the notion of cultural holes.

2 The Cultural Holes Argument

Recent theoretical developments at the intersection of cultural sociology and network theory seek to provide novel ways to move beyond traditional conceptualizations of networks as simply

the "conduits" through which cultural contents flow and of culture as a disembodied abstraction devoid of a relational basis (Pachucki and Breiger 2010; Mische 2011; Fuhse 2009). One of the key contributions of this line of theory for the sociological study of taste and culture consumption is the proposal that the very relations between persons and the cultural forms that they choose can be productively analyzed using the conceptual resources and methods adapted from network analysis (DiMaggio 2011).

These efforts promise to bring some much needed analytic specificity and theoretical bite to Peterson's (1983) re-thinking of expressive consumption as empirically detectable *patterns* of cultural choice. In what follows, I seek to contribute to this line of thinking on the culture-networks link. I present a general analytic and measurement framework that I believe is useful in furthering the conceptualization of expressive cultural choice patterns as inducing a network of persons connected to the cultural items that they choose. This requires that we treat the standard persons by variables matrix in which survey data are coded and made available to analysts as an example of a *two-mode* network. This is a proposal that has been made before (Borgatti and Everett 1997), but the theoretical and measurement implications of which have yet to be fully taken seriously in the sociological study of cultural taste (but see Goldberg 2011).

I suggest that this re-conceptualization of the usual Arts Participation Survey data available to researchers in the sociology of taste can provide us with a more powerful theoretical lens to tackle outstanding measurement issues in the quantitative study of cultural stratification (Peterson 2005). This pertains in particular to research relevant to theorizing socially consequential heterogeneity in personal patterns of cultural choice (Bourdieu 1984; Lizardo 2006a; Ollivier 2008; Peterson 1992; DiMaggio 1987; van Eijck 2001). I demonstrate the productivity of this measurement approach by showing how the key organizing concept of quantitative cultural stratification studies, Peterson's (1992) notion of "cultural omnivorousness" can be readily rethought as indexing the capacity of persons to bridge gaps in the "cultural structure." I focus on one key conceptual advance that has emerged in recent theorizing of the culture-network linkage: the notion of *cultural holes* (Pachucki and Breiger 2010). This is a natural generalization to the two-mode (person by cultural items) case of Burt's (Burt 1992) pioneering formalization of patterns of advantageous and disadvantageous

positioning in social networks as given by the "redundancy" of the contacts that ego is connected to.[2]

The key to the cultural holes argument is as follows. It is clear that we can specify structural positioning in social (person to person) networks that are analytically distinct from simply the number of connections that persons make (because they get at patterns of *bridging* across network clusters). This means that it is also possible to do the same in person-to-culture networks. As Pachucki and Breiger (2010: 13) note, "The notion of cultural holes points to the structuring of boundaries and the *lack of complete connections among cultural forms*" (italics mine). In what follows, I show that we can cash in on this proposition by taking advantage of the fact that cultural forms are connected to one another through the persons that choose them (DiMaggio 1987). Thus, in the very same way that we can ascertain whether persons serve as bridges between different social worlds in the context of standard sociometric measurement strategies, the usual Arts Participation survey data set contains information that can be exploited to ascertain the extent to which persons serve as bridges between the different cultural forms that they choose.

2.1 An Illustration

The basic intuition behind the cultural holes argument is illustrated in Figures 1 and 2. The figures display the cultural "ego-network" of two hypothetical respondents each of whom make the same number (four) of cultural choices of the kind that are typically available in arts participation surveys (such as the NEA's Survey for Public Participation in the Arts). The cultural ego-network is naturally centered on the respondent ("ego" in the figure); an edge is drawn between the person and each of the cultural items that he or she reports liking or engaging in. Additionally, and most importantly, cultural items are conceptualized as (somehow) being connected to one another, so there are edges connecting each cultural item to other cultural items. The *strength* of the connections between cultural items is given by the number corresponding to each of the bi-directional arcs linking each of the red vertices (proportional to the width of the culture to

[2] Note that in contrast to some interpretations of the structural holes argument, in the cultural holes argument, there is no implication that persons "strategically" choose their positions in between cultural holes to extract information or control advantages. Instead, any advantages accrued to individuals emerge as an unintended consequences of their cultural choices.

culture edges). These numbers are derived from actual survey data (the 2008 SPPA) and will be given substantive motivation and mathematical formalization below; for now, it is only sufficient to focus on their relative magnitude.

[Figure 1 about Here]

Some pairs of cultural items, such as Listening to Rap and Listening to Gospel music (shown in Figure 2), are only weakly connected to one another as we would expect given the well-documented socio-demographic differences between their respective audiences. Other cultural items, such as Listening to Country Music and listening to Classic Rock (shown in Figure 1), are strongly connected to another. We would like to say that the person who makes the set of cultural choices shown in Figure 2 is more likely to be a bridge between *cultural holes*—such as the one that separates the typical hip hop and rap enthusiast (Tanner et al. 2009) from the typical Opera fanatic (Benzecry 2009)—than the person that makes the set of choices in Figure 1. Researchers in the sociology of taste (in particular those who think of omnivorousness in typological or categorical terms) would also want to say that the first person is *omnivorous* than the other one (e.g. van Eijck 2001). There is thus a formal and conceptual homology between the theoretical notion of omnivorousness and emerging understandings of what it means to bridge a cultural hole. In fact, it is clear that from a structural perspective, an omnivorous person is one who is capable of bridging different cultural (and by implication social) worlds (Peterson 1992; DiMaggio 1987).

[Figure 2 about Here]

In the analysis of sociometric data, there already exists a well-known set of metrics for quantifying the extent to which ego bridges across different social worlds (Burt 1992). Thus, to cash in on the proposed formal homology between omnivorousness and cultural holes, we require an analogue to such indices for cultural network data. This will allows us to sharpen our intuition that the person portrayed in Figure 2 is bridging cultural worlds to a greater extent than the person portrayed in Figure 1.

3 Reconceptualizing omnivorousness

3.1 Omnivorousness as centrality in the cultural network

The literature on cultural omnivorousness has endeavored—with only mixed success (Peterson 2005)—to provide empirical indices of this concept in a way that highlights the tendency of individuals to cross stylistic boundaries in their cultural choices (van Eijck 2000, 2001; Van Eijck and Lievens 2008).

One simple (if somewhat criticized) approach to generating an ordinal scale of omnivorousness is simply to add the *number* of cultural items that the person chooses. Redefining the standard rectangular data matrix as an $i \times j$ persons by cultural items affiliation (also called "two-mode") network, gives us new insight into this empirical index of omnivorousness. From this perspective, "omnivorousness by volume" is given by:

$$OV_i = \sum a_{ij} \quad (1)$$

Where a_{ij}=1 if person i chooses genre j. In terminology appropriate for the analysis of two-mode networks, omnivorousness by volume is simply the *degree centrality* of the person in the cultural affiliation network; conversely, the "popularity" of a genre is its centrality in the other mode (Faust 1997; Hidalgo and Hausmann 2009). It is a long-standing observation in network research that centrality tends to be correlated with many factors of interest (including as we will see below, the capacity to bridge cultural holes). This explains why the humble OV index actually exhibits high-levels of criterion validity (Warde et al. 2008; Fishman and Lizardo 2013). In spite of this, omnivorousness by volume has been rejected by some as appropriate for capturing the essence of the omnivorousness phenomenon precisely because of the intuition that even when persons make the same *number* of choices, they may still be a difference in the levels of omnivorousness of those choices. A solution to this problem emerges once we take into account that persons make choice among cultural forms that are themselves connected to one another.

3.2 The cultural network

We have seen that in order to develop a natural metric quantifying the ability of a given individual to bridge across cultural holes, it is not enough to have a sense of the *number* of items

that the individual is connected to (omnivorousness by volume). It is also crucial to quantify the extent to which the cultural items that the person chooses are connected *to one another*. That is, we need to generate a *weighted network of cultural items* in which the entry o_{jk} in the adjacency matrix **O** gives us the strength of the connection between cultural item *j* and cultural item *k*. I propose that this cultural item by cultural item network can be induced by resorting to the duality property (Breiger 1974; Faust 1997): Cultural items are connected to one another through the persons that choose them—thus defining boundaries between genres (DiMaggio 1987)—in the very same way that persons end up being (indirectly) connected to one another because they make similar cultural affiliation choices (McPherson 2001).

Treating the standard $n \times k$ data matrix of persons by items given by the usual arts participation survey as a two-mode network we can generate a $k \times k$ cultural network (**C**) through the projection formula (Breiger 1974):

$$\mathbf{C}=\mathbf{A}'\mathbf{A} \qquad (2)$$

Where **A** is the original rectangular persons by items data matrix. The entries c_{jk} of the **C** matrix now represent the number of persons in the sample that report liking or engaging in *both* cultural activities *j* and *k*. The diagonals of the matrix (c_{jj}) are the total number of persons that report engaging in the j^{th} activity. We can generate a weighted cultural network (Barrat et al. 2004), represented by adjacency matrix **O**. The entries o_{jk} in the matrix are obtained by calculating the extent of *overlap* (Latapy et al. 2008) between all pairs of cultural items:

$$o_{jk}= \frac{c_{jk}}{min(c_{jj},c_{kk})} \qquad (3)$$

This is essentially the "min-clustering" between any two pairs of genres included in the survey;[3] $o_{jk}=1$ when the audience of the smaller of the two genres is fully contained in the audience of the genre with the larger audience; $o_{jk}=0$ in the (empirically unlikely) limiting case of two genres having fully disparate audiences. In the weighted network cultural items that share an

[3] Taking the maximum instead of the minimum leads to the "max-clustering" interpretation (Latapy et al. 2008).

audience will be strongly connected to another (will have larger values of o_{jk}), while cultural forms with disparate audiences will be weakly tied to another, as represented by smaller o_{jk} values. Naturally, $o_{jk}=1$ for all $j=k$.

3.3 Revisiting omnivorousness by volume

The overlap matrix of cultural items can be used to construct an index of the extent to which persons live in clustered versus less constrained cultural worlds. This is of particular interest when the task is to produce an index of the extent to which a person is embedded in a cultural ego-network that features strong audience overlap between cultural items versus one that is composed of cultural forms that are only weakly connected to one another. To the extent that the cultural choices of a given individual approximate the latter pattern, we can speak of an individual bridging across cultural holes. In this section, I use the audience overlap information embedded in the cultural network representation to develop a new measurement strategy that is consistent with the intuition that persons may differ in levels of omnivorousness even when they are equivalent in *number* of choices made. This approach addresses the concerns that have motivated researchers to move towards (increasingly elaborate) empirical indicators of omnivorousness beyond the OV ordinal index, and shows it to be a special case of a more general quantity.

Before getting to that, it is important to point out that the *OV* index has been somewhat unfairly maligned in the literature. While it is true that ultimately this indicator leaves something to be desired, it is also instructive (from a measurement perspective) to highlight the number of appealing properties that it possesses. First, *OV* is simple and requires no specialized apparatus–-such as factor analysis, latent class analysis, or correspondence analysis–of statistical estimation to compute. Simplicity is a virtue in this context for a variety of reasons. Simple indices are easier to replicate across studies, require the postulation of fewer untestable assumptions, and make fewer demands on the data. Second, whatever its ultimate flaws, *OV does* capture an important feature of our intuitions about omnivorousness: the fact that it an *ordinal* (not a metric) concept. In other words, researchers are usually interested in ranking respondents into some sort of *order*, so that they can say things like "on average respondents with college degrees are more omnivorous than respondents without a college degree" or on average persons have become *more* omnivorous over time." There are various reasons to prefer this ordinal formulation, not the least of which is that

(like essentially every other "measure" in the social sciences) while the ordinal scale can be justified, metric and other interval scales (as well as typologies based on so-called "latent" factors) cannot (Cliff 1996; Michell 2005). Other approaches to indexing omnivorousness either attempt to force-fit (usually unjustifiably) the concept into one that is presumed to be covertly metric (e.g. omnivorousness as some sort of latent trait with a continuous structure) or lose the appealing ordinal property of omnivorousness by forcing it to be a cell in a nominal typological space.

The problem with OV_i has been noted repeatedly: it assigns respondents equal ordinal ranks, when our intuition tells us that those respondents do not have "equal" levels of omnivorousness. In our terms, respondents are misclassified on the ordinal rank by being assigned equal values on the scale when they should be receiving different values. Thus, the two hypothetical respondents shown in Figures 1 and 2, would both receive a score of "four" if we go by OV_i, which is counter-intuitive (and empirically misleading) given their cultural choice patterns. Factor analytic methods capture the intuition that these two patterns of cultural choice are distinctive by postulating that genres fall into types and the persons that like genres across types are more omnivorous that persons that like genres that all belong to the same type (van Eijck 2001). However, factor-analytic methods lose the ordinal simplicity of the volume index and make high demands on the data, by presuming for instance the existence of non-observable latent variables (themselves endowed with metric structure) that account for the correlation between the items. Factor analytic methods also force the researcher to make controversial assignment decisions of genres into types, which is most problematic for genres that cut across types (e.g. where the assignment of genres into categories is "fuzzy" rather than crisp (Hannan et al. 2007). Finally, factor-analysis is limited to extracting information on patterns of covariance among the cultural indicators, losing the information contained in the pattern of *relationships* between actors and items.

3.3.1 Effective Omnivorousness

I propose an ordinal index of omnivorousness adapted from the analysis of the local structure of sociometric ego-networks that has the virtues of both simplicity and intuitiveness, while dealing with the main objection that motivates analysts to reject the ordinal OV index. This index uses the audience overlap matrix to penalize persons who choose genres that are themselves strongly connected to one another (e.g. have high audience overlap). Conversely, persons who choose

genres which are not strongly connected to one another (e.g. belong to relatively distinct audience clusters) are assigned a higher score. In our terms, persons who bridge cultural holes are considered more omnivorous, even when they select the same number of genres as persons who choose genres with strong audience overlap. Some readers may have already noted that this is the same strategy used by (Burt 1992: 52) in developing what he referred to as an "effective" ego-network size metric. I will refer to our analogue index as "effective omnivorousness" (EO).

Using the notation developed so far, EO is given by:

$$EO_i = \sum_{j \in N(i)} \left[a_{ij} - \left(\frac{1}{OV_i - 1} \sum_{k \in N(i)}^{k \neq j} o_{jk} \right) \right] \qquad (4)$$

Where everything is as above and $N(i)$ is the "cultural neighborhood" (the set of all genres chosen) of the i^{th} person. The main difference between *OV* and *EO* is that *OV* assigns a value of one to each link between a person (i) and a cultural item (j) and sums across the number of items that a person chooses, essentially giving the same weight to each genre. *EO* does the same thing but subtracts the quantity enclosed in parentheses from the initial value of one for each edge linking a person to a cultural item. This is the average overlap of the j^{th} genre with all of the other genres that the person chooses. The choice of a genre that is itself strongly tied to other genres that a person chooses counts for less than a link to a genre that is weakly tied (has low audience overlap) to the other genres that the person chooses. While not immediately obvious, note that when we set the genre overlap matrix **O** to the null matrix ($o_{jk}=0$ for all j, k) in equation 4, essentially ignoring genre overlap, then EO = OV. The effective omnivorousness score thus makes explicit the informal intuitions of those who see *OV* as limited; the volume metric is a limiting case of *EO,* one that does not take into account the extent of audience overlap between the genres chosen by each person.

3.3.2 Cultural Network Efficiency

Once we have calculated *EO* for each person, then it is easy to derive a simple metric of the extent to which a person tends to bridge cultural holes that is independent of the number of genres that the person chooses. This metric redeems the intuition that some persons are more likely to bridge across cultural worlds even when choosing the same number of genres. Essentially this is the "efficiency" (Burt 1992: 53) of the person's cultural network (CNE), and is given by the ratio of effective omnivorousness to omnivorousness by volume:

$$CNE_i = \frac{EO_i}{OV_i} \qquad (5)$$

Cultural network efficiency equals one in the limiting case that $OV=EO$ (the person chooses cultural forms with zero audience overlap) and equals zero in the limiting case that $EO=0$ (the person chooses cultural forms that have completely overlapping audiences). In most empirical settings we would expect these extremes to be highly unlikely, with $0 \geq CNE_i \leq 1$.

[Figure 3 About Here]

4 Analytic Strategy

4.1 Constructing the Cultural Network

In this section, I examine the general criterion validity of cultural network efficiency and reflective omnivorousness as indices of the extent to which the person bridges cultural holes. To that end, I use data from latest wave (2008) of the Survey for Public Participation in the Arts (SPPA). The survey includes information on the respondent's musical taste, literary taste and participation in various leisure and arts-related activities. I restrict the analysis to the cultural items corresponding to both musical and literary choices (K=23). After deleting respondents (a) with missing information on at least one of the items, and (b) respondents who chose less than two items, we are left with a rectangular data matrix of dimensions 4190×23, with the number of rows indexing the number of respondents included in the sub-sample.[4] This matrix is coded so that it contains only binary entries with $a_{ij}=1$ if the i^{th} respondent reports choosing the j^{th} cultural item.

To construct the cultural network, I transformed the rectangular two-mode ($i \times k$) persons by cultural items matrix into a 23×23 one-mode matrix where the jk^{th} cell contains the number of

[4] Note that effective omnivorousness is not defined for persons who choose not items ($OV_i=0$), while for strict univores (persons who choose only one item), effective omnivorousness is always (trivially) equal to the raw omnivorousness by volume score.

respondents that choose those two cultural items as specified in equation 2. I then compute the min overlap between each item as outlined above in equation 3. I use the sample estimates of each overlap score (o_{jk}) to compute empirical estimates of EO_i, and CNE_i for each respondent as given in equations 4 and 5. To keep matters simple, I use a binarized version ($\mathbf{O}^{bin}$) of the genre overlap matrix instead of the raw overlap scores. The binarized cultural network matrix is constructed by using 0.5 as the cut-off value (this is the mean overlap across all of the cultural items). Thus, $o_{jk}^{bin}=1 \rightarrow o_{jk} \geq 0.5$, otherwise $o_{jk}^{bin}=0$.

