
Market positioning: the shifting effects of niche overlap

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Organizational ecology models of market dynamics emphasize the competition-inducing role of inter-organizational niche overlap—targeting similar market niches increases competitive pressure and thus reduces organizations' fitness. Recent studies, however, have suggested that moderate niche overlap may positively influence organizational viability by enhancing comparability and promoting legitimacy spillovers. Data on consumers' impressions of Dutch music festivals and on the growth and decline of early Internet search engines were used to test the proposition that niche overlap may, in fact, be non-monotonically related to organizational fitness. Since new organizations must first gain recognition by being comparable to others, they will benefit more from niche overlap than older incumbents. The results confirm that both the appeal that organizations generate as well as their growth rates are non-monotonically related to niche overlap, and that positive effects of niche overlap decrease with organizational age.

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1. Introduction

For organizations to thrive, they have to position themselves well with respect to other organizations in their resource environment. While doing so, different

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organizations may find themselves appealing to the same resource providers—audiences—causing their niches to overlap (intersect). Competition increases in such situations and organizational fitness decreases. At least, this is the story told in the older ecology literature (Hannan and Freeman, 1989).

More recent work on organizations' audiences (Hannan *et al.*, 2007) has complemented the niche overlap story with a different tale. For organizations to thrive, their audiences have to be able to identify, comprehend, and appreciate organizations' offerings, be they products, services, or jobs. Incomparable offerings are hard to comprehend, might be perceived as failing to meet social norms or expectations (Rao *et al.*, 2005; Hsu, 2006), or may get insufficient attention.¹ Human associative pattern recognition works in a way such that comparable offerings are more easily grasped and acknowledged (Simon, 1990). In the words of Wittgenstein (1953), a range of comparable offerings helps audiences to notice a "family resemblance." Once a group of organizations establish a family resemblance of their offerings, they collectively signal an identifiable product (or organizational) category, as the microbrewery movement in the USA has done (Carroll and Swaminathan, 2000).² This enhances the legitimacy of the category (Johnson *et al.*, 2006), from which all pertaining organizations benefit in terms of legitimacy spillovers (Kuilman and Li, 2009). Especially, younger organizations not yet recognized by their potential audience may benefit from such spillovers brought about by making their offerings comparable to those of others. Therefore, a moderate degree of niche overlap may sometimes be an objective to strive for.

Niche overlap thus promotes legitimacy spillovers and competition at the same time. No niche overlap can render an organization difficult to identify and isolate it from the larger audience, but too much overlap can entail too much competitive pressure, so there seems to be an optimum in between where appeal balances competition. This suggests that the effect of niche overlap is non-monotonic, giving niche overlap a humped relationship with organizational fitness. In addition, because new organizations will presumably benefit more from showing conformity and family resemblance than older ones which are already known by the audience, the positive effect of niche overlap on fitness probably decreases with organizational age.

We cast these two conjectures into a theory and provide two empirical tests using cross-sectional and longitudinal data on audience preferences with respect to music festivals in The Netherlands (Study 1) and Web search engines (Study 2). The results from both studies strongly support the two conjectures.

¹Innovations often start out as misfits before becoming seen as legitimate (Kennedy 2008), but that is another part of the story not dealt with here.

²Organizations' intentions with respect to niches and overlaps do not imply a one-to-one mapping with audience perceptions thereof. This sort of mismatch may affect organizations, but it does not affect our story.

2. Theory

Along with our presentation of the theory in postulates, below, we also formalize the main argument in formal logic (Appendix A). Over the last two decades, theory building within organizational ecology has benefited greatly from the employment of formal logic (e.g. Péli *et al.*, 1994; Pólos *et al.*, 2002; Kuilman *et al.*, 2009). Using formal logic has shown to help identify loopholes and inconsistencies in theoretical arguments, and to make such arguments more rigorous and precise. In their recent work, the founders of organization ecology advocate the use of non-monotonic logic (e.g. Hannan *et al.*, 2007). Using non-monotonic logic helps to deal with (seeming) inconsistencies that often emerge during theory development. In classic (e.g. first order) logic, new inconsistent information leads to falsification of an entire theory, while in non-monotonic logic, such information leads to a *specification* of the argument. To formalize an argument that describes non-monotonic dynamics, such as ours, using non-monotonic logic seems to be a natural choice. In Appendix A, we apply a non-monotonic logic called the Language of Theory Building (LTB; Hannan *et al.*, 2007) to formalize our argument. In the main text, we present our propositions and theorems in natural (i.e. non-formal) language.

The abstract concept of a niche is well-suited to analyze an organization's positioning in its environment, which we conceptualize as a socio-demographic space following the work of McPherson and colleagues (McPherson, 1983; McPherson and Ranger-Moore, 1991; Mark, 1998). Customers or (potential) employees can be mapped along dimensions, such as age and level of education, in a multidimensional socio-demographic space. Customers and employees are considered key members of the audience to any organization. An organization that seeks to attract resources from such audience members in this socio-demographic space attempts to position itself where audience members have at least some level of intrinsic appeal towards its offerings. This (set of) position(s) is defined as the organizational niche (Hannan *et al.*, 2007).³ An organization's fitness then is characterized by its share of the total appeal that exists for this (set of) position(s) (Hannan *et al.*, 2007).

Without competitors, an entity has a so-called fundamental niche, but once multiple entities compete for the same resources and have overlapping fundamental niches, the latter turn into realized niches (Hutchinson, 1957; Carroll, 1985). Overlap in (fundamental) niches, defined as the fraction of the focal organization's fundamental niche covered by the fundamental niches of competing organizations (McPherson, 1983), may arise for several reasons including imitation, industry regulation, technological standards, or just by chance. If competition is intense, realized niches are smaller than, and hence proper subsets of, fundamental niches. Fitness of

³Since organizations cannot appeal to every audience member in a heterogeneous environment, their niches are limited, and organizations have to trade off appeal for audience diversity, scope, a trade-off which is called the *principle of allocation* (Hannan and Freeman, 1977; Hsu, 2006; Hsu *et al.*, 2009; Kovács and Carroll, 2010).

the organization involved is reduced accordingly. The negative effect of niche overlap on fitness has received most of the scholarly attention in this field (Carroll and Hannan, 2000), and continues to be assumed as the generic baseline situation in recent renderings of the theory (Hannan *et al.*, 2007: 196–198). As the deleterious consequences of competition increase at an increasing rate with growing competitive intensity (Hannan and Carroll, 1992), organizational fitness can be expected to decline at an increasing rate with growing niche overlap.

Postulate 1: Niche overlap reduces organizational fitness.

