

# **EvoS and the Binghamton Neighborhood Project**

## **Understanding and Improving the Human Condition from a Unified Theoretical Perspective**

Using science to understand and improve the human condition requires integration across disciplines, from molecular biology and neurobiology to history, sociology, cultural anthropology, and economics. This kind of integration requires a unifying theoretical framework that can be applied across all human-related disciplines.

The biological sciences provide a model of unification that can be emulated by the human-related sciences. The study of life in general includes a much greater array of disciplines than the study of our own species, from molecular genetics to biogeography, yet all of these disciplines can be related to each other through a common set of principles provided by evolutionary theory. This unification took place over the course of the 20<sup>th</sup> century, enabling the geneticist Theodosius Dobzhansky to famously say in the 1970's that "nothing in biology makes sense except in the light of evolution."

A comparable unification did not take place for the human behavioral sciences during the 20<sup>th</sup> century, but it is currently in progress. What accounts for the time lag? In part, it is because evolutionary theory became associated with political ideologies that attempted to justify social inequality. Also, the glamour of reductionistic science and minimalistic theoretical frameworks such as behaviorism and rational choice theory made speculations about our distant past appear irrelevant. For these and other reasons, evolutionary theory became confined to the biological sciences and avoided for most human-related subjects for most of the 20<sup>th</sup> century, with the exception of particular disciplines such as physical anthropology and human genetics.

All of this is starting to change, mostly within the last 20 years. The field of economics provides an excellent example of conceptual integration made possible by evolutionary theory. During the last half-century, economics has been dominated by rational choice theory, which attempts to explain all aspects of human behavior on the basis of individual utility maximization. This single minimalistic principle led to an enormous body of theory that ultimately failed to account for many aspects of human behavior. Economists who became dissatisfied with rational choice theory initiated the field of experimental economics as a way to empirically investigate human preferences. If people don't entirely strive to maximize their personal utilities, what *do* they strive for? The selection of Vernon Smith and Daniel Kahneman to receive the Nobel Prize in 2002 reflects the impact of experimental economics on the field of economics.

Empirical inquiry is an essential component of any scientific field, but it must be guided by a theoretical framework. What guides experimental economics, if not rational choice theory? One answer to this question is "cognitive psychology," the field represented by Kahneman. However, cognitive psychology can only identify the proximate mechanisms that guide human behavior, without explaining how they came into existence.

Evolutionary theory is required to provide the ultimate explanation for how human preferences came into existence, either directly by genetic evolution or indirectly through open-ended psychological and cultural processes that themselves require a genetically evolved architecture.

These trends illustrate an important point: The field of economics has *always* relied upon evolutionary theory to justify its assumptions. Most rational choice theorists are not young earth creationists. When challenged to explain their assumption that humans always act to maximize their personal utilities, the most straightforward answer is evolutionary—personal utility maximizers survived and reproduced better than those who behaved otherwise. In essence, rational choice theorists are in the position of saying “I *require* evolutionary theory but I *don't need to know much about* evolutionary theory, to the extent that it justifies my assumption about personal utility maximization.” Experimental economists are in the same position when they base their research on a more complex set of assumptions provided by the field of cognitive psychology.

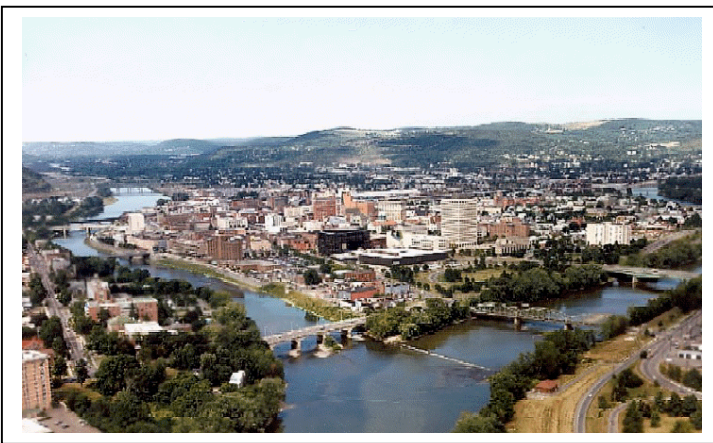
In this fashion, all roads lead to evolutionary theory. In the biological sciences, this is known as the proximate-ultimate distinction. Everything that evolves requires two complementary explanations; a) the mechanistic process that causes the trait to exist in individual organisms (proximate causation), and b) the environmental forces that caused the trait to evolve, rather than other traits, often because of its contribution to survival and reproduction (ultimate causation). Well-rounded research programs in the biological sciences pay equal attention to proximate and ultimate causation, which mutually inform each other.

This balanced perspective is only recently emerging within the field of economics. Authors such as Ernst Fehr, Simon Gächter, Samuel Bowles, Herbert Gintis, and Gerd Gigerenzer are identifying the human social preferences that are likely to exist in the ultimate sense, based on their contribution to survival and reproduction. This inquiry includes but also goes beyond genetic evolution. Evolutionary game theory assumes a generalized replicator dynamic, whereby the most successful behavioral strategy increases in frequency over time. This can include fast-paced processes based on imitation, learning, and intentional thought in addition to the slow-paced process of genetic evolution, vastly expanding the domain of evolutionary theory and its relevance to contemporary human social dynamics.

A balanced evolutionary perspective, based on both proximate and ultimate causation, enables the field of economics and all other human-related disciplines to become unified in the same sense as the biological sciences. Proximate causation incorporates disciplines such as neurobiology, molecular genetics, and learning theory. Ultimate causation incorporates disciplines such as cultural anthropology, paleoanthropology, evolutionary psychology, and cross-species comparisons. An examination of the current literature in the human-related sciences and even the humanities shows that this integration is taking place spontaneously and at a rapid pace.

## **A Whole University/Whole City Approach to Understanding and Improving the Human Condition from a Unified Theoretical Perspective**

At Binghamton University, a campus-wide evolutionary studies program called EvoS provides an infrastructure for the kind of interdisciplinary research outlined above (<http://evolution.binghamton.edu/evos/>). EvoS makes it easy for undergraduate students, graduate students, and faculty to learn about evolution as a theory that applies to all aspects of humanity in addition to the biological world. The faculty training component is important, because most faculty in human-related subjects did not receive



**Figure 1.** A view of downtown Binghamton at the confluence of Chenango and Susquehanna Rivers.

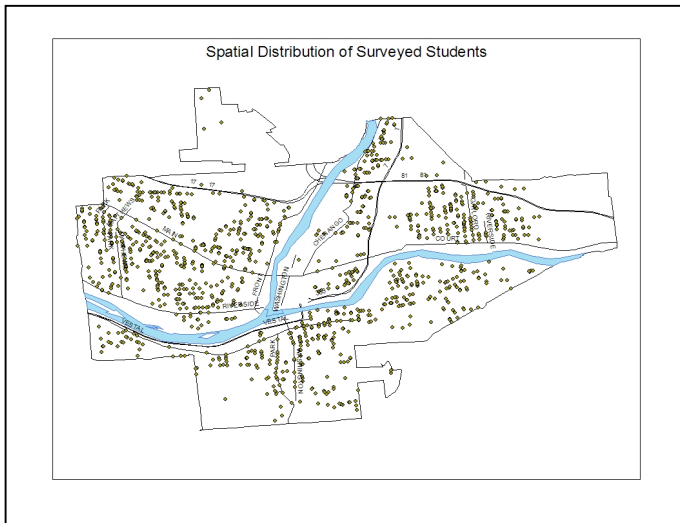
formal evolutionary training during their own higher education. EvoS currently includes over 50 faculty participants representing virtually every college and department on campus. In addition to its role as a training program, EvoS was recently given the designation of an Institute for Advanced Studies within Binghamton University, in recognition of its capacity for fostering interdisciplinary research collaborations. The research

described in this report provides an outstanding example, drawing from disciplines as diverse as evolutionary biology, economics, cultural anthropology, molecular genetics, social psychology, and prevention science.