A visualization of the resulting network of cultural items if shown in Figure 3. The figure reveals an intuitive core-periphery arrangement (Borgatti and Everett 2000). Genres associated with the commercial arts (e.g. "industry" genres in music (Lena and Peterson 2008)) are located at the center of the network (e.g. Classic and Contemporary Rock, Country, Mysteries), exhibiting high-levels of overlap with just about every other genre. These are surrounded by niche cultural tastes located at the periphery of the diagram (e.g. Rap and Romance Novels) which are not connected to one another (with some natural exceptions such as religious books and gospel music).

[Figure 4 About Here]

4.2 Univariate Distributions

The univariate distribution of the relevant quantities is shown in figure 4. Not surprisingly, it is easy to appreciate that the distribution of the number of choices (OV_i) is shifted to the left, with a "long tail." Most persons make few to a moderate number of choices, but a non-negligible proportion of persons make a large number of choices. As shown in the second panel, adjusting the volume metric to account for genre overlap produces efficient omnivorousness scores that are even more inequitably distributed (the distribution falls at a faster rate as we move right and the proportion of persons with small values increases). This is consistent with the intuition that raw volume hides substantively relevant individual differences in omnivorousness by ignoring the overlap between cultural choices. The third panel shows the CNE_i (the ratio of EO to OV) distribution. Here we can see that while both OV_i and EO_i are skewed right, the ratio of the two

quantities displays a more equitable (normal) distribution ($\mu = 0.30$; $\sigma = 0.25$), with the majority of respondents found in the $0 \geq CNE_i \leq 0.6$ range. For the typical respondent the omnivorousness by volume score is about four times as large as the adjusted (effective) score. This is consistent with the intuition that persons differ in their omnivorousness levels even when they make the same number of choices.

4.3 Removing Statistical Dependencies based on OV_i

The main substantive issue is the extent to which the *pattern* of cultural choices that individuals make leads them to be more or less likely to bridge structural holes. In order to make headway in answering this question we have to deal with one important analytical roadblock. Namely, persons will be more (or less) likely to bridge cultural holes even if there is no substantively interesting pattern in their cultural choices solely due to the fact that (given a heterogeneous distribution of audience sizes across genres) persons who make more choices will be more likely to choose genres with relatively disparate audiences than persons who make a smaller number of choices. Thus, any sociodemographic characteristic (e.g. education) that is correlated with OV_i will have a (non-substantive) correlation with both EO_i and CNE_i. That is, persons who choose more genres will have a higher effective omnivorousness (and thus a more efficient cultural network) than persons who choose less genres, but we will not be able to tell whether this is because of the simple fact that they choose more genres, or whether (within levels of OV_i) this is due to the structure of their choice set.

[Figure 5 About Here]

I deal with this issue as follows. Continuing to treat the observed data matrix as a two-mode network, I use the link rewiring procedure proposed by Maslov and Sneppen (2002) to generate a randomized version of the data that preserves its main topological properties. The algorithm (depicted in Figure 5) is simple: we select two random individuals and one random cultural item from their respective cultural neighborhoods (the set of cultural items that the individual has chosen). We then proceed to swap the person to cultural item link for each individual so that each person comes to be connected to the item chosen by the other and vice-versa, while eliminating the

previous connection. We then repeat this for a pre-determined number of trials until we can be sure that we have randomized most of the choices (larger data sets require more trials). For these data, I repeated the link rewiring procedure for 10^5 trials. After this we are left with a data set that is identical to the original one in terms of the respective centralities across each mode—preserving both the distribution of choices across persons (the observed OV_i for each individual) and the distribution of expansiveness for each item (the popularity of each genre)—but devoid of any higher order effects due to the pattern of cultural choices across persons.

Using this randomized version of the data, I calculate a series of parallel metrics for effective omnivorousness and cultural network efficiency (EO_i^{rnd} and CNE_i^{rnd}). I then use these as dependent variables in a standard regression analysis. Comparing coefficient estimates from these models to those obtained using the response variables from the real data provides information on which individual differences are primarily driven by stochastic links between number of choices and the probability of bridging a cultural hole, and which ones are connected to systematic features of the cultural choice pattern of persons who belong to a given sociodemographic category.[5]

[Table 1 About Here]

5 Results

In the following analysis, I consider five sociodemographic markers that have been of interest to researchers in the sociology of taste: education, age, gender, ethnoracial status, and marital status. Table 1 shows coefficient estimates of regression models predicting OV_i (raw number of choices made) in column 1, cultural network efficiency in the observed data (column 2) and cultural network efficiency in the randomized data (column 3). Column 1 reports coefficients (estimated via maximum likelihood) from a regression model in which the conditional mean is

[5] To ascertain whether the randomization procedure was effective, I computed the zero-order Pearson correlation coefficient between CNE_i and CNE_i^{rand}, which as expected is close to zero ($r = 0.012$).

specified to follow a *truncated* Poisson distribution (Cameron and Trivedi 1986).[6] Columns 2 and 3 report coefficients from a *fractional logit model*, which is appropriate for continuous response variables that are bounded between zero and one (Papke and Wooldridge 1996). In the table, *t*-statistics (the ratio of the corresponding coefficient to its standard error) are reported to the right of each coefficient estimate. In all models, standard errors are calculated using the "robust" (Huber-Sandwich) estimator of the variance. A *t*-ratio of about 2 to 1 (e.g. 1.96, corresponding to $p = 0.05$) is considered within the bounds of statistical significance at conventional levels; a t-ratio closer to one-and-a-half to one (e.g. 1.65, corresponding to $p = 0.10$) is considered within the "borderline" of a statistically significant result. Larger ratios imply greater certainty around the point-estimate.

5.1 Socio-demographic correlates of cultural holes

5.1.1 Education

As shown in the first and second columns of Table 1, the educated not only make a larger number of choices than other respondents ($t = 16.30$), but are also appear to be more likely to choose genres with disparate audiences ($\beta^{educ}=0.227$). In this respect, we may conclude that—consistent with classical theoretical sources in the culture and stratification literature (Collins 1975; DiMaggio and Mohr 1985)—the educated are indeed more likely to bridge cultural holes than the less educated ($t = 6.07$). However, as shown in the third column of the table, education predicts cultural network efficiency almost as well in the rewired data (where cultural choices are presumed to occur at random) as it does in the observed data ($\beta^{educ}=0.167$; $t=4.57$). This suggests that in large part, individual differences in the probability of traversing cultural worlds premised on education are driven by the cultural expansiveness of educated individuals (and the relative paucity of choices of the less educated) and not by systematic features of their cultural choice pattern that are independent of cultural network size.

[Figure 6 About Here]

[6] The truncated Poisson regression model is appropriate since OV_i is a count variable forced to have a lower bound of two.

5.1.2 Age

As shown in column 1 of Table 1, I find that age has a *curvilinear* effect on the number of cultural choices that a person makes, with the first order effect being positive (t=2.72) and second order (quadratic) effect being negative (t=−2.10), suggestive of an "inverted U-shape" curve (Stolzenberg 1980). This life-course pattern is consistent with previous research on age and arts participation that also finds that cultural activity is highest for middle-aged respondents in comparison to young adults and the elderly (Harrison and Ryan 2010). The non-linear effect of age on OV_i is illustrated in the left-hand panel of Figure 6. In the figure, circles mark the predicted number of genres for age groups ranging from respondents of age twenty to age seventy in ten year increments, while the vertical lines give us the 95% confidence interval around the predicted value. As the figure clearly shows, the predicted number of cultural choices peaks at about age fifty and begins to experience a slight decline thereafter.

When it comes to bridging cultural holes on the other hand, we find a decidedly different pattern (see the middle panel of Figure 6). Cultural network efficiency experiences a steep decline as we move from young to old (t=−7.16) albeit at a decreasing rate (t=5.76). As shown in Model 3 and in the right-hand panel of Figure 6, this result is strictly a product of the *pattern* of choices made by older and younger persons, since if it was based purely on the number of choices, then propensity to bridge cultural holes would also peak at middle age, and would never decline as steeply as we observe in the real data for older persons.