To illustrate the pervasiveness of this postulate in ecological reasoning, consider resource partitioning theory (Carroll, 1985; Hannan *et al.*, 2007). According to this theory fragment of organizational ecology, in mature markets, scale-advantage-seeking organizations crowd the center of a socio-demographic space in order to appeal to a large audience. For instance, Boone *et al.* (2002) have shown that demand for many goods and services peaks along dimensions of age, education, religion, and politics, and that generalist newspapers position themselves accordingly to maximize their readership and advertizing revenue. Such crowding at the market's center, in turn, enforces a competition-driven shake-out among these competitors. Resource partitioning theory recognizes niche overlap as an unavoidable but purely negative force that decreases firms' life chances. Small specialist organizations that do not depend on large audiences move to, or are founded on, the market's periphery in un-crowded niches. Organizations then have to choose between positions in which less competitive engagement is required to generate some appeal and the more munificent but also more competitive positions where the level of actual appeal strongly depends on market engagement relative to others (Kovács and Carroll, 2010). This theory fragment thus acknowledges a trade-off between appeal and niche overlap, without postulating it explicitly.

Extending recent theorizing about categorization and labeling in markets (Hannan, 2010), however, it may be argued that when an organization increasingly overlaps with others in a socio-demographic audience space, an increasing proportion of that audience will be likely to consider at least some of the products or services of the organizations involved comparable and at least partially similar given their appeal to a shared subset of the audience. This then also leads an increasing proportion of the audience to refer to the organization with a label shared by those similar others and to consider the organization a member of the corresponding category (Hannan *et al.*, 2007). When, for example, from 2000 to 2002, Nokia, Palm, and Blackberry introduced mobile devices combining the functionality of the PDA's and mobile phones, consumers worldwide quickly started to refer to these products as "Smartphones," after Ericsson's pioneering R380 Smartphone model. By being granted the Smartphone label, the new producers received recognition with regard to the functionality of their products. Common patterns of resource utilization and

audience attention can thus be a major basis for similarity clustering and shared labeling (Hannan *et al.*, 2007: 37–39). We expect that the relationship between niche overlap and labeling an organization as similar to others will be especially strong at low levels of niche overlap. After all, once a sufficiently large proportion of the audience labels an organization as a member, the audience may get to a point where it will reach a consensus on the membership of that organization, and further increases in niche overlap will then not lead significantly more audience members to assign the label.

Postulate 2: At low levels of niche overlap, the greater its niche overlap with other members of a legitimate category, the greater the proportion of the audience that will label the organization as a member of that category.

Attaching a label to an organization has considerable implications. In particular, those that fail to fit into an established market category tend to be devalued or sanctioned (Hsu, 2006; Rao *et al.*, 2005) and to receive less attention (Zuckerman, 1999). However as Hannan *et al.* (2007) point out, those organizations labeled as a member of a legitimate category enjoy the benefits of that legitimacy in terms of allowing audiences to infer what features they can expect from that organization and enhancing their understanding of what the organization is about. Organizations (that do not violate audiences' expectations) benefit from the legitimacy spillovers originating from the broader category of organizations of which they are a labeled member, since legitimacy spillovers occur when "social recognition for one organization (or group of organizations) leads to similar organizations receiving greater social recognition as well" (Kuilman and Li, 2009: 229). The label thus functions as a minimal test code for membership in the legitimate category (Hannan *et al.*, 2007: 80–82). Following this argument, the category memberships an organization claims to hold may be less important than the labels audience members attach to it. If a desirable label is attached, an organization stands to benefit from legitimacy spillovers, otherwise it does not. The larger the proportion of the audience that attaches a label to an organization, the greater the potential for legitimacy spillovers to occur.

Postulate 3: The greater the proportion of the audience that will label the organization as a member of a legitimate category, the more that organization stands to benefit from legitimacy spillovers.

Public legitimation and social recognition, in turn, are critical for any organization in mobilizing resources and gaining support from external audiences. When legitimacy can be sourced from some well-understood organizational category, this greatly facilitates the task of mobilizing resources. Conversely, if customers do not have an understanding of or even disapprove of a particular category of organizations of which a given organization is part, that organization is unlikely to generate

much appeal for its products or services. Thus, legitimacy spillovers from a broader category of organizations improve an organization's fitness.

Postulate 4: Legitimacy spillovers improve fitness.

From Postulates 2, 3, and 4, the first theorem can be derived (see Appendix A for technical details).

Theorem 1: At low levels of niche overlap, greater niche overlap improves fitness.

Note that Theorem 1 applies only under specific circumstances, namely when niche overlap is below a particular level. Under other circumstances (see Appendix A for additionally needed background knowledge), the more general case expressed in Postulate 1 should apply. This yields Theorem 2.

Theorem 2: At high levels of niche overlap, greater niche overlap reduces fitness.

Conjointly, Theorems 1 and 2 form our main predictions. Other scholars have arrived at similar conclusions about the non-monotonic effects of organizational niche overlap, albeit from different perspectives. White (1981) argued that when firms have no detailed knowledge about their clientele, they closely watch each others' prices and product qualities and position themselves accordingly, conforming to an overall "market schedule" of prices and qualities. The best market positions are neither too close to nor too distant from the positions of others. This positional balance view harks back to the tension between differentiation and conformity described by Simmel (1950/1908; in Popielarz and Neal, 2007), which has also been elaborated in the literature on industrial organization and management (Deephouse, 1999; Boone *et al.*, 2009).

We thus argue that some degree of niche overlap is presumably beneficial to all kinds of organizations, because it makes audiences more likely to attach a common label to an organization that maintains overlap with others, facilitating the transfer of legitimacy to this organization. However, new organizations should benefit more from niche overlap than incumbents do. The former have to jumpstart their recognition among the audience, typically still lack symbolic and material resources, and will have little legitimacy of their own (Freeman *et al.*, 1983). Older organizations, on the other hand, will have had more time to establish their own legitimacy. As Hannan and Freeman (1984: 158) noted, "New organizations [...] have rather weak claims on public and official support. Nothing legitimates [...] individual organizations [...] more than longevity." Illustrating this notion, Kuilman and Li (2009) found that for foreign banks in Shanghai, marginal and less-legitimate population members relied more on population-level legitimacy spillovers than well-established members, who had been accredited legitimacy of their own. Yet,

another study found that older actors do not depend as much as on category membership as their novice colleagues did (Zuckerman *et al.*, 2003). Therefore, in sum, for older organizations, niche overlap does not contribute much to their legitimacy; in contrast, for younger organizations, niche overlap improves legitimacy spillovers.

Postulate 5: Up to a certain age, niche overlap improves legitimacy spillovers.

From Postulates 4 and 5, Theorem 3 can be derived.