An extension of EvoS called the Binghamton Neighborhood Project (BNP) provides the infrastructure for community-based research from an evolutionary perspective (<http://evolution.binghamton.edu/bnp/>). Binghamton is a small city (population approximately 50,000) in a region of New York (Figure 1) that has been economically depressed over the last few decades. It is ethnically diverse, both from past immigrations from various parts of Europe and current immigrations from all over the world. Over 18 different primary languages are spoken by students in Binghamton's single high school. Finally, Binghamton's proximity to New York City introduces elements of the drug trade and other criminal activity, in addition to more positive influences such as an art scene. In short, Binghamton shares the same problems and potentials as many other cities, but its relatively small size makes it manageable as a "field site" for basic and applied research on humans from an evolutionary perspective.

## Preliminary Research

The BNP began with a survey called the “Developmental Assets Profile (DAP)” developed by Search Institute, a non-profit organization dedicated to the scientific study and improvement of communities (<http://www.search-institute.org/>). In collaboration with the Binghamton City School District, The DAP was given to approximately 2000 students in grades 6-12 in May 2006. Background information included residential location (see Figure 2), enabling us to create GIS (Geographical Information Systems)



**Figure 2.** Spatial distribution of surveyed Binghamton High School students.

maps for individual social preferences and elements of the individual’s social environment, including family, neighborhood, school, religion, and extracurricular activities. The survey revealed impressive variation among neighborhoods and enabled us to conduct correlational and regression analyses, one of which will be described below. The DAP will be given longitudinally at two-year intervals, enabling us to conduct time series analysis and monitor the effect of interventions over the long term.

The DAP was the starting point for an expanding GIS database that is being assembled in collaboration with our community partners. With the Binghamton City School District, we have obtained data on academic performance, disciplinary cases, and gathered our own student self-report information on bullying behavior (all collection procedures are approved by Binghamton University’s Human Subject Review Board to strictly protect the identity of individual students). With the Police Department and partners involved with the prevention of youth and gang violence, we have obtained data on juvenile crime. With the Broome County Health Department, we are obtaining an extensive list of health variables, such as the birth weight of infants and body mass index of adults. With Binghamton University’s GIS center, we have obtained data from previous studies on aspects of the built environment, such as the cosmetic and structural quality of houses throughout the city. From publicly available sources, we have obtained a host of information, such as US Census Statistics, landscape variables from aerial photographs, and so on.

This ongoing effort illustrates a number of important points. First, the beauty of GIS technology is that it allows all spatially-based information to be interrelated. Second, an enormous amount of this information is available, but it is typically dispersed among many sources. Uncoordinated information is almost as bad as no information at all. Third, in our experience at least, our community partners are thrilled to join us in what we both

perceive as a win-win situation. Our collaboration with the Broome County Health Department provides a good example. They maintain their own extensive GIS database of health variables, but they are too busy administering their various programs to mine the data to its full potential, much less integrate it with other databases or relate it to the basic scientific literature. Moreover, standard Health Department procedures typically report GIS data at a relatively coarse spatial scale, such as zip code, even though the data itself is available at a much finer spatial scale. By partnering with the BNP, our community partners get access to an entire network of university faculty in addition to data coordination and analysis services that they would not have otherwise.

In addition to coordinating with community partners, the BNP has also coordinated with other academic units within Binghamton University that are involved in community based research and development. In particular, we have a close relationship with the Center for Applied Community Research and Development (CACRD), which has its offices in a new building built by Binghamton University in downtown Binghamton to facilitate University-Community relations. The CACRD helps to coordinate projects with community partners and adds its own academic expertise in subject areas such as social network analysis.