We can thus conclude that the cultural choices of younger persons are much more likely to feature genres with disparate audiences, while the cultural choices of older persons disproportionately draws from genres with overlapping audiences, hindering their capacity to bridge across cultural holes, even as they make a larger number of choices. It can thus be said that for older persons the cultural reality matches the socio-metric reality. The key finding in research on the dynamics of personal networks across the life course concerns the fact that as persons age, social networks decline in size and becomes less diverse losing weak-ties and elective friendship and becoming heavier with kin and close friends (Bidart and Lavenu 2005; Degenne and Lebeaux 2005; Aartsen et al. 2004; Marsden 1987; Burt 1991; Cornwell et al. 2008). The relative overlap

and homogeneity of the cultural choices of older persons comes to reflect their position in the social structure.

[Figure 7 About Here]

5.1.3 Gender

Studies dealing with gender differences in cultural participation reveal a very consistent picture (e.g. Bihagen and Katz-Gerro 2000). On average, women make a larger number of cultural choices than men, and outstrip men when it comes to most other indicators of cultural activity and arts participation (DiMaggio 2003; Lizardo 2006b; Christin 2012). In contrast to the realm of social capital, where women tend to be disadvantaged in comparison to men, in the cultural capital realm, we generally observe a female advantage. We should not only expect women to make a larger number of choices than men, but to live in less clustered cultural worlds.

The results shown in Table 1 are consistent with this argument. Women choose more cultural items than men (t=5.78), and they are more likely to choose items with non-overlapping audiences (t=5.76). Note that this effect disappears in the randomized data, suggesting that the propensity of women to bridge cultural holes *is not* a by-product of their allied propensity to choose more items (as it is for educated persons), but that it is traceable to the structure—not the raw number—of their cultural choices. In particular, this is likely because women are more likely to choose genres that cut across the institutional divide between the commercial and the more institutionalized non-profit arts, which are also less likely to have overlapping audiences (DiMaggio 2003; Lizardo 2006b; Christin 2012).

5.1.4 Gender and Class

A key mechanism governing the cultural and lifestyle choices of men and women is normative in character; to the extent that gender norms define certain cultural pursuits (e.g. reading romance novels) as inherently gendered, this will have the effect of restricting the cultural choices of men, thus preventing them from bridging cultural holes. Classic proposals in the cultural stratification literature point to the fact that gender norms governing cultural choices tend to be more exacting and rigid among working class men (Bourdieu 1984; Collins 1993), especially when it comes to highly "gendered" cultural choices (such as so-called "highbrow" culture (Lizardo 2006b). We

should thus expect gender differences in the ability to bridge cultural holes to vary across a class gradient. If the cultural choices of working class males are relatively more constrained, then women should be more likely to outperform men in cultural network efficiency at lower levels of education, with the gender difference dissipating for highly educated professionals.

Figure 7 shows the predicted cultural network efficiency scores, estimated from a model similar to that shown in Table 1, but in which the gender effect is allowed to vary by educational level. The left-hand panel shows the predicted CNE_i scores for the real data, and the right-hand panel shows the same predicted scores for the randomized data. The results are consistent with expectations. The gender gap in the propensity to bridge cultural holes is strongest at lower levels of education and narrows as we move up the educational ladder. At the highest level (post-graduate education), there is no gender-gap in cultural network efficiency. This suggests that the gender difference is concentrated precisely among lower SES respondents and is driven by two mechanisms: (a) the propensity of low education women to be as likely to bridge cultural holes as their more educated counterparts, and (b) the propensity of working class males to choose genres with overlapping audiences in comparisons to both women of the same levels of education and their more educated male counterparts.

5.1.5 Ethnoracial status

The effects of ethnoracial status provide an example of how omnivorousness by volume may actually pull in a different direction than the capacity to bridge cultural holes (as indexed by cultural network efficiency). As shown in the column 1 of Table 1, both Blacks (t=−3.75) and Hispanics (t=1.78) make an *overall* lower number of choices than Whites. However, as shown in column 2, ethnoracial minorities are *more* likely to bridge cultural holes than Whites (p<0.001). This conclusion is bolstered by the fact that if we look at the results obtained using CNE_i^{rnd} as the response, there are no race effects, suggesting that it is the pattern (rather than the number) of choices that are driving this result.

[Figure 8 About Here]

This is a counter-intuitive finding, since a reasonable prior would have been to suppose that ethnoracial minorities in the United States would live in more constrained cultural worlds and thus be less likely to bridge cultural holes. In contrast to Whites who, as representatives of the dominant

culture, can select cultural genres based on purely aesthetic or autotelic criteria, members of ethnoracial minorities (like African Americans) will, in addition to these considerations, be induced to take into account the relative extent to which a given genre reflects in-group *authenticity*. This is what Carter (2006) has referred to as "non-dominant" cultural capital. Concern with the cultivation of non-dominant cultural capital should have the consequence of both narrowing the total palette of choices *and* leading to a choice of genres that already have high levels of audience overlap with one another (because they appeal disproportionately to members of the minority group).

While we observe the predicted narrowing of choices, we do not observe the expected cultural hole liability, finding instead a cultural hole advantage. These findings are thus consistent with a different argument: rather than following an exclusively authenticity-based strategy, Blacks and Hispanics seem to be opting for what Carter (2006) has referred to as *cultural straddling* approach; namely, an attempt to cultivate *both* dominant and non-dominant forms of cultural capital. This pattern of cultural choices would naturally result in a person bridging cultural worlds, which is precisely what the cultural network efficiency is meant to capture and what the findings reveal.

[Figure 9 About Here]

5.1.6 Ethnoracial Status and Age

A test implication of cultural straddler argument is that the ethnoracial minority advantage in cultural straddling should be uneven across levels of age. As Carter (2006) and Warikoo (2007) have noted, the cultural straddling approach is distinctive of recently born (or second-generation in the case of children of immigrants) minority youth who are exposed to the dual pressure of adaptation to the dominant culture while maintaining allegiance to the in-group subculture, a problem that was not faced (to the same extent) by their parents and (especially) their grandparents. Figures 8 and 9 shows the results of a fractional logit model that allows the effect of race and ethnicity to vary by age.[7] The results are consistent with the expectation that younger minority youth are more likely to cultural straddlers than their elder counterparts are. The cultural straddling

[7] the age categories cutoffs and labels are those recommended by (Burt 1991) from analysis of GSS ego-network data.

advantage of African-Americans and Hispanics is concentrated among students and young adults, declining for middle-aged persons and essentially disappearing among those of retirement age.

5.1.7 Marital Status

Sociometric research shows that marital status transitions (e.g. from single to married) has discernible impacts on a person's social world. At the level of interpersonal relations, the social networks of married individuals become more homogeneous and kin-heavy, gaining in density what they lose in diversity (Marsden 1987; Munch et al. 1997; Wellman et al. 1997). We should thus expect that being married should have a corresponding effect on a person's cultural worlds, with married persons inhabiting more constrained cultural worlds, characterized by less efficiency than persons who are not married. The data only partially support this hypothesis. While it is true that married respondents make less choices than their unmarried counterparts (t=−3.73), they do not pay a cultural hole penalty (|t=0.32|), even though (as indicated in the null model) they should (t=−1.65). This suggests that while marriage does bring with it a decline in the number of choices, it does not result in a concomitant decline in the relative likelihood of bridging cultural worlds.

6 Discussion and Conclusion

In this paper, I have provided an analytic and measurement framework for the empirical analysis of "cultural holes" in the context of traditional Arts Participation data collected through national surveys. This is the primary source of data in quantitative analyses of cultural taste and consumption (Bourdieu 1984; Warde et al. 2008; Coulangeon and Lemel 2007; Torche 2007; Chan and Goldthorpe 2007). I have argued that the notion of cultural hole specifies an important property that has always been at the center of the classic theoretical statements in the cultural stratification literature (e.g. DiMaggio 1987) but which has so far proven to be empirically elusive. The dominance of the notion of cultural omnivorousness in the recent literature in fact can be read as emerging from the fact that cultural omnivores have always been thought of as those who are more likely to bridge cultural holes. Most major theoretical statements link the concept of cultural omnivorousness to the ability of high status persons to code-switch and thus navigate diverse, constantly shifting social worlds (DiMaggio 1987, 1996; Peterson and Kern 1996; Peterson 1992; Ollivier 2008; Lizardo 2008). In this way, the consensus that cultural omnivorousness—given by the number of cultural choices made—is the primary index of cultural stratification in the

contemporary context can be thought of as a convenient surrogate for the more specific proposition that it is the ability to bridge across cultural holes that has become the primary marker of status in post-traditional societies (Holt 1998; DiMaggio and Mohr 1985; Lizardo and Skiles 2012).

6.1 Contributions

In providing a measurement framework that specifies in an intuitive way the notion of "cultural holes" this paper is meant to contribute primarily to the sociological study of cultural stratification. I have shown that there is empirical merit to the oft-noted suspicion that, while empirically connected, the idea of omnivorousness as quantity of choices is not necessarily equivalent to the notion of omnivorousness as implying the ability to bridge across cultural worlds. Two persons may make the same number of cultural choices, and yet have very different *patterns* of clustering across the cultural items that they choose. Recent theory at the intersection of cultural sociology and network theory tells us that these two people will be differentially positioned to convert the cultural capital realized in their distinct choice patterns into other forms of social or material advantage (Lizardo 2006a; Pachucki and Breiger 2010). While the notion of "patterns of cultural choice" has been at the centerpiece of empirical research in the culture and stratification literature since Peterson's groundbreaking contributions (Peterson 1983), the empirical specification of cultural choice patterns has remained a relatively murky and fragmented affair (Peterson 2005). In this paper, I provide a framework with which to empirically specify a strategic dimension of individual differentiation in patterns of cultural choice.

