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From Experimental Economics toward Integral Human Rationality

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Benedict XVI in *Caritas in Veritate* calls for integral human development; *integral* meaning that of the whole person. There has developed a field of experimental economics within the discipline of economics that has been vigorously and rigorously testing the postulates of a narrowly defined *homo economicus* and challenging economics from within. Vernon Smith's pioneering work on experimental economics and his insight on two types of rationality, constructivist and ecological, can be synthesized into integral human rationality that pursues not only material well-being but also nonmaterial, for example, social, emotional, and moral. This article introduces experimental methodology in economics and briefly reviews selected well-established and replicated results in two-person anonymous personal exchange and impersonal market experiments that demonstrate integral human rationality. The methodology and regularities established through experimental economics can be used to further our understanding of integral human rationality and inform us as to which paths or policies are more likely to lead to integral human development.

The great challenge before us, accentuated by the problems of development in this global era and made even more urgent by the economic and financial crisis, is to demonstrate, in thinking and behavior, not only that traditional principles of social ethics like transparency, honesty and responsibility cannot be ignored or attenuated, but also that in *commercial relationships* the *principle of gratuitousness* and the logic of gift as an expression of fraternity can and must *find their place within normal economic activity*. This is human demand at the present time, but it is also demanded by economic logic. It is a demand both of charity and of truth. (Pope Benedict XVI)[1]

> Experimental economics is good at measurement, testing, and discovery in studying the microeconomics of human behavior governed by the informal norms of social exchange and the more explicit rules of exchange in institutions.… The learning from a half-century of experimental discovery will be particularly significant if we can find a way to leverage that learning into a broader understanding of the human career. (Vernon Smith)[2]

Introduction

Pope Benedict XVI's encyclical *Caritas in Veritate* addresses the concern of the human condition in a world that seems to focus on temporal and material matters to the exclusion of other things. Benedict expresses a concern for the total well-being of people throughout the world, for their "integral" nature: spiritual as well as material. Thus he writes,

> Besides requiring freedom, *integral human development as a vocation also demands respect for its truth*.… Paul VI answers the question by indicating the essential quality of "authentic" development: it must be "integral, that is, it has to promote the good of every man and of the whole man."[3] The focus of this article will be the integral human being in the context of social and economic exchange.

Benedict XVI, writing in the midst of the unfolding global financial crisis, is naturally drawn to the questions of material economic growth and the "*malfunctions and dramatic problems*" still weighing down on the development of humanity.[4] He enumerates some of these dramatic problems followed by a call to action:

> all this leads us to reflect on the measures that would be necessary to provide a solution to problems that are … of decisive impact upon the present and future good of humanity. The different aspects of the crisis, its solutions, and any new development that the future may bring … require new efforts of holistic understanding and a *new humanistic synthesis*.[5]

I will show in this article that there is a field of research and a growing body of empirical evidence within the discipline of economics that has already been developing such holistic integral understanding of human action and, perhaps quite unintentionally, leading to the new humanistic synthesis of the collected body of knowledge. This growing field is experimental economics, pioneered and developed by Vernon Smith whose contributions to economic science have been recognized by the Nobel Prize in economic sciences in 2002.[6]

Experimental Methods as An Answer to Problems with Data in Economics

Smith carefully and painstakingly discusses experimental methods in other sciences, relates them to, and defines them for economics.[7] For most of its history, economics has been a nonexperimental, field-observational science similar to astronomy or meteorology. Economists have used observations generated by historical economic outcomes over time. The use of collected data alone leads to methodological problems arising from two sources. First, there is no empirical basis for the assumptions surrounding the economic process that generated the data. Economists base their analysis on the general, introspectively "plausible," assumptions about human preferences and rationality and then apply them to the observed behavior in the economy. Economics has not had a body of tested behavioral principles that have survived controlled experimental tests, which then can be used to explain the naturally occurring observational data. Smith calls much of economic theory "'ecclesiastical theory'[8]: it is accepted (or rejected) on the basis of authority, tradition, or opinion about assumptions, rather than on the basis of having survived a rigorous falsification process that can be replicated."[9] As a result, the experimental economics research program has been driven by the desire to rely not just on logical parables traditionally used by economists to describe human action and rationality (an exercise in logic). Instead, experimentalists seek testable and tested results that could be just as, if not more, informative to our economic analysis of competing institutions or proposals for human betterment. As I will return to later in the article, Smith unintentionally also embarked on the testing of the standard neoclassical economic model of human rationality, in which a human agent is a self-interested utility-maximizer, acting independently and taking into account full and relevant information.[10]

The second problem that Smith identified is with observational economic data itself: "Most of the data of economics has been collected by government or private agencies for non-scientific purposes."[11] The question of the credibility of such data is no small issue. In an attempt to improve the credibility of observational data, the government agencies in the United States have improved ways of gathering and recording data. It is common knowledge that many countries still experience problems with questionable data even if gathered by the government, not to mention private businesses. This provides an opportunity for economic scientists to gather their own experimental data through laboratory- and field-experiment studies for scientific purposes, which brings us to the discussion of the experimental method in economics and the role of *demonstrable* knowledge.

Experimental economics offers a rich scientific methodology for testing, studying, and understanding environments, institutions, and the resulting behavior in a controlled laboratory setting prior to implementing them in the natural world (i.e., the world outside the laboratory). Experimental economists define the "environment" as a collection of characteristics (such as agent values, preferences, technology, and commodity endowment) that together define the gains from trade or exchange; the "institution" as the rules (formal laws or informal traditions) of communicating, message exchanging, and contracting of private property in a market-exchange setting; and "behavior" as agent message choices conditional on the environment and the institution.

An example of the subprime mortgage lending market will illustrate the three-part distinction. The environment of subprime mortgage lending can be defined by, for example: (1) the borrower's values and preferences for buying a house (to become a home-owner or to speculate on the rising prices of houses, buy-low-sell-high motivation); (2) the lender's values and preferences for giving a loan (a lender might, for example, be "required" to give a certain amount of loans to less credit-worthy borrowers); (3) the amount and types of loanable funds the lender has to loan out (own capital or "purchased" funds; monetary policy for short-term interest rates can influence the environment); (4) the availability of housing for the potential buyers; and (5) government-sponsored enterprises (Fannie Mae and Freddie Mac) providing a source of funding for residential mortgages and securitizing these loans before selling them to the interested investors. This example demonstrates that the real-life environment of a market is often too complex to establish any clear causality in terms of outcomes.

The institution for lending will define the rules of message and property-rights exchange among the parties involved; lender, borrower, and seller of the property: (1) the type of loan, fixed-rate or adjustable-rate mortgages; (2) the rules and standards for gathering and verifying information about the borrower's credit-worthiness; (3) the rules of verifying and titling the property from the seller to the borrower through the intermediary of the lender; and (4) the rules of transferring funds from the lender (who has approved the mortgage loan) to the seller of the property. Each one of the "institutions" will define the incentives faced by each party in exchange. The incentives will result in varying behavior by different economic agents as the institutions and the environment change. This is the messy and complex real-world situation that we face in economic analysis. What might be the resulting observed behavior by economic agents in subprime mortgage lending?

We might observe a rise in the number of subprime loans given out and taken out as we did from the end of 1990s through 2006 in the United States. We might observe the growth in the number of adjustable-rate mortgages, especially during the times when the short-term interest rates, due to expansionary monetary policy, are very low—near zero. They become very attractive to borrowers at "teaser" rates. The government-led policies of increased homeownership among the low-income may lead to an unintentional change in lending and underwriting standards. Securitization by government-sponsored enterprises may create a false security in such financial instruments and unintentionally increase the moral-hazard problem, where lenders do not assume full responsibility for the risky loans they have given out.

What this one example illustrates is how the characteristics of environment and institutions interact and can lead to a subprime mortgage crisis, which in turn spills over with global consequences. It may be that each individual rule or environment characteristic will itself be harmless. In fact, individual characteristics may have come about with a goal of aiding economically a disadvantaged group of society. In combination, however, unintended consequences can arise with disastrous results. It is also quite possible that each one of the parties to an exchange has acted in a fully rational way and to the best of their knowledge and understanding.

With this example in mind, how does an economist proceed in establishing the root causes of the current financial crisis and the solutions or remedies to prevent it in the future? Should one start by questioning the rationality of individual players by blaming the crisis on individual greed? Greed as a vice is always present and a root cause of the crisis; it carries very little explanatory power. Perhaps the real question, then, is whether certain characteristics of the environment and institutions for lending have created or amplified areas for opportunism to be exploited by those who are able.

How can one study the impact of various characteristics of a particular economic environment or economic institution, or a combination thereof, in a natural economy? Unless we are willing to conduct natural experiments with members of society, the only possible, humane, and realistic method is economic laboratory or field experiments that study natural phenomena in a controlled setting. I will now discuss the use of experimental methods to study market-and-personal-exchange phenomena while at the same time introducing Vernon Smith's concept of two types of rationality, their interplay in economic analysis, and the experimental evidence regarding the two.

Two Types of Rationality

Vernon Smith's scientific journey through the experimental economics research program has led him to a deeper and more nuanced understanding of the rational "standard socioeconomic science model" (the mainