

sadness and worrying behaviors (Agumadu et al. 2004; de Graaf et al. 2005; Van de Vliert et al. 2004; Kovalenko et al. 2000; Okawa et al. 1996; Rehdanz & Maddison 2005). Indeed, expressed happiness is rated among the most preferred characteristics in a potential new friend, and is thus effective for attracting novel/risky relationship partners (Chang 2004; Farmer et al. 2003; Vigil 2007; Xu & Zhang 2007), thereby increasing the size of one's social network and risk of exposure to foreign pathogens. On the other hand, sadness and worrying behaviors are more effective for inducing solicitous responses from reliable/existing relationship partners (e.g., Kaniasty & Norris 1995; Terwogt 2002; Vigil 2008). Related incongruities are findings of higher levels of happiness and of confidence, and the formation of larger social networks among more religious and more conservative-leaning people in Western samples (e.g., Keyes & Reitzes 2007; Napier & Jost 2008; Vigil 2010). Other research has failed altogether to find a correlation between sensitivity to pathogen disgust and conservatism (Tybur et al. 2010).

An alternative "socio-relational" model for explaining the above findings suggests that people are primed to behaviorally advertise differing fundamental components of their *reciprocity potential*, or value as a prospective social partner, depending on the opportunity and the effectiveness at using such traits for regulating different types of social networks (Vigil 2009). Some affect behaviors, such as expressed joy and confidence, are functional for demonstrating personal empowerment or one's *capacity* to reciprocate, whereas other behaviors, such as sadness and worrying, are more effective at conveying the impression of appeasement and vulnerability (i.e., non-threat) and general *trustworthiness* attributes. Capacity cues (e.g., physical attributes) are more immediately discernable through limited interactions as compared to trustworthiness cues (e.g., interpersonal attributes), which instead require repeated interactions to accurately verify in others. Humans may have therefore relied on the former to regulate larger, more fluid, peer networks that limit the amount of time that can be invested in individual relationships' and relied on the latter to regulate smaller, more intimate social networks that facilitate the opportunity to advertise time-consuming investment behaviors (Vigil 2009). Thus, from a socio-relational perspective, it makes sense that people would be primed to heuristically express more network-aggrandizing capacity cues (e.g., felt happiness) under climatic conditions that facilitate the ability to interact with a greater number of affiliates (warmer climates), and to express network-consolidating trustworthiness cues (e.g., felt sadness) under climatic and topographical conditions that physically limit the ability to interact with others (colder climates; Vigil 2009). Similarly, patterns among conservatives (e.g., higher income, more joy and aggression, and, important here, more peer relationships; Vigil 2010) can be understood from the socio-relational thesis that experiential prosperity precipitates the behavioral advertisement of personal empowerment cues that are effective at regulating larger, riskier social networks (Vigil 2009; 2010).

However, perhaps the greatest limitation of F&T's model is that it cannot currently account for *intra-regional* variability in assortative sociality, such as the phenomenon of developmental changes and sex differences in many of the phenotypes that the authors describe. For instance, females show higher levels of religiosity, liberal-political ideals, in-group helping (compassion) behaviors, and out-group stigmatization; and they form smaller, more intimate and exclusive social networks as compared with males (Eagly & Crowley 1986; Ekehammar et al. 2003; Geary et al. 2003; Norrander & Wilcox 2008; Rose & Rudolph 2006; Stark 2002; Walter & Davie 1998; Vigil 2009). Though not addressed by the authors, many of these sex differences can be explained by an evolutionary history of male-male coalitional competition and male-biased philopatry, whereby males tended to remain in closer proximity to their male-kin, while females emigrated into the social networks of their husbands, essentially heightening their risk of parasitic infection (Geary 2002; Geary

2010; Geary & Flinn 2002; Wrangham & Peterson 1996). Females have more active immune systems than do males (Bouman et al. 2005; Klein 2000; Zuk & McKean 1996). Thus, some sex differences in assortative sociality and immune functioning are consistent with the parasitic-threat hypothesis that sex differences in societal behaviors and in social networks may be due to ancestral females having been exposed to higher levels of parasitic threat in their ecology.