There have been recent calls to go beyond simple definitions of omnivorousness as given by the number of cultural choices that the person makes in the sociology of taste literature. Most of these attempts—involving factor-analytic, latent class techniques designed to clusters the rows (individuals) of the usual $n \times k$ data matrix—do not exploit (at least directly) the relational features of two-mode survey data (but see Goldberg 2011; Goldberg and Baldassarri 2010 for an important exception). These efforts thus end up producing empirical indicators that only marginally improve over the traditional degree-based measures of quantity of choices made. Most crucially, these techniques (or others based on qualitative typologies) fail to take advantage of the fact that the cultural neighborhood surrounding the person is structured according to the interrelationships of the cultural items with other another, which means that the full analytic panoply of network theory applies, thus bringing the sociological study of cultural taste closer to recent theoretical

innovations at the intersection of cultural sociology and network analysis (Borgatti and Everett 1997; Burt 1992, 2005; Hidalgo and Hausmann 2009; Faust 1997; DiMaggio 2011).

The framework proposed here is able to do precisely that. In addition, this approach actually illuminates two major limitations of standard clustering-based attempts to make headway on the measurement front: (1) the fact that simple cultural degree-based indicators (e.g. sum of the number of cultural choices made) usually end up having as much (if not more) criterion validity than more elaborate factor analytic or latent-class-based attempts—or more *a priori* typological strategies—to cluster respondents into groups based on the choices that the they make (Warde et al. 2008); and (2) the fact that these complicated empirical proxies end-up losing the key theoretical intuition that set the contemporary study of cultural omnivorousness in motion: the fact that cultural omnivores are more likely to serve as *bridges* across social and cultural worlds than those persons who are either culturally inactive or who restrict their range of choices to a few items.

The reason why simple indicators of cultural ego-network degree will be strongly correlated with key socio-demographic markers (and thus have as much criterion validity as more their more complicated counterparts) is precisely because cultural ego-network degree is the most natural index of position in the cultural network; in effect it is equivalent to the centrality of the actor in this network. High degree actors will always be "central" because they serve as the key conduits through which disparate cultural activities are connected to one another (Feld 1982; Faust 1997). In this way, degree of the cultural ego-network will always provide a good proxy whenever the goal is simply to get a sense of the extent to which a given individual is likely to be able to navigate complex and heterogeneous environments. However, if the analyst is interested in empirically disentangling the sheer propensity to make a large number of cultural choices from this last facet, then the analytic framework proposed here: (a) provides a way to do that in a natural way; (b) takes advantage of the relational features of the data and (c) does not have to rely on hard to defend methodological strategies (some of which ask more of the data than it can give) or inductive typological distinctions.

6.2 Further extensions

The measurement framework proposed here is easily extended beyond the concerns of the sociology of taste and the cultural stratification literature. For instance, it is clear that if all surveys are examples of two-mode networks, then individuals can also be thought as occupying

heterogeneous positions in person × opinions or person × belief networks.[8] Opinions and beliefs are connected to one another if they are shared by the same set of persons. In this context, the purely topological features of position in a cultural network acquire more salience than simply degree-based measurements of number of choices made since the "number of opinions" that a person has is fixed by design.[9] For instance, this can be done by taking some number of opinion items *k* and subjecting the categories of each item to the type of "disjunctive coding" traditionally used to prepare the data for a technique such as Multiple Correspondence Analysis (MCA). This will result in a person × opinion network in which each respondent will be linked to the same fixed *number* of opinions $k_i=k$, although each respondent will be linked to their own unique *opinion set* (e.g. agree that more gun control is needed, disagree that government should help those out of work, etc.). This means that the *topological structure* (e.g. clustering, mean popularity, etc.) of each respondent opinion neighborhood will differ in systematic ways.

Taking the number of opinions as fixed, we can still study clustering in the person by opinion network. Some persons will share opinions that are closely connected to one another (thus having high levels of clustering) while other persons will have opinions that do not share may persons who hold them. This is a natural way to produce a quantitative measure of the notion of "cross-pressure" from classic theorizing on the link between social networks and cognition take from structural balance theory (Davis 1963). Generalizing the insights gained from the conceptualization and

[8] This is essentially the same insight exploited by Goldberg (2011) in developing relational class analysis (RCA). Beyond this superficial similarity, the two approaches are very different (and thus perfectly complementary). RCA is concerned with extracting "classes" of persons based on their (higher order) response pattern similarities (and thus on developing a multi-dimensional classification of individuals). The approach offered here is focused on partitioning persons along a one-dimensional continuum, keyed to their relative capacity to bridge across disconnected segments of the cultural world.

[9] This does not necessarily need to be the case. Including "don't knows" can lead us to develop measures of cultural stratification based on the willingness to offer an opinion and thus on degree-differences in the cultural opinion network. It is clear the "opinion degree" will be strongly correlated with institutionalized markers of society-wide status such as education (Bourdieu 1984).

measurement of cultural holes offered here, a person who bridges a cultural hole by taking stances that very few other share may not necessarily be not be necessarily "irrational" (in the sense of being incapable of having "consistent" attitudes) but may be instead be a key link providing integration across otherwise disconnected (or increasingly polarized) social boundaries.

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Table 1. Coefficient estimates of the effects of selected socio-demographic characteristics on omnivorousness by volume, effective omnivorousness and cultural network efficiency for both real and randomized data, 2008 Survey for Public Participation in the Arts.

	OV		CNE (real)		CNE (random)	
main						
Education	0.334	(16.30)	0.225	(6.07)	0.167	(4.57)
Age	0.0572	(2.72)	-0.259	(-7.16)	0.0774	(2.14)
Age Squared	-0.0857	(-2.10)	0.407	(5.76)	-0.159	(-2.26)
Gender (Woman = 1)	0.122	(5.78)	0.293	(7.90)	0.0421	(1.15)
Race/Eth. (Black = 1)	-0.0934	(-3.75)	0.415	(10.89)	-0.0400	(-1.00)
Race/Eth. (Hispanic = 1)	-0.0475	(-1.78)	0.372	(8.35)	0.0674	(1.49)
gc_married	-0.0802	(-3.73)	-0.0122	(-0.32)	-0.0613	(-1.65)
Constant	1.935	(125.98)	-1.009	(-37.40)	-0.290	(-11.03)
Obs	4190		4190		4190	
Model Fit	366.7		355.8		38.1	

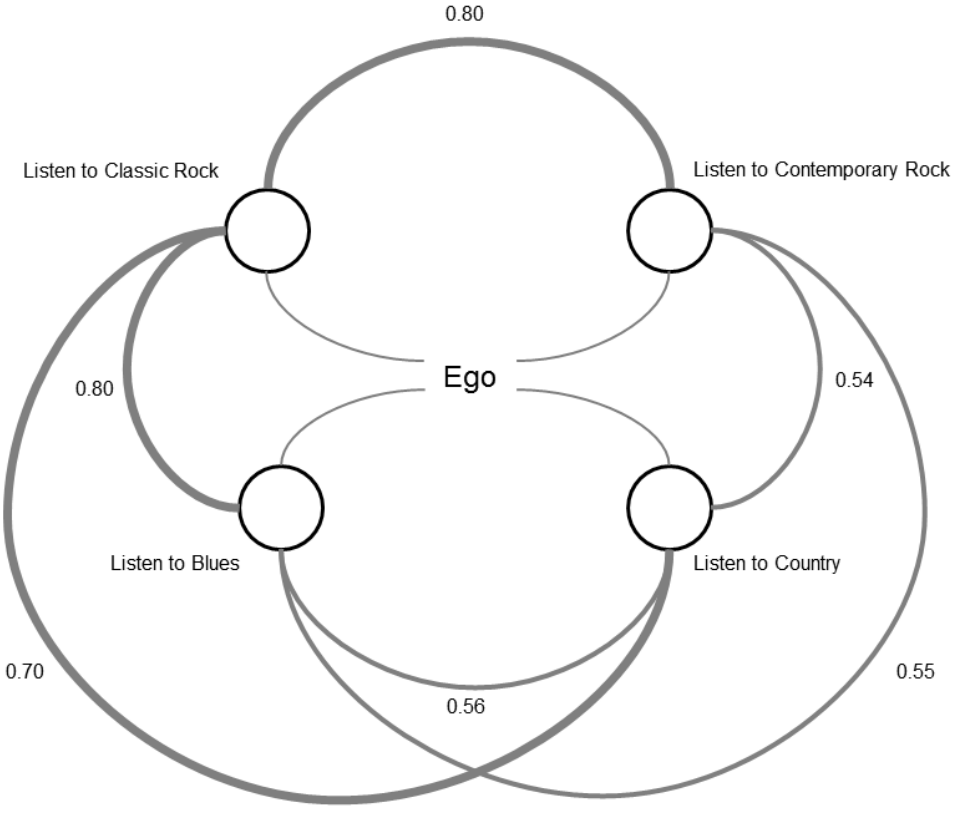

Figure 1: “Cultural Ego Network” for a hypothetical respondent, 2008 SPPA.