Theorem 3: Up to a certain age, niche overlap improves fitness.

Note that, similar to Theorem 1, Theorem 3 only deals with young organizations. What happens when organizations are older is not yet specified. However, Postulate 1 deals with the default case, including organizations of unspecified age, and says that for these organizations, niche overlap reduces fitness. Theorem 3 updates Postulate 1 for younger organizations, but not for older ones. By adding a small piece of background information, however (Appendix A), we are able to derive Theorem 4, pertaining specifically to older organizations.

Theorem 4: For older organizations, niche overlap reduces fitness.

Taken together, Theorem 3 and 4 describe the interaction between niche overlap and age in their relationship with fitness. Whereas for younger organizations, niche overlap is beneficial; for older organizations, it is merely an adversary condition: the positive effects of niche overlap wear off while the negative effects of competition remain.

Empirical evidence for the existence of a non-monotonic relationship between niche overlap and organizational viability has been found in studies by Dobrev *et al.*, (2001), confirming earlier work by Deephouse (1999) and Olzak and Uhrig (2001), and was later confirmed by Dowell (2006) and by Zhang *et al.* (2009). In all those studies, researcher-imposed categorizations of products, organizations, or groups of organizations were used to determine inter-organizational niche overlap. For example, Dowell (2006) measured niche overlaps among bicycle sellers in terms of predetermined product characteristics. Ideally, researchers' categories should match those of consumers, but products which researchers consider similar may have different life-style connotations and compete much less than it might seem, while dissimilar looking products might sometimes compete more strongly. Product perceptions are in the eye of the beholder, and products' symbolic and associative meanings go well beyond straightforward product categorizations (Keller, 1993). In order to sidestep this pitfall, the measurement of intra-organizational niche overlap in this article was based solely on consumer perceptions, of Dutch music festivals (Study 1) and of Internet search engines (Study 2).

3. Study 1: niches among music festivals

The Netherlands has one of the richest traditions of music festivals in Europe and hosts several of the oldest annual festivals in the world. The Netherlands also has one of the highest densities of music stages, ranging from music halls to public parks that are occasionally turned into festival hotspots. Since 1970, many pop and jazz festivals have been founded, and during the summer, there is a peak of festival activity over a broad range of genres and festival sizes. Some of these festivals have developed from hippy gatherings into mega-events (Koranteng, 2004), while others have stayed close to their local roots and still draw their audiences mainly from local communities (Ministry of O.C.W., 2007).

3.1 Methods

Data were collected from a stratified sample of the Dutch population by approaching respondents in public places like shopping centers in various cities and villages in the Netherlands in 2006 and 2007 (unrelated to music events). In all, 1557 people responded (717 males and 840 females). The sample was stratified based on the population sizes of the Dutch provinces. The result was a slight overrepresentation of younger males (age under 20 years), and underrepresentation of persons >60 years compared with the NIPO sample on stage art (TNS NIPO, 2004), but, in general, the sample reasonably approximated the composition of the Dutch population. The data were collected by trained interviewers, who polled respondents' opinions, awareness, considerations, and behavior with respect to music festivals. In particular, respondents were first asked which music festivals (which have music as the key component of their program, rather than theatre, food and drink, or travelling) they considered going to. They were then asked whether they had actually visited some of the festivals they had considered. Respondents who had indeed visited a music festival in 2006–2007 ($n = 848$) were asked to fill out a questionnaire on the festival they had visited most recently. The reason for visiting most frequently cited (55.2%) was the atmosphere of the festival in question.⁴ These efforts resulted in cross-sectional data on 139 music festivals in 2006 and 2007. While they collectively covered a wide range of genres (Table 1), about 40% of the festivals specialized in one particular genre or sub-genre; the remainder may be regarded broad niche organizations (Table 2).

The set of people who said they had considered visiting a particular festival was taken as indicating the fundamental niche (audience) for that festival. If one person

⁴Other reasons for visiting were experiencing live music (37.8%), specific artists (29.5%), specific genres (26.3%), meeting people or new friends (10.2%), and seeing new artists (6.6%). This shows again the limited validity of predetermined product categories in consumer research. In this case, the musical genres of festivals capture only a small portion of what consumers find important.

Table 1 Number of festivals active in each genre

Genre	Total
Pop	73
Rock	79
Jazz	25
Dance	62
Hip Hop	43
Classical	13
Dutch	14
World	14

Table 2 The distribution of single- and multi-genre festivals

No. of genres	Frequency	Percent	Cumulative
1	56	41.2	41.2
2	22	16.2	57.4
3	23	16.9	74.3
4	24	17.6	91.9
5	9	6.6	98.5
6	2	1.5	100.0

claimed to have considered two (or more) festivals, that person was regarded as being in the niche overlap (audience intersection) of those festivals. The niche overlap of a given festival, then, consisted of all those who were in niche overlaps of the focal festival and other festivals. To compare organizations with different fundamental niches, we used Jaccard's measure for asymmetric dyadic relations, arriving at a measure of dyadic niche overlap as the fraction of a fundamental niche overlapped by another organization's niche. Subsequently, all the dyads of each festival were aggregated to assess its overall niche overlap with all its "neighbors" (McPherson, 1983; Podolny *et al.*, 1996). Thus, for festival y ,

$$O_{yx} = |Y \cap X|/|Y|, \quad (1)$$

where O_{yx} is the fraction of y 's niche that has overlap with x 's niche; $|Y|$ refers to the cardinality of the set Y which denotes the number of respondents considering festival y , and $|Y \cap X|$ denotes the cardinality of the subset of respondents considering both

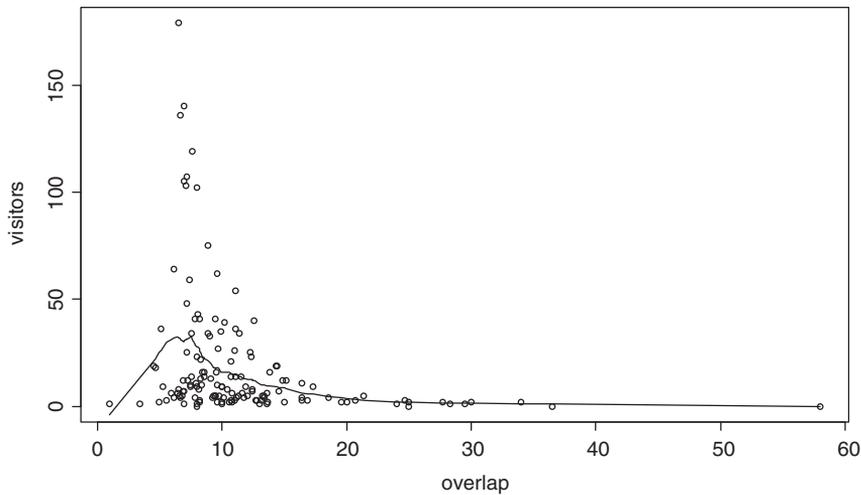


Figure 1 The number respondents claiming to have visited a music festival on the vertical axis, and the total niche overlap [equation (2)] on the horizontal axis. The line was drawn using the super smoother algorithm in R.

festivals y and x . The total niche overlap of festival y is the sum of dyadic overlaps over the range of festivals,

$$O_y = \sum_x O_{yx}. \quad (2)$$

This measure of niche overlap, which was log-transformed to normalize its distribution, was expected to relate non-monotonically to the number of actual visitors. The latter was used as a proxy for fitness in this cross-sectional study, given that the number of actual visitors should correspond closely with the share of the total appeal that exists within a festival's fundamental niche (Hannan *et al.*, 2007). Festivals that were neither considered nor visited by any respondent were removed from the data set, reducing the initial number of festivals from 143 to 137.

3.2 Results

Figure 1 clearly shows a humped relationship between niche overlap and the number of visitors, with the peak of the distribution to the right of the origin. The smallest (i.e. least successful) festivals often have very low or very high niche overlap with others, whereas the largest (most successful) festivals all have moderate niche overlaps.⁵

⁵The variance in niche overlaps showed a weakly negative but not significant relationship with the number of visitors. This means that for a given total niche overlap of a given festival, it might be slightly better for it if all its overlaps are roughly similar than if there is high variation among them.

Table 3 Negative binomial regression for the number of music festival visitors

	Model 1	Model 2	Model 3
Summer	-0.16 (0.07)**	-0.27 (0.06)***	-0.27 (0.06)***
Randstad	0.92 (0.35)***	0.62 (0.28)**	0.61 (0.30)**
Age	0.04 (0.01)***	0.03 (0.01)**	0.11 (0.00)***
Niche overlap		4.12 (0.38)***	4.89 (0.48)***
Niche overlap squared		-1.17 (0.05)***	-1.23 (0.06)***
Niche overlap * Age			-0.04 (0.01)***
Constant	2.01 (0.08)***	-0.82 (0.64)	-2.21 (0.84)***
ln(alpha)	0.19 (0.08)	-0.13 (0.11)	-0.14 (0.11)
Log likelihood	-525.32	-500.24	-499.11
Observations	137	137	137

Robust standard errors in parentheses.

*** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

Given the nature of the dependent variable (a count variable of which the distribution is highly skewed) as well as its over-dispersion, the effect of niche overlap was tested using a negative binomial regression. The results presented in Table 3 confirm the humped relationship between niche overlap and the number of visitors. The effects of festivals to take place in summer or in the most densely populated area of the country (Randstad) have been taken into account; festivals that exist longer tend to attract a larger crowd (Model 1). Model 2 incorporates niche overlap and niche overlap-squared and improves significantly over Model 1 (likelihood ratio $\chi^2 = 50.16$; d.f. = 2; $P < 0.001$). Model 3 adds the interaction between festival age and the first-order effect of niche overlap. The corresponding coefficient is statistically significant ($P < 0.01$), confirming our conjecture that the positive effect of niche overlap wears off as an organization ages. Although Model 3 displays only a marginal improvement in fit over Model 2, at the expense of an additional degree of freedom, the improvement over the baseline Model 1 is statistically significant (likelihood ratio $\chi^2 = 50.16$; d.f. = 3; $P < 0.001$). When controlling for the distinction between specialists (single-genre festivals) and generalists (multi-genre festivals), and for subsidy received, the results remain qualitatively the same.

3.3 Discussion

This audience-based data set offers support for both our first and second conjectures. But, because of the cross-sectional design of Study 1, the conclusions should be interpreted with some care. Numbers of visitors inferred from a cross-sectional survey is a rather distant proxy for organizational fitness. Neither growth nor

mortality rates were measured directly, so drawing solid conclusions about the causal direction would be unsound.

Moreover, the time frame in which the data were collected must be assumed to be fairly representative, and not characterized by exceptional events such as rapidly rising or falling resource volumes (carrying capacity). There was, however, no indication that the data were influenced by strong exogenous events at the time of collection. Most organizational ecology studies use longitudinal data, though, which we will use as well for our Study 2.

4. Study 2: niches among Web search engines

In order to investigate the influence of niche overlap over time, a web-based method was developed for measuring audience perceptions of inter-organizational comparability, and was applied to the Internet search engine industry over the period 1993–2000.

Soon after the introduction (in 1993) of the hyperlinked World Wide Web as we now know it, search engines became the most important tool for retrieving information from the Web (Lawrence and Giles, 1999). They became gate keepers mediating information flows between Web pages and Internet users worldwide. The economic value of this mediating position is indicated by the enormous market values of search engines, rising into the hundreds of billions of US dollars in their first 10 years of existence.⁶

The first search engines, such as Altavista, Infoseek, and Excite covered the entire Web and provided their services in English. In the late 1990s, over a 100 other search engines were established catering to specific languages or geographic areas. Those latter search engines had narrow niches, and their founding marks an era of differentiation in the search engine industry. In 2001, over 80% of the available search engines specialized in finding pages from a specific non-English language such as Portuguese, Russian, or Japanese, which often also implied geographic specialization.

Anecdotal evidence from the search engine market is in line with our conjectures, and suggests explicit awareness in the field that some degree of niche overlap with competing organizations is something to strive for. The Google search engine (founded in 1998), for example, in its first few years of existence actively referred to competing search engines by accompanying each search result by the line: “Try your

⁶For an overview of search engines, see <http://www.zakon.org/robert/internet/timeline/>. We also consulted searchenginewatch.com, <http://www.archive.org/web/>, and searchengineguide.com. For the Web seen as a social network at the time of data collection, Broder *et al.* (2000) and Kleinberg and Lawrence (2001) described its structure, Albert *et al.* (1999) its diameter, and Huberman and Adamic (1999) its growth dynamics.

search on Yahoo, Altavista, Alltheweb . . .” This strategy helped to establish Google as a member of a peer group, and possibly allowed it to differentiate itself within this peer group (Zuckerman, 1999). Other, mainly regional, search engines have followed a similar strategy. However, when Google became known as a legitimate search engine, it no longer needed to demonstrate its niche overlap with other search engines, and it abandoned the explicit comparison.