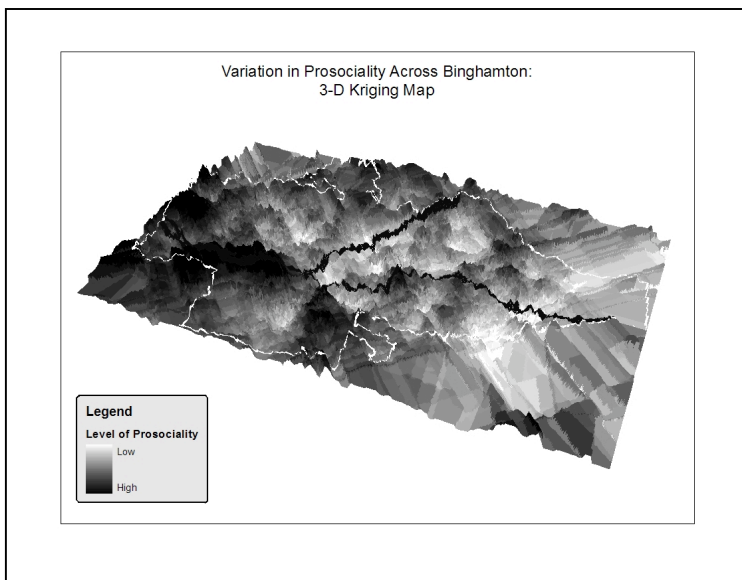
**A specific focus on prosociality:** The BNP is envisioned in part as a general infrastructure for community-based research, which can be used to address a diversity of subjects from any theoretical perspective. In addition, we have developed a specific focus on prosociality, which we define as a preference for helping others and society as a whole. Prosociality is a major theme of both evolutionary theory and the experimental economics literature. It is also clearly relevant to the quality of everyday life. In fact, there is evidence that numerous positive assets (such as self-esteem and ability to plan for the future) and negative assets (such as delinquency and substance abuse) are manifestations of a more generalized prosociality .

From an evolutionary theoretical perspective, prosociality poses a puzzle because helping others and society as a whole often decreases the welfare of the prosocial individual, compared to less cooperative social partners. However, this problem has a solution: Prosociality can succeed as a social strategy *to the extent that prosocial individuals can associate with other prosocial individuals*. This basic generality emerges from all evolutionary theories of social behavior, including multilevel selection theory, inclusive fitness theory (also called kin selection), and evolutionary game theory (including the concept of reciprocity).

Human sociality is notable for the degree to which prosociality extends beyond genealogical relatives and narrow reciprocators, to include larger groups of unrelated individuals. A number of mechanisms loosely associated with “culture” can potentially explain this expansive form of human prosociality, including the tendency of individuals to copy the behaviors of others (conformance transmission), to agree upon social norms, and especially to punish violations of social norms at little cost to the punisher.

The field of experimental economics has been especially influential in showing how cooperation can succeed or fail, depending upon the circumstances. To choose a classic example, in n-person public goods games without an opportunity for punishment, most people begin by being moderately cooperative, but a minority of individuals elect to cheat. As soon as the cooperators realized that they are being exploited, they tend to withhold their cooperation as the only way to protect themselves. When the game is modified to provide an opportunity to punish cheaters, then at least some (but not all) cooperators elect to punish rather than withhold their own cooperation, even at considerable expense to themselves. If there is a sufficient number of punishers, then cheating ceases to be an attractive strategy and cooperation increases to high values.

This and other experimental games provide an elegant methodology for studying prosociality and have been played in many permutations in the laboratory. To take them beyond the laboratory, however, we need to have independent measures of prosociality in the real world. The BNP enables us to provide this kind of information at the scale of an entire city. Figure 3 shows a GIS map for prosociality, as measured by 8 questions on the DAP, such as “I think it is important to help other people,” and “I am trying to help solve social problems.” Agreement with each question was indicated on a four-point scale, which was summed and normalized for each student so that the lowest possible response received a score of zero and the highest possible response received a score of 100. The continuous surface shown in Figure 3 is based on a method called kriging, which calculates a value for each location based on an extrapolated value from neighboring locations. The GIS map reveals substantial variation among neighborhoods in self-reported prosociality, with dark “hills” representing high values and light “valleys” representing low values.

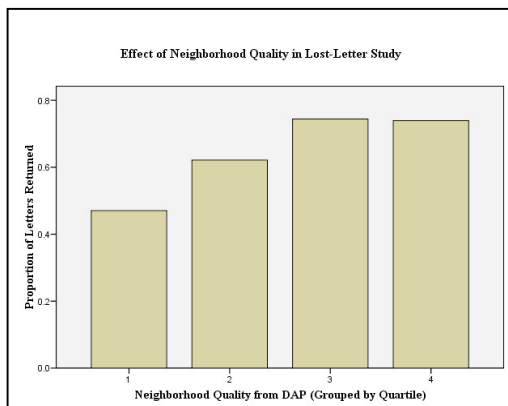


**Figure 3.** Using the spatially distributed data from the DAP surveys, kriging techniques can estimate the variation in prosociality across the city.