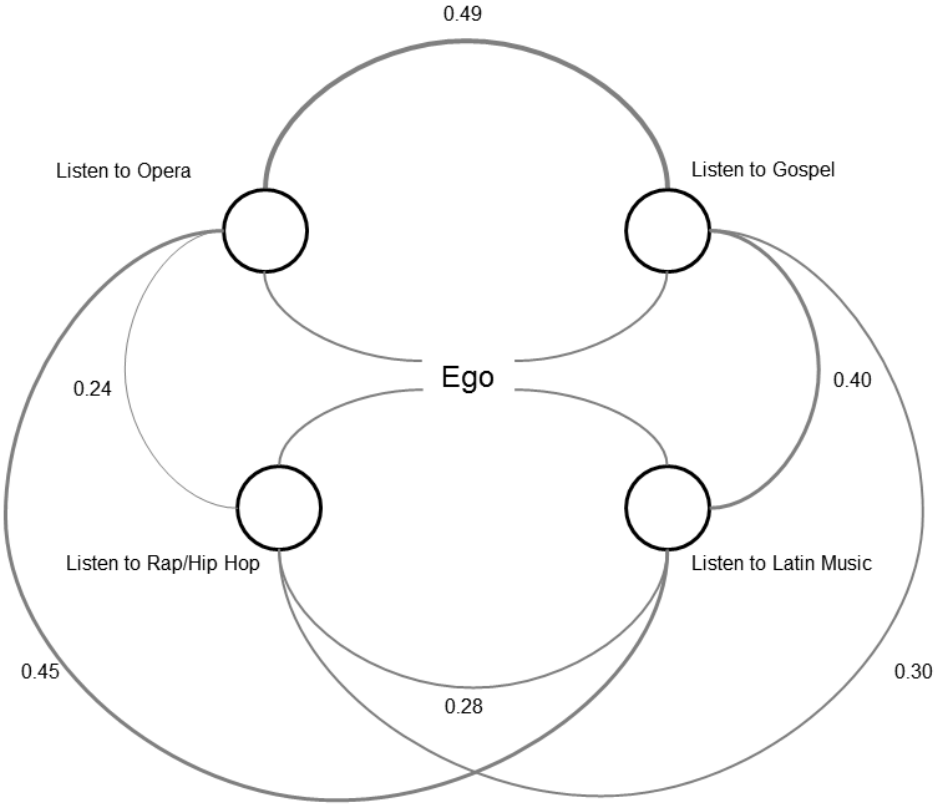

Figure 2: “Cultural Ego Network” for a hypothetical respondent, 2008 SPPA.

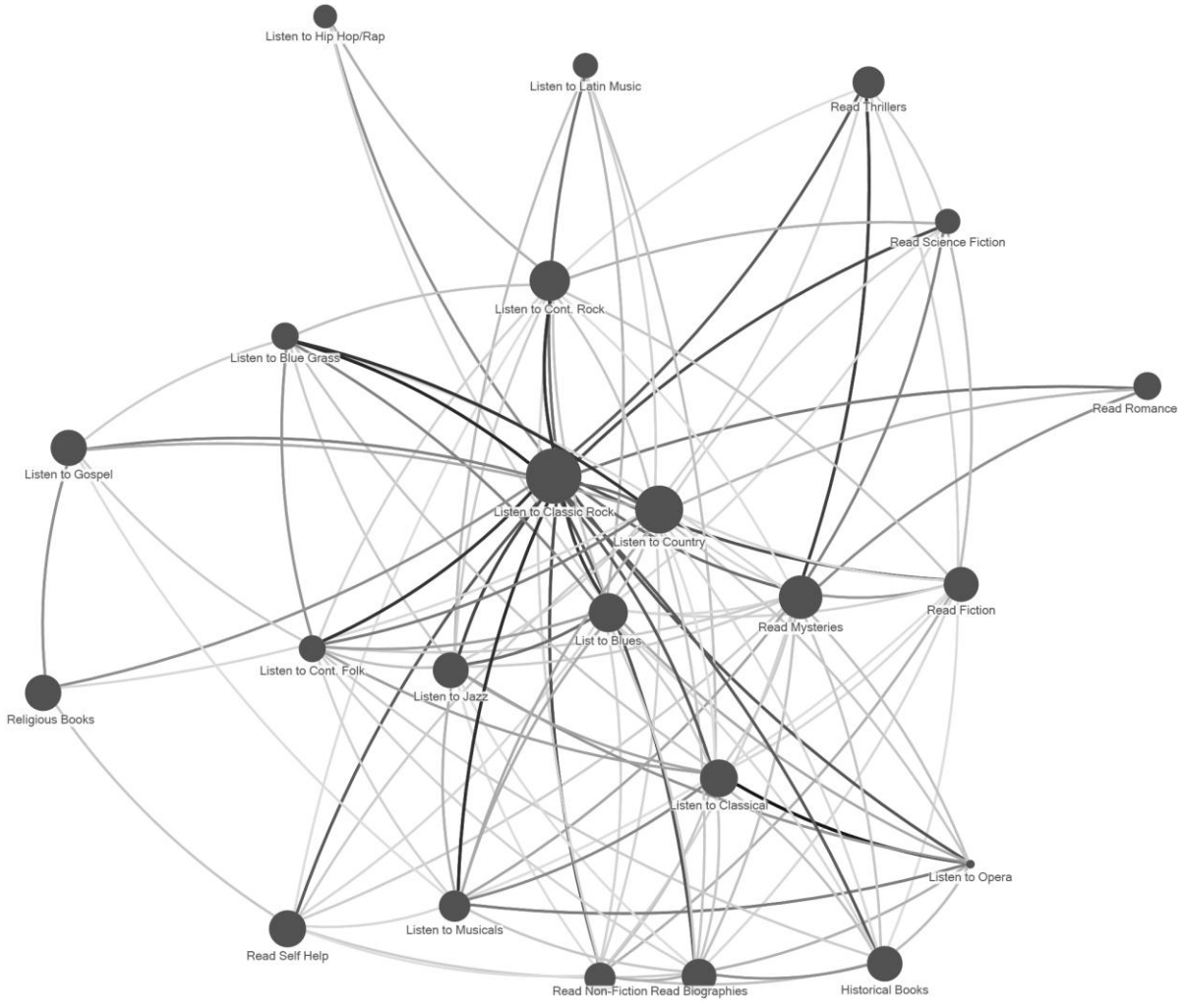

Figure 3: One-mode projection of the cultural network for 23 musical and literary taste items taken from the 2008 Survey for Public Participation in the Arts. Only edges between cultural forms where $o_{jk} \geq 0.5$ are shown. Darker edges represent higher overlap and lighter edges represent lower overlap. Size of vertex is proportional to the percentage of respondents who choose the genre.

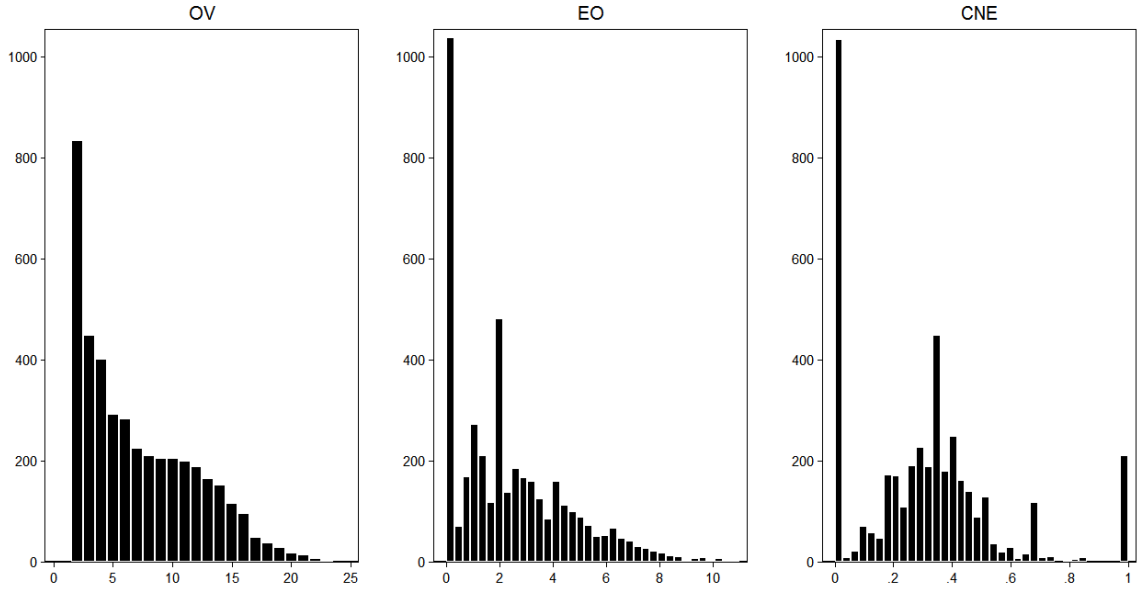

Figure 4: Univariate distribution of Omnivorousness by Volume (OV_i, Effective Omnivorousness (EO_i), Cultural Network Efficiency (CNE_i), 2008 Survey for Public Participation in the Arts (N = 4190).