4.1 Methods

An inventory of all Internet search engines established between October 1993 and October 2000 was first prepared. Rather than using a specific predetermined list of search engines, an exhaustive search was conducted for services that were referred to by web users as a “search engine.” This search resulted in a list of 137 Internet search engines, ranging from early initiatives such as ALIWEB, World Wide Web Worm, and the Repository-Based Software Engineering (RBSE) spider, to early prototypes such as Excite, Galaxy, and LookSmart, to surviving services such as Altavista, AskJeeves, and Google, and to geographically specialized engines such as Voila.fr, Yandex.ru, and Ilse.nl. Whereas 74.2% of the search engines were independent ventures, 25.8% (such as Altavista.nl and Yahoo.fr) were subsidiaries of other search engines. Figure 2 shows that most founding took place between October 1996 and December 1998.

The (now obsolete) search engine Northernlight was then used to collect measurements of audience size and niche overlap over a 2-week period in 2001. The choice of Northernlight was based on the fact that at the time it had comprehensive coverage of the Web (ranking third among search engines; Hawking and Craswell, 2001), handled Boolean operators correctly, and facilitated searches into the past. Although Northernlight originated in 1997, its index contained web pages dating back as far as 1993. Web pages were dated based on the time they were last updated. Parallel testing with other search engines made clear that Northernlight’s results were not biased. An automated querying script, tailored for this purpose, forwarded Northernlight more than 250,000 queries, and stored the answers in a database.

Using Northernlight, it was possible to assess for each quarter year the web pages which contained a link to any of the 137 search engines. The number of links received was taken as indicating the audience size of each search engine. If web pages contained links to multiple search engines, this was taken as an indication that these search engines were in the same consideration set in the perception of that website’s owner. The 9613 pairs of search engines co-listed on web pages were used to calculate a measure of total niche overlap for each search engine. The aggregated Jaccard measure was again employed. Note that, in line with recent renderings of niche theory (Hannan *et al.*, 2007), the measure was again entirely audience-based, as it was the website owner who decided to place links to one or more search engines. Average niche overlap per search engine increased until April 1999 and then

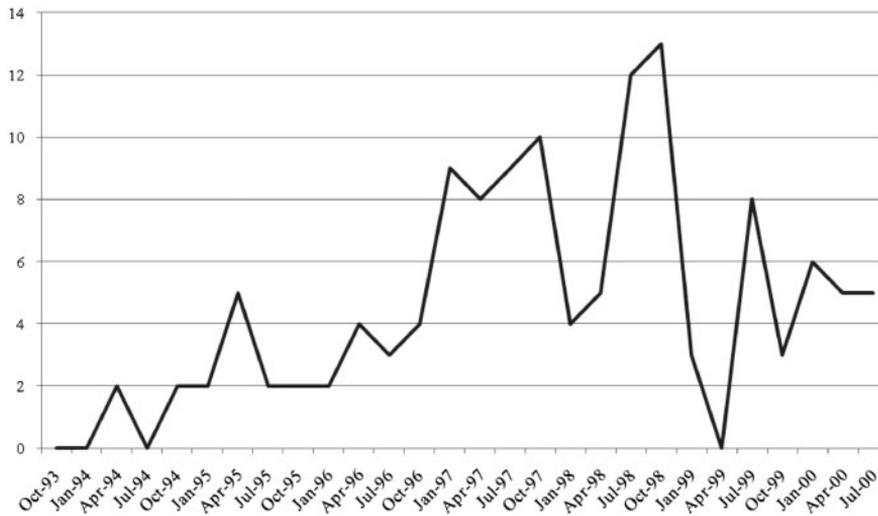


Figure 2 Number of search engine founding per quarter, October 1993–October 2000.

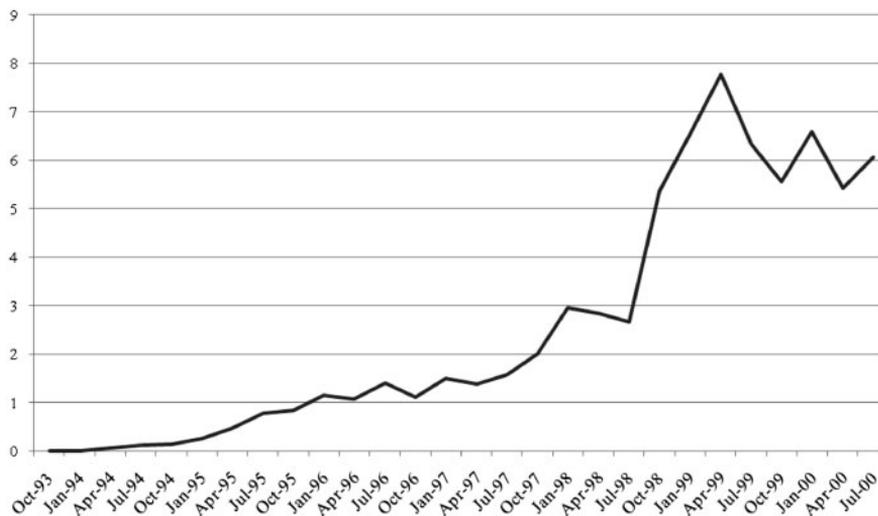


Figure 3 Mean total niche overlap per search engine by quarter.

decreased (Figure 3). This pattern is commensurate with resource partitioning theory (Carroll, 1985), which predicts that after a period of strong competition among generalists (search engines that cover the entire Web in English) characterized by industry concentration, smaller specialists (in language, region, or subject matter)

will move into the market periphery, resulting in decreasing niche overlap per capita.⁷

Over the entire period of observation, search engine overlap averaged 4.59 (SD = 8.55), meaning that website owners who listed a particular search engine listed on average 4–5 of the other 137 search engines as well. Niche overlap for subsidiaries of larger search engines such as Google France belonging to Google ($M = 7.28$, $SD = 15.09$) was significantly larger than niche overlap for independent ventures [$M = 3.68$, $SD = 4.28$; $F(1, 1458) = 50.16$, $P \leq 0.001$].

Growth was used as a dependent variable indicating organizational viability. A “growth event” was recorded each time a search engine’s niche, or audience, grew more than 10% faster than Northernlight’s index in that quarter, which in turn can be considered a proxy for the growth of the entire Web in that particular quarter, i.e. the increase of the environment’s carrying capacity. Growth events occurred for 45.9% of the search engines per quarter, on average. Figure 4 shows that, after March 1995, the percentage of growth events was fairly constant, varying between 35% and 59%. Subsidiaries experienced significantly more growth events (55.9%) than independent ventures [42.5%; $F(1, 1458) = 20.01$, $P \leq 0.001$].⁸

4.2 Results

To test the conjecture that niche overlap is non-monotonically related to the occurrence of growth events, the data were used to evaluate a discrete-time proportional hazards model with a complementary log–log transformation⁹ (Allison, 1982). The control variables included calendar time to take into account possible time trends; the number of previous growth events experienced by a search engine; and whether or not a search engine was a subsidiary. Following density dependence theory (Carroll and Hannan, 2000), the number of organizations, N , as well N^2 , both at $t - 1$, were used as controls, but both were highly correlated with time (at the 0.99 and 0.96 level, respectively) and therefore not independently significant. Therefore, they were omitted from the final model formulation. Their lack of significance was

⁷Generalists have economies of scale, in this case, low marginal costs when they provide their search results to an increasing number of users worldwide, and more users’ increases a search engine’s value to advertisers (Bakos and Brynjolfsson, 2000). Specialists, in this market would technically speaking have the same scale advantages, but as they are constrained by the sizes of relatively smaller language groups, regions, or subject matter, they can reap scale advantages only to a limited extent.