Still, sex differences in emotional functioning are well established, with males reporting higher levels of empowerment gestures (e.g., inflated confidence), and females reporting higher levels of vulnerability gestures (e.g., sadness, worrying, and pain behaviors; see Vigil 2009). These dimorphisms are accountable by the socio-relational model which predicts that male-biased philopatry increased the benefit for females to form smaller and more protective social networks, to develop higher cognitive thresholds for trusting peers, and to signal higher levels of trustworthiness (e.g., vulnerability) cues to attract and maintain more continuous and reliable relationship partners in the absence of strong (inclusive-fitness) familial bonds. Males, in contrast, having evolved within kin-based communities, would have experienced a reduced benefit to form intimate, time-consuming relationships and a greater cost for advertising trust cues in favor of capacity gestures, which may be more efficient for regulating a greater number of relationships, and thus larger and more functional coalitions (Vigil 2009). Hence, many of the instances of *intra-regional* assortative sociality that covary with sex can be accounted by a socio-relational model which capitalizes on the differential expression of fundamental social cues for maintaining distinct social networks. It is therefore likely that the selection pressures that each model emphasizes complement each other in their ability to account for both inter- and intra-regional assortative social cognitive/behavioral strategies.

Immigration, parasitic infection, and United States religiosity

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Abstract: Fincher & Thornhill (F&T) present a powerful case for the relationship between parasite-stress and religiosity. We argue, however, that the United States may be more religious than can be accounted for by parasite-stress. This greater religiosity might be attributable to greater sensitivity to immigration, which may hyperactivate evolved mechanisms that motivate avoidance of potential carriers of novel parasites.

Fincher & Thornhill (F&T) document a large and predicted correlation between parasite-stress and religiosity cross-nationally and within the United States. F&T also present a powerful theoretical and empirical case for the effects of parasite-stress on the promotion of boundaries between in-group and out-groups, including the generation and maintenance of ethnocentrism and xenophobia. We argue, however, that the United States may be more religious than can be accounted for by parasite-stress. This greater religiosity (relative to cultures with similar parasite-stress levels) might be attributable to greater sensitivity to immigration, which may hyperactivate evolved mechanisms that motivate avoidance of potential carriers of novel parasites.

Historically, the United States has been a Mecca for immigration and for concerns about immigration: from the first settlers on Native American soil, to the enormous influx of Europeans in the early 1900s, to today's perpetual dialogue on the fear or protection of Hispanic and Middle Eastern immigrants. Recent research indicates that the United States is less favorably disposed toward immigrants than are most European countries (who, in turn, are less religious; e.g., Isernia et al. 2010). This apparent hypersensitivity to immigration in the United States could be the product of several factors. First, since the inception of the country, immigration of one group or another has been cause for concern among native citizens. The Irish, the Polish, the Japanese, and the Russians are each groups that have been the focus of concern coinciding with their mass immigration to the United States. This intense and typically negative concern about immigrants and immigration might reflect hypersensitivity to the changes and threats they bring. Out-groups, including immigrants, may be (or are perceived to be) "lacking knowledge of and therefore violating local customs or norms, many of which, like hygiene and methods of food preparation, may prevent infection from local parasites" (target article, sect. 2.1, para. 3). These violations are registered as threats by our "behavioral immune system," which F&T explain is "comprised of ancestrally adaptive feelings, attitudes, and values about and behaviors toward out-group and in-group members, caution about unwillingness to interact with out-group people, and prejudice against people perceived as unhealthy, contaminated, or unclean" (sect. 2.1, para. 1). To many Americans, immigrants are seen as just that: "unhealthy, contaminated, or unclean." But why is this? Perhaps the American media and other interest groups are priming individuals for fear of parasitic infection with certain "keywords" in connection to immigrants.

It is not uncommon to hear remarks from conservative personalities, politicians, and news sources comparing immigrants to subhuman species. The use of terms that compare immigrants to particular nonhuman species seems to justify the treatment of them as such (see Livingstone Smith 2011). Representative Curry Todd (2010), a republican from Tennessee, commented during a Joint Fiscal Review Committee meeting on a medical program that covers Tennessee children, including immigrant children: "We can go out there like rats, and multiply then, I guess," in reference to the pregnant women that come into America. Michael Savage (2006), a conservative talk-show host, referred to Mexican immigrants as "vermin" and Rush Limbaugh (2005), a conservative radio host, referred to immigrants as an invasive species: "So invasive species like mollusks and spermatozoa are not good, and we've got a federal judge say, 'You can't bring it in here,' but invasive species in the form of illegal immigration is fine and dandy – bring 'em on, as many as possible." F&T summarize the results of recent research on diverse Western samples which indicate:

that scores among individuals on scales that measure the degree of xenophobia and ethnocentrism correspond to chronic individual differences in perceived vulnerability to infectious disease; those who perceive high disease risk are more xenophobic and ethnocentric than those who perceive low disease risk. Importantly, this research also shows that xenophobia and ethnocentrism within individuals increases under experimental primes of greater disease salience in the current environment. (sect. 2.1, para. 13)

The relationship of hypersensitivity to immigrants and increased religiosity might be attributable, in part, to the select terms and vitriol often used to describe immigrants by the religious conservative media. Likening immigrants to "vermin" and "rats" may prime disease salience and, therefore, motivate greater assortative sociality (see also Livingstone Smith 2011).

A second possible explanation for the apparent US hypersensitivity to immigration is the relative isolation of the United States from other countries. The mainland is bordered by just two

countries. Latin American immigrants tend to be treated more poorly than are Canadian immigrants, certainly by the conservative religious media and other interest groups. This might be attributable to the perceived potential threat posed by immigrants from countries with higher parasite-stress, such as Mexico and other Latin American countries. This difference in treatment of immigrants might be exacerbated by the fact that Mexicans and other Latin Americans comprise a much larger proportion of immigrants than do Canadians. The more striking cultural differences and associated perceived threats between Americans and Latin Americans might therefore be doubly threatening, given the much larger immigrant population. In addition, because the US mainland shares its borders with just two countries, its citizens may be less accustomed to cross-national travel. In Europe, in contrast, one can traverse through multiple countries within a day's time. Individuals in the United States therefore may be more aware of immigrants entering the country, simply because immigration is more apparent when it occurs.

We speculate that, in combination with parasite-stress, increased sensitivity to immigration into the United States (with immigrants perceived as potential carriers of novel parasites) hyperactivates evolved mechanisms that motivate assortative sociality. The current levels of parasite-stress in combination with the sensitivity to immigration might explain the collectivistic and especially religious nature of the United States, relative to other countries with similar parasite-stress levels. Furthermore, as immigrants enter the United States, native individuals within areas of high parasite-stress may be more likely to enforce the dividing line between in-group and out-group, promoting and maintaining ethnocentric and xenophobic behaviors and in-group connectivity with religious activities. The elevated parasite-stress in combination with hypersensitivity to immigration might form a perfect storm for increased religiosity as protection against novel infectious diseases.

Time allocation, religious observance, and illness in Mayan horticulturalists

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Abstract: Analysis of individual differences in religious observance in a Belizean community showed that the most religious (pastors and church workers) reported more illnesses, and that there was no tendency for the religiously observant to restrict their interactions to family or extended family. Instead, the most religiously observant tended to have community roles that widened their social contact: religion did not aid isolation – thus violating a key assumption of the parasite-stress theory of sociality.

If humans evolved adaptive flexibility in religiosity and family focus depending on pathogen prevalence in their local geographic area, time allocation studies should show that religious individuals choose isolation from outsiders, and as a consequence experience fewer communicable illnesses than less-religious individuals in the same location. The group or regional differences found by Fincher & Thornhill (F&T) must represent aggregated differences in individuals' behaviour.

As tests of whether reduced contact with outsiders is an aspect of religiosity, and whether religious individuals experience fewer illnesses as a result, I analyzed interview-based data from