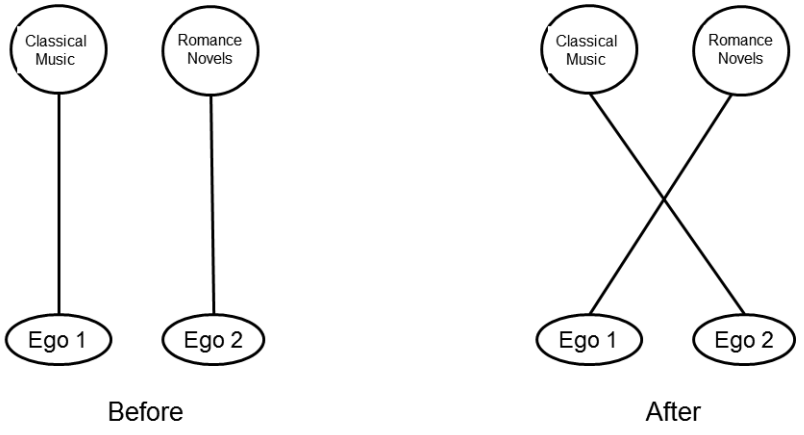

Figure 5: Illustration of the link-rewiring procedure as applied to the SPPA data. Two individuals are selected at random and then a random cultural item from their current cultural ego-network is also selected. I then swap the links so that each individual is now connected to the other person's cultural item and their current connection is deleted. We then repeat the same procedure for a predetermined number of trials until no further change is observed in the data.

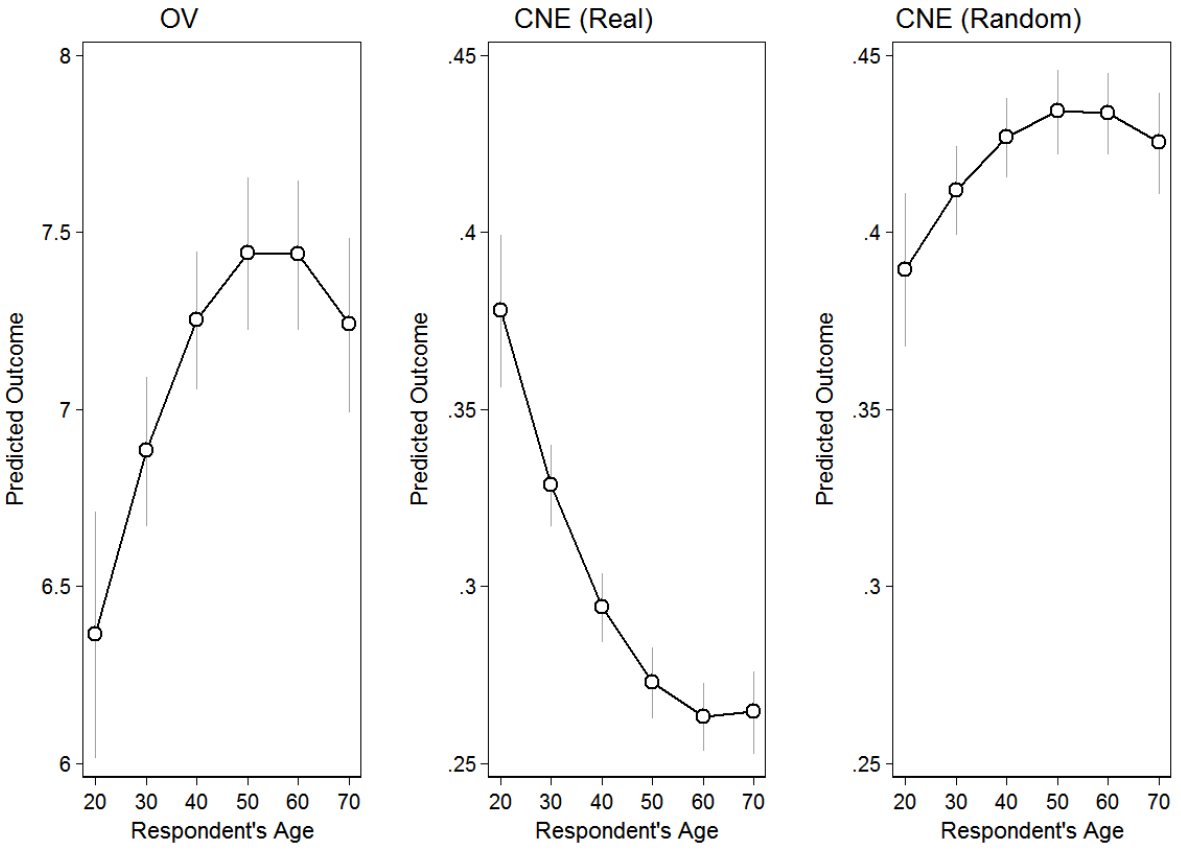

Figure 6: Predicted N. of Cultural Choices and Cultural Network Efficiency (along with 95% confidence intervals) by age, 2008 Survey for Public Participation in the Arts.

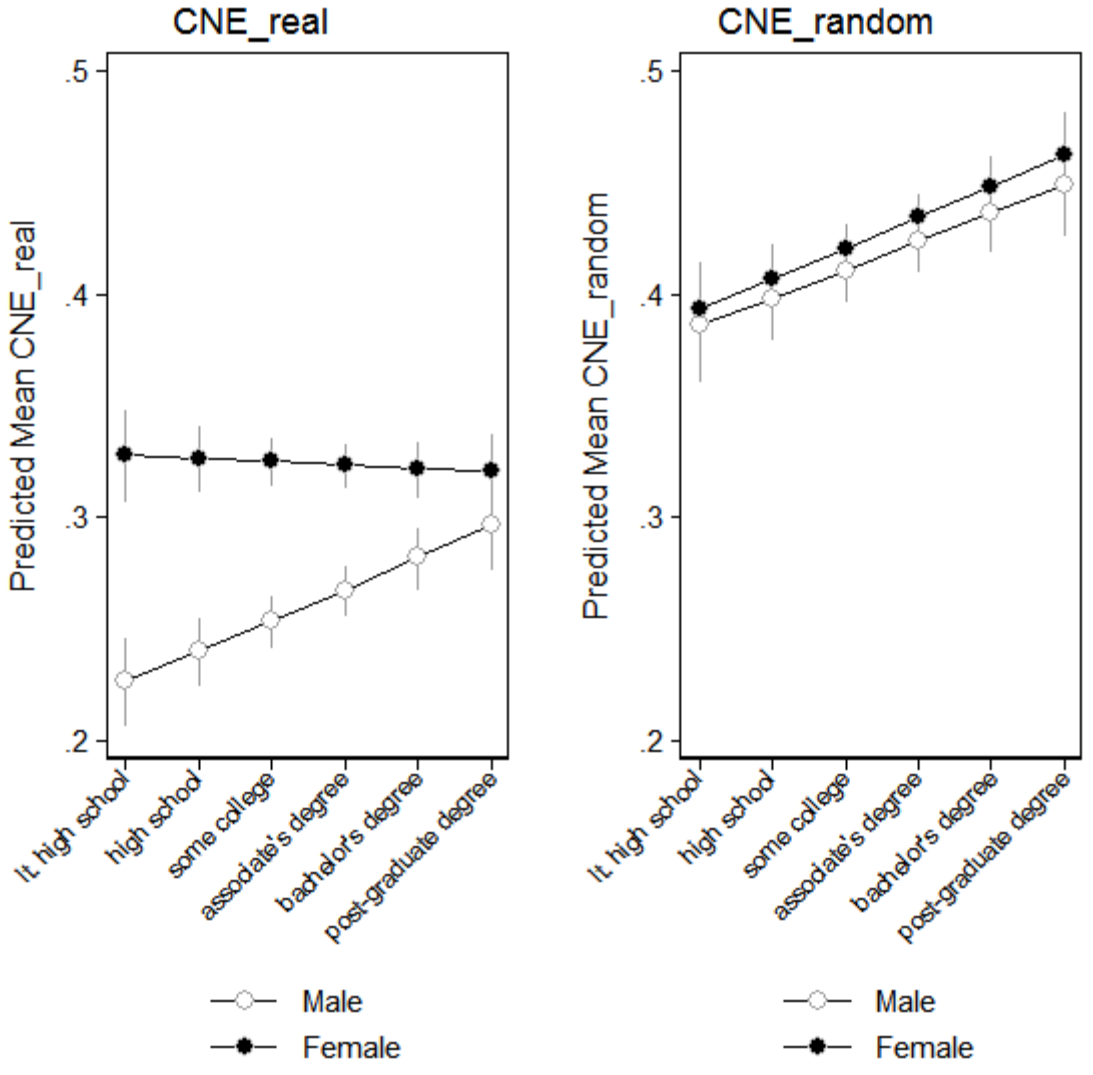

Figure 7: Predicted Cultural Network Efficiency and Cultural Network Constraint (along with 95% confidence intervals) by levels of education for men and women, 2008 Survey for Public Participation in the Arts.

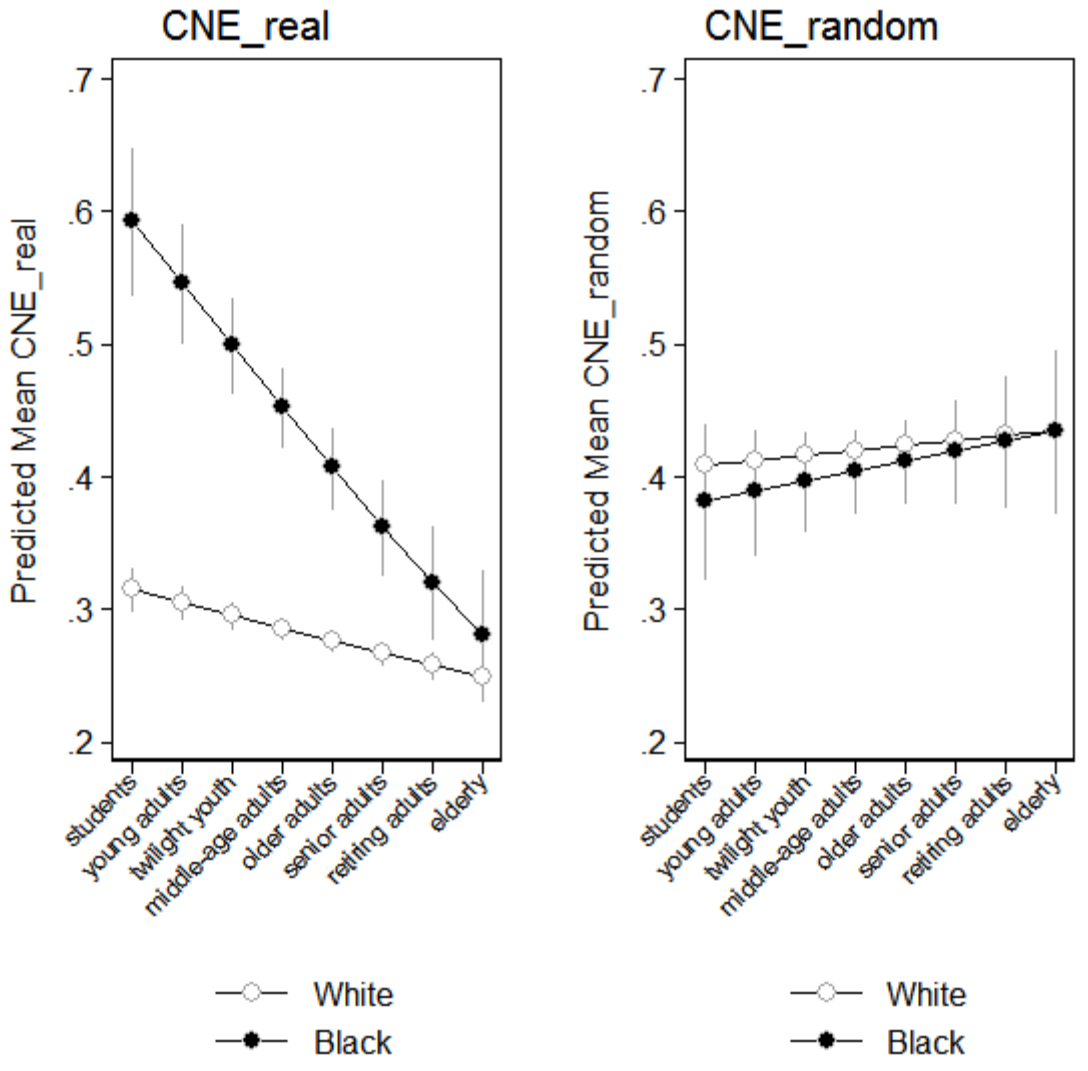

Figure 8: Predicted Cultural Network Efficiency and Cultural Network Constraint (along with 95% confidence intervals) by age categories for White and African American respondents, 2008 Survey for Public Participation in the Arts.

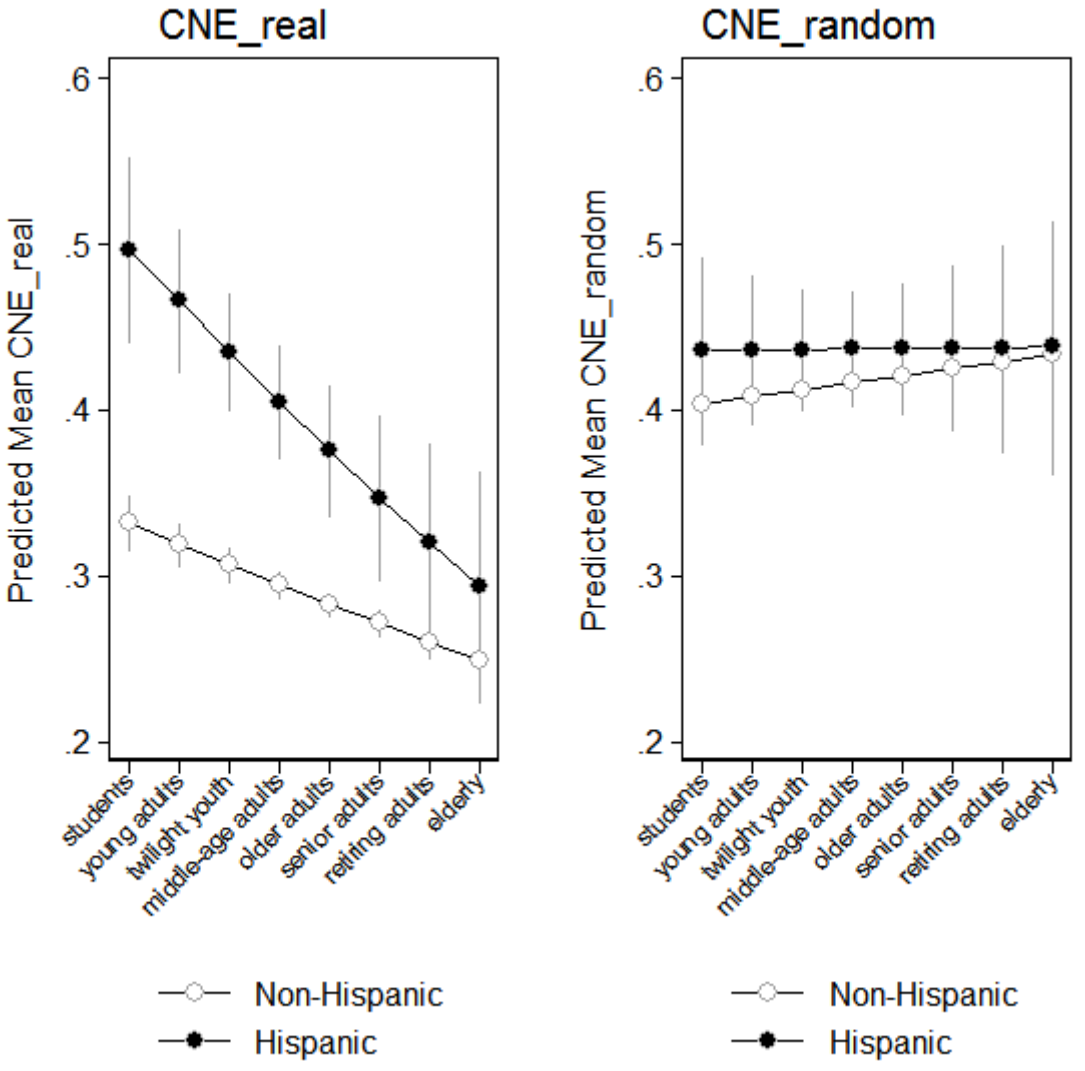

Figure 9: Predicted Cultural Network Efficiency and Cultural Network Constraint (along with 95% confidence intervals) by age categories for Hispanic and Non-Hispanic respondents, 2008 Survey for Public Participation in the Arts.