⁸We also derived Kaplan–Meier (1958) estimates for a set of differently specified growth events (20%, and 30% larger than the index; estimates not shown). This procedure confirmed that 10% growth with respect to the Web’s growth was the most reasonable threshold for growth events, but our results remained robust for 20% and 30% thresholds.

⁹Continuous time (semi-)parametric specifications, including piecewise-constant exponential models, were also tested in addition to the complementary log–log specification, and all provided similar coefficient estimates. Only the complementary log–log model is presented in detail.

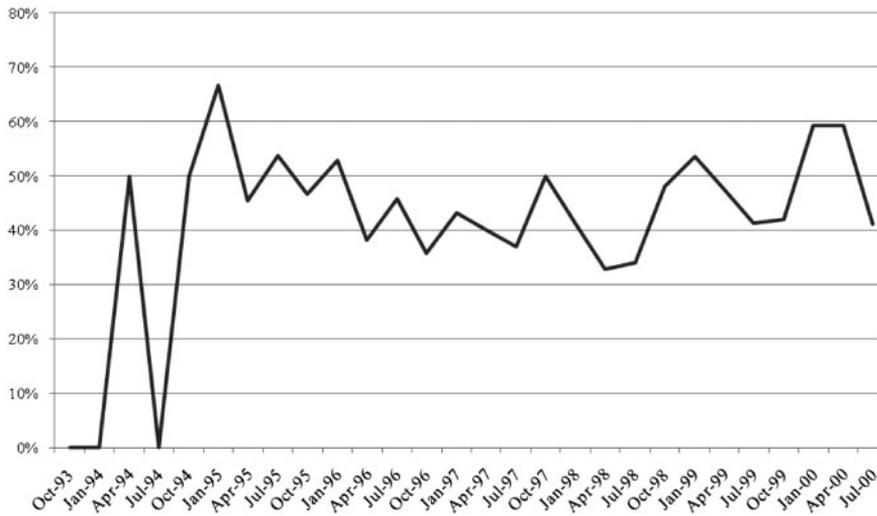


Figure 4 Percentage of search engines experiencing growth events per quarter.

probably due to the overall growth of the Web during the entire period of observation; density should be significant if one were to study the population over a longer period of time. Changes in carrying capacity were controlled for by relating growth to that of the entire Web; for a growth event to occur, a search engine had to grow at least 10% faster than the Web as a whole. Niche overlap at $t - 1$, and also its square were included to test for both rectilinear and non-monotonic relationships.

The results in Table 4 confirm that niche overlap at $t - 1$ was non-monotonically related to the incidence of growth events. A one unit increase in niche overlap at time $t - 1$ was found to predict an increase of about 3% in the probability of growing at least 10% faster than the Web as a whole (Model 1). Therefore, having some niche overlap with other search engines increased the probability of growing strongly in the subsequent quarter. However, the significant contribution of niche overlap squared to the model shows that when niche overlap becomes very high, it has a negative effect. This is clear evidence for the conjectured humped relationship between niche overlap and growth, at least in the Internet search engine population.

Subsidiary firms had a much higher probability (32%) of growing faster than non-subsidiaries. The effects of niche overlap, however, were very similar for both types of firm, as separate analyses confirmed (models not reported here). Also, Model 2 strongly confirmed the conjectured interaction between niche overlap and age. Apparently, new search engines need more niche overlap than older ones to get noticed and to win over audience members. Once they are known, the positive effect of niche overlap diminishes. However, in contrast to what Theorem 4 states, the positive effect

Table 4 Coefficients of the discrete-time proportional hazards models

	Model 1	Model 2
Baseline hazard function $[\ln(t)]$	-1.1050 (0.090)***	-1.1133 (0.090)***
Niche overlap at $t - 1$	0.0264 (0.009)***	0.0786 (0.017)***
(Niche overlap at $t - 1$) ²	-0.0001 (0.000)*	-0.0003 (0.000)**
Historical time	0.0287 (0.009)***	0.0287 (0.009)***
Age	-0.1418 (0.014)***	-0.1095 (0.016)***
Subsidiary	0.1686 (0.092)*	0.1981 (0.092)**
No. of prev. 10% growth events	0.1761 (0.023)	0.1859 (0.024)***
Age \times Niche overlap at $t - 1$		-0.0099 (0.003)***
Constant	-0.6202 (0.1719)***	-0.6519 (0.179)***
Observations	1459	1459
No. of episodes	952	952
No. of events	664	664

Notes: significance at the confidence level: *** $P \leq 0.01$, ** $P \leq 0.05$, * $P \leq 0.1$. Standard errors in parentheses.

of niche overlap does not vanish completely. This finding suggests that perhaps Theorem 4 was stated overly strong: age may reduce the positive effect of niche overlap, but not eliminate it. Alternatively, the finding may indicate that organizations in our search engine population were not yet at the age at which niche overlap becomes a solely negative force. In the period 1993–2001, consumers were in the process of adopting the Internet, and Internet search engines were still a new concept to many.

4.3 Discussion

Study 2 introduced a web-based method to extract, over time, audience perceptions of inter-organizational comparability on the one hand and organizational growth rates on the other. The results of the subsequent event history analysis are clear: audience-based niche overlap has a non-monotonic relationship with organizational fitness, and new organizations benefit more from niche overlap than older organizations. Study 2 thus reinforces the findings of Study 1, but without the methodological drawbacks of the latter's cross-sectional design. Both studies used audience-based inter-organizational comparability perceptions to assess niche overlap, distinguishing them from prior ecology studies, which have usually employed researcher-imposed overlap assessments.

Study 2 observed organizations in a turbulent period. Many newcomers were settling in while incumbents were seeking scale advantages. The presence of different types of organizations highlighted their different strategies with respect to

audience-based overlap perceptions. In addition, the search engine population as a whole was gaining ground, resulting in a continuously increasing carrying capacity. Even after correcting for this increase, which might have obscured the more subtle effects of niche overlap, audience perceptions of inter-organizational comparability still had a significant impact on organizational fitness. Therefore, even in this resource-abundant period, search engines which positioned themselves well were more successful than search engines that were either too close to or too far from the main stream.