What accounts for this spatial variation in prosociality? As a preliminary answer, we conducted a hierarchical linear regression with individual prosociality as the outcome variable and other subscales from the DAP measuring aspects of the social environment as independent variables, such as family (10 items including “I have parents/guardians who help me succeed”), neighborhood (3 items including “I have a safe neighborhood”), school (10 items including “I have teachers who urge me to develop and achieve”),

First-Level Predictors	Effect Size (S.E.)
Family	.257 (.023)***
General	—
School	.205 (.018)***
Religion	.062 (.011)***
Extra-Curricular Activities	.138 (.013)***
Neighborhood	.111 (.015)***
Second-Level Predictors	
Neighborhood Quality	.149 (.072)*
Median Income (log transformed)	-2.527 (3.198)
Cross-Level Interactions on Neighborhood	
Neighborhood Quality	.005 (.002)*
Median Income (log transformed)	-.119 (.091)
Parameters Estimated	14
Deviance	12,579

**Table 1.** Results from a multi-level analysis with Prosociality as the dependent variable show that the various areas of social support available to youth each influence the social attitudes of an individual. Further, the quality of one’s neighborhood as rated by various residents contributes as a second-level predictor, beyond the effects of one’s own opinion. Error terms were included only for intercepts with second-level effects. \* -  $p < .05$ , \*\*\* -  $p < .001$ .



**Figure 4.** An increase in neighborhood quality by one quartile predicts an envelope as being 46% more likely to be returned ( $B = .378$ ,  $SE = .137$ ,  $Wald = 7.581$ ,  $p = .006$ ).

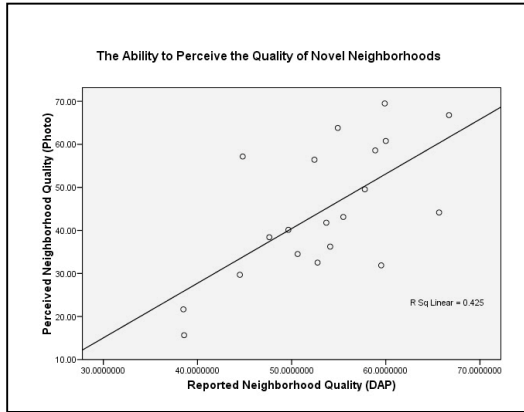
with the assessment of students who actually live in the neighborhoods, as shown in figure 5. Evidently, cues of neighborhood quality can be assessed from photographs in a matter of a few seconds without any other knowledge of the neighborhoods.

Third, we measured external holiday decorations as a natural expression of prosociality by conducting a census of over 3500 houses during December 16-20, 2007. Figure 6 shows that the neighborhoods assessed as high quality by students on the DAP literally

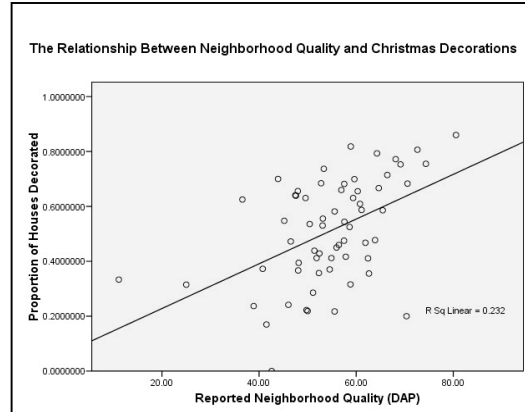
religion (2 items including “I am involved in a religious group and activity”), and other extracurricular activities (2 items including “I am involved in a sport, club, or other group”). Census block groups (N=63 for the City of Binghamton) were used as the grouping variable. Table 1 shows that a large proportion of the variation in individual prosociality can be accounted for by the aspects of the social environment. Importantly, each aspect contributes independently, suggesting that the most prosocial individuals receive their social support from a number of sources. Another interesting result is that neighborhood is significant as both an individual-level and a group-level variable. In other words, the prosociality of an individual depends in part on the quality of his or her neighborhood, as assessed by everyone in the neighborhood, independently of how the *individual* happens to assess his or her neighborhood.