5. General discussion and conclusions

These results complement those of earlier studies on the effects of niche overlap because for the first time niches and niche overlap have been measured directly on the basis of consumers' appreciation of the offerings of competing organizations and not on the basis of predetermined metrics. Measuring competition this way gives a more valid account of the actual competitive and cooperative relations between organizations. In addition, an operational definition of niche overlap in terms of audience overlap facilitates cross-fertilization between organization ecology theories about market dynamics and theories from consumer psychology and media-related research. Studies of legitimacy might benefit from hybridizing theories from these fields, and may also take into account the effects of diversifying and globalizing media channels.

A non-monotonic relation between niche overlap and organizational fitness was found in the search engine population for both independent ventures and for subsidiaries of larger firms. It seems surprising that while subsidiaries' niches were significantly more crowded than independents, subsidiaries at the same time were more likely to experience significant growth. This finding indicates that subsidiaries—often locally targeted versions of large broad-niche organizations—may be more resilient than independents against the competitive pressures exerted by their peers. A similar pattern was noticed long ago for region and submarket specialized subsidiaries of large department stores and motoring companies (Chandler, 1962). Those subsidiaries could benefit from scale advantages through the holding companies, were, to some extent, protected against financial risks (Padgett and McLean, 2006), and could further exploit a portion of their environment that the (initially small) holding company had pioneered earlier.

The finding that some degree of niche overlap may benefit organizations' viability does not apply equally to all organizational environments. For natural resources, to which classical biological theories apply (e.g. Levins, 1968; Schoener, 1974), the game is basically zero sum. When fishing boats go out to sea, fish caught by one boat cannot be caught by a competitor, so they need to keep enough distance. Even if one boat's catch is used by another boat as a signal to throw out its nets at the same

spot—an instance of mutualism—their niche overlap will not increase the number of available fish. In contrast, they will benefit from overlap in the audience part of their environment, as in the harbor they can collectively attract for each boat a larger number of fish consumers than individual boats can attract on their own.¹⁰

The scope of these studies did not include markets characterized by contested identities. Our theory suggests that greater niche overlap facilitates comparability and, as a result, legitimacy spillovers. Yet, in contested arenas, in contrast, comparability facilitates the detection and sanctioning of those organizations that threaten established identities or what Dobrev *et al.* (2006) has called “violation by comparison.” For instance, Negro *et al.* (2011) in their study of Italian winemaking found that wine makers that defected marginally from previously accepted practices were perceived as posing a stronger identity threat than those who departed more substantially from established practices. In addition, consider the political arena where some political parties might have nearby but not identical positions on a political spectrum. They compete for recognition and voters, but, at the same time, their adjacent niches make the distinctions between them more salient, which threatens (rather than legitimizes) their ideological identity (Barnett and Woywode, 2004). Therefore, while in general, we would expect comparability to lead to legitimacy spillovers, under specific conditions (fields characterized by contestation) comparability may trigger sanctioning instead. In such situations, the relationship between niche overlap and fitness would be expected to follow a pattern that is distinct from the one predicted here.

One way to extend these arguments would be to explore how organizations themselves differ in their responses to niche overlap. The extent to which organizations actively compete or cooperate depends not only on the extent of their niche overlaps, but also on the organization’s perceptions thereof. Perceptions and actuality can differ when framing occurs, which happened during airwaves auctions for mobile telephony in the USA (1994–1995). Then, companies with the same technological standard (that could connect to each other more cheaply than different standards could) might have perceived their differences in area coverage as complementary. Accordingly, researchers expected tempered bidding between firms with the same technology from different regions, and fiercer bidding between firms with different technologies. It turned out, however, that the technologically similar firms bid fiercely against each other (Bruggeman *et al.*, 2003). Apparently, the auction was perceived as a threatening situation where customers could be lost to rivals and not as an opportunity to attract consumers through cooperation.

¹⁰Notice that one should distinguish between niche overlap on the one hand and common goals on the other. For example, fishing boat captains who fiercely compete at sea may collaborate in negotiations with their local government about harbor infrastructure, and try to enhance the fitness of all fishing boats through their collective action.

Natural environments and contested identities set aside, the results of both studies clearly disprove the straightforward notion that niche overlap always negatively influences organizational fitness. In fact, the results show that organizations with some degree of niche overlap were more viable than organizations in non-overlapping or in highly overlapping niches in two very different fields. Niche overlap suggests that audiences perceive the product or service offerings of the organizations involved to be at least partially comparable and as a result are more likely to assign a common label to the organizations. Being described by a common label benefits individual organization, as it allows for the transfer of legitimacy.

The results also show that the trade-off between the benefits and drawbacks of niche overlap is dynamic: young organizations stand to benefit more from legitimacy spillovers than older, more established ones. Legitimacy spillovers facilitate access to resources such as loans, contracts with suppliers, and a qualified work force, resources that are usually critical to the viability of young organizations (Freeman *et al.*, 1983). As new organizations age and obtain legitimacy of their own, the positive effects of niche overlap diminish, though without vanishing altogether, while the negative effects of competitive pressure remain.

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APPENDIX A: logical formalization

This appendix describes the formalization of the paper's argument in LTB, a non-monotonic logic (Hannan *et al.*, 2007). This appendix includes (i) a set of formal postulates (i.e. assumptions), (ii) formal theorems (conclusions) derived from the postulates, and (iii) methods of derivation. Notation (logical constants, variables, functions, name constants, and relations) is explicated in Table A1 in Appendix A. For Postulate 1, a reading aid is provided, which should help with the remaining sentences as well.

Postulate 1: Niche overlap reduces organizational fitness.

$$\forall x, x', t, t' [(NO(x, t) < NO(x', t')) \rightarrow (Fit(x, t) > Fit(x', t'))]$$

Read: Normally, for variables x , x' , t , and t' , if niche overlap for an organization x at time t is smaller than niche overlap for an organization x' at time t' , then fitness for an organization x at time t will be greater than fitness for organization x' 's at time t' .

Note that x could be equal to x' , or not. The same holds for t and t' . Therefore, Postulate 1 could apply to a single organization experiencing a change in niche overlap over time, or to two organizations experiencing unequal niche overlap at the same, or different, times. In theory, this postulate could even apply to a single organization at a single point in time. Then, however, the antecedent cannot hold, and neither can the consequent. Note, furthermore, that Postulate 1 (as well as the postulates below) aims to capture the relationship between organizational properties in isolation, that is in the absence of variation in other, possibly intervening, properties such as organizational size, quality of management, market characteristics, or economic conditions. Our postulates should be interpreted under *ceteris paribus* (all other things being equal) conditions. In fact, one of the benefits of using non-monotonic logic in social science theory building is that it treats *ceteris paribus* statements as they are: general statements that are challenged, but not immediately refuted, once new, more specific, information becomes available.

Postulate 2: At low levels of niche overlap, the greater its niche overlap with other members of a legitimate category, the greater the proportion of the audience that will label the organization as a member of that category.

$$\aleph x, x', t, t' [(NO(x, t) < NO(x', t') \leq NO^*) \rightarrow (Lab(x, t) < Lab(x', t'))]$$

Note that NO^* , the level of niche overlap below which an increase in overlap generate more widespread labeling, remains unspecified. Although Postulate 2 does not allow NO^* to be 0 – the absolute minimum – NO^* may vary between markets. In markets, where labels are complex and singular, and therefore harder to attribute (e.g. advanced technological products or services) NO^* will be much higher than in markets where labels are simple and generic (e.g. toys).

Postulate 3: The greater the proportion of the audience that will label the organization as a member of a legitimate category, the more that organization stands to benefit from legitimacy spillovers.

$$\aleph x, x', t, t' [(Lab(x, t) < Lab(x', t')) \rightarrow (LS(x, t) < LS(x', t'))]$$

Postulate 4: Legitimacy spillovers improve fitness.

$$\aleph x, x', t, t' [(LS(x, t) < LS(x', t')) \rightarrow (Fit(x, t) < Fit(x', t'))]$$

Applying the cut rule to Postulates 2, 3, and 4 generates Theorem 1.

Theorem 1: At low levels of niche overlap, niche overlap improves fitness.

$$\beta x, x', t, t' [(NO(x, t) < NO(x', t') \leq NO^*) \rightarrow (Fit(x, t) < Fit(x', t'))]$$

Note that Theorem 1 only covers the specific cases where niche overlap levels are low. What happens in other cases, is yet undecided. To be able to derive a theorem about these cases, we need to add some implicit background information.

Background Postulate BG1: If, at high levels of niche overlap, overlap of x at t is higher than of x' at t' , then in fact overlap of x at t is higher than of x' at t' .

$$\forall x, x', t, t' [(NO^* < NO(x, t) < NO(x', t')) \rightarrow (NO(x, t) < NO(x', t'))]$$

Note that Postulate BG1 requires NO^* to be lower than the absolute maximum; otherwise, the antecedent could not be true. Therefore, it is established that NO^* is between NO_{\min} and NO_{\max} .

Applying the cut rule to Postulates 1 and BG1 generates Theorem 2.

Theorem 2: At high levels of niche overlap, niche overlap reduces fitness.

$$\forall x, x', t, t' [(NO^* < NO(x, t) < NO(x', t')) \rightarrow (Fit(x, t) > Fit(x', t'))]$$

Together, Theorem 1 and 2 describe the non-monotonic relationship between niche overlap and fitness. Note that both theorems do not cover all possible instances of niche overlap. If $NO(x, t)$ and $NO(x', t')$ are on opposite sides of NO^* the consequent is undecided, as it should be.

Postulate 5: Up to a certain age, niche overlap improves legitimacy spillovers.

$$\forall x, x', t, t' [((NO(x, t) < NO(x', t')) \& (Age(x, t) < Age^*) \& (Age(x', t') < Age^*)) \rightarrow (LS(x, t) < LS(x', t'))]$$

Note that Postulate 5 leaves the relationship between the ages of x at t and x' at t' unspecified—it only requires that both ages are larger than Age^* . Note, furthermore, that Age^* , the organizational age below which an increase in niche overlap yields more legitimacy spillovers, is not specified. Like NO^* , Age^* may vary between markets. In markets, where consumer trust and long-term performance are pivotal (e.g. banking, cars), it may take a long time to individually earn legitimation. In such markets, Age^* will be relatively high. In contrast, in markets where novelty and originality are important qualities (e.g. the music industry), Age^* may be much lower.

Applying the cut rule to Postulates 4 and 5 generates Theorem 3

Theorem 3: Up to a certain age, niche overlap improves fitness.

$$\beta x, x', t, t' [((NO(x, t) < NO(x', t')) \& (Age(x, t) < Age^*)) \& (Age(x', t') < Age^*)] \rightarrow (Fit(x, t) < Fit(x', t'))]$$

Similar to Theorem 1, Theorem 3 only covers the specific cases where both x at t and x' at t' are young organizations. What happens in the remainder cases yet needs to be decided upon? Again, we add some implicit background information.

Background Postulate BG2: If, for older organizations x at t and x' at t' , overlap of x at t is higher than of x' at t' , then in fact overlap of x at t is higher than of x' at t' .

$$\aleph x, x', t, t' [((NO(x, t) < NO(x', t')) \& (Age^* < Age(x, t))) \& (Age^* < Age(x', t'))] \rightarrow (NO(x, t) < NO(x', t'))]$$

Now, applying the cut rule to Postulates 1 and BG2 generates Theorem 4.

Theorem 4: For older organizations, niche overlap reduces fitness.

$$\beta x, x', t, t' [((NO(x, t) < NO(x', t')) \& (Age^* < Age(x, t))) \& (Age^* < Age(x', t'))] \rightarrow (Fit(x, t) > Fit(x', t'))]$$

Together, Theorem 3 and 4 describe the interaction between niche overlap and organizational age on fitness. Theorem 3 and 4 do not cover all possible instances: If x at t is an older organization and x' at t' a younger organization, or vice versa, the consequent is undecided, as it should be.

Table A1 Notation for logical constants, random variables, functions, name constants, and relations

Notation	Meaning
Logical constants	
\rightarrow	Material implication
$\&$	Conjunction
\bowtie	Non-monotonic “normally” quantifier
β	Non-monotonic “presumably” quantifier
Variables	
x, x', t, t'	
Functions	
$NO(x, t)$	Niche overlap with other members of a legitimate category for organization x at time t
$Fit(x, t)$	The fitness of organization x at time t
$Lab(x, t)$	The proportion of the audience that assigns the category label to organization x at time t
$LS(x, t)$	The extent to which organization x can benefit from legitimacy spillovers at time t
$Age(x)$	The age of organization x at time t
Name constants	
NO^*	The level of niche overlap below which further increases in niche overlap lead to more audience assigning the category label to organizations within a particular market.
Age^*	The age below which further increases in niche overlap lead to more legitimacy spillovers for organizations within a particular market.
Relations	
$x < x'$	x is smaller than x'
$x \leq x'$	x is smaller than, or equal to, x'