**Validating self-report measures of prosociality.** We have conducted three additional studies on small-scale variation in prosociality, to confirm and extend the DAP results based on self-report. First, we employed a method from social psychology that involves dropping stamped addressed envelopes on sidewalks and using the return rate to indicate the propensity of residents to perform a small act of kindness by mailing the letters. Results indicate a 20-point difference in return rate among neighborhoods, which correlates with the quality of the neighborhoods as reported by students on the DAP, as shown in figure 4.

Second, we had college students assess the quality of a sample of neighborhoods based on photographs. Results show a strong correlation with the assessment of students who actually live in the neighborhoods, as shown in figure 5. Evidently, cues of neighborhood quality can be assessed from photographs in a matter of a few seconds without any other knowledge of the neighborhoods.



**Figure 5.** Individuals can recognize the quality of neighborhoods unknown to them ( $r = .652, p = .002$ ).



**Figure 6.** Neighborhoods with higher reported quality have more active participation in holiday decoration ( $r = .482, p < .001$ ).

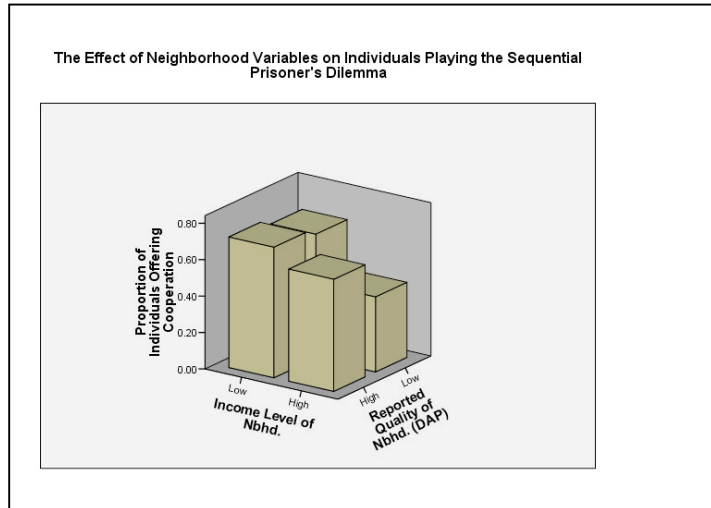
glow more brightly during the holiday season. This cannot be attributed to the Christian religion per se because a smaller study of Halloween decorations during October 28-30, 2007 reached a similar conclusion.

These results are currently being written up for publication. They convincingly demonstrate small-scale variation in prosociality, both in self-reported attitudes (such as the DAP) and in action (such as holiday decorations and mailing letters). They also illustrate some of the advantages of our whole university/whole city approach. All three studies were conducted at virtually no expense with the help of Binghamton University students participating in the EvoS program. In the case of the holiday decoration study, a team of 20 volunteers was able to measure the entire city, from the first house censused to the production of the GIS map, in a period of six days.

**Using experimental economics games to study prosociality in conjunction with other methods.** We have conducted two pilot experiments to demonstrate the feasibility of incorporating experimental economics games into our research program. They were designed in consultation with Dr. Jeffrey Carpenter (Middlebury College), who is a leader in applying experimental game methodology to field situations and a collaborator on our current research.

In collaboration with the Binghamton City School District, we played the two-person sequential prisoner's dilemma game with 167 high school students by visiting social studies and health classes. Students were briefed about the game and indicated on paper how they would play a) as the first mover; b) as the second mover if the first mover cooperates; and c) as a second mover if the first person defects. The payoffs were \$30 for mutual cooperation, \$45 for the temptation to cheat, \$10 for the sucker's payoff, and \$15 for mutual defection. After the papers were collected, a pair of responses was chosen at random, one member of the pair was randomly chosen to play first, and each member was paid real money depending upon how they indicated they would play the game. Finally the students were told about the purpose of the game and how it can be used to study individual differences among people and variation in the quality of our

neighborhoods. School personnel used the student names to attach residential addresses and then replaced the names with arbitrary ID numbers to protect the identities of the students. The exercise proved to be a rewarding educational experience for the students in addition to a way of gathering scientific information.



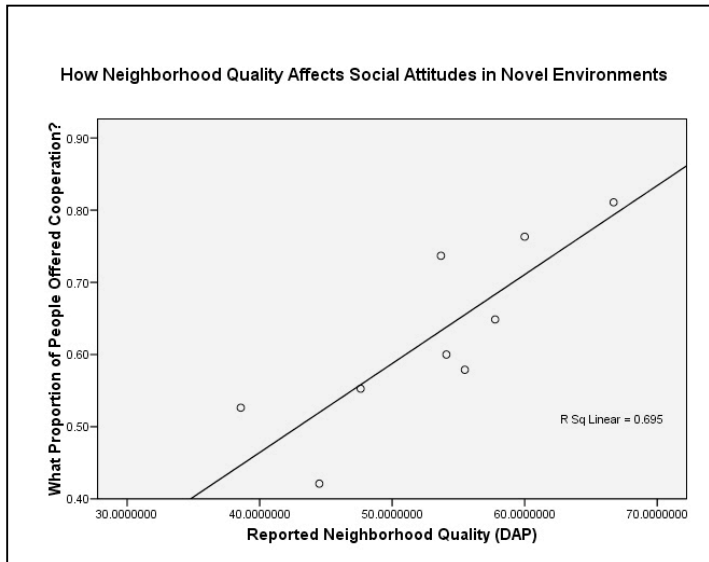
**Figure 7.** Residents of a higher quality neighborhood are more likely to offer cooperation ( $B = .063$ ,  $SE = .030$ ,  $Wald = 4.413$ ,  $p = .036$ ) while higher median income predicts residents to be less likely to do so ( $B = -3.88$ ,  $SE = 1.319$ ,  $Wald = 8.643$ ,  $p = .003$ ) when using scores on math tests as a covariate.

The decision of whether to cooperate during the first move of the sequential prisoner's dilemma game provides a behavioral indicator of the propensity to initiate cooperation in social interactions. Figure 7 shows the proportion of students who initiated cooperation during the first move as a function of a) the quality of their neighborhood, based on the average assessment of all students in the same census block group who took the DAP in 2006, and b) median income of the neighborhood, obtained from US

census statistics. The pairwise correlation between neighborhood quality and median income is positive, as might be expected. However, Figure 7 shows that there is a residual *negative* correlation between median income and propensity to initiate cooperation, as measured by the sequential Prisoner's Dilemma game. The students most likely to initiate cooperation come from neighborhoods that are *high* in quality and *low* in medium income.

One way to explain these results is that students from low-income neighborhoods need to cooperate more in their daily lives and are therefore more practiced at initiating cooperation, compared to more wealthy students who can pay for what they need. In the parlance of the social capital literature, poor students must make up in social capital what they lack in financial capital. If this interpretation is correct, then small-scale variation within a single city bears an intriguing resemblance to the worldwide variation among traditional societies. The most cooperative traditional societies are those that habitually engage in cooperative activities as part of their daily lives and do not have a lot of financial capital that can be substituted for social capital.

Our second pilot experiment was a modification of the study involving photographs described earlier. College students viewed photographs of a sample of neighborhoods, as before, but instead of assessing the quality of the neighborhoods, they played the sequential Prisoner's Dilemma game with a high school student from each neighborhood. This was not an imaginary exercise, because we had the responses of the high school students from our first pilot experiment. Thus, after the college students completed their



**Figure 8.** Neighborhood quality positively correlated ( $r = .834$ ,  $p = .005$ ) with the proportion of people who offered cooperation to its residents.

responses on the basis of the photographs, we picked one student at random, one neighborhood at random, and actually played the game between the college student and a high school student from that neighborhood, paying the college student real money. As shown in Figure 8, merely viewing photographs of a neighborhood strongly influences the propensity to initiate cooperation with someone living in the neighborhood. If these results are accurate, they suggest that residents of high and low quality neighborhoods inhabit starkly different worlds when it comes to cooperation—even from total strangers.

### Conclusion

Even though EvoS and the BNP are only a few years old, they demonstrate the potential of our whole university/whole city approach to understanding and improving the human condition from a unified theoretical perspective. EvoS has created a network of faculty and students that spans all disciplines, enabling us to move in virtually any research direction. The BNP provides a network of community partners who can take an equal role in a consensus process for deciding the most important issues to be addressed in our community. Science and technology provide an arsenal of empirical methods for gathering, integrating, analyzing, and disseminating information. We think that we are poised to have a substantial impact on the quality of life in our community, which will make our approach a model for other universities and their surrounding communities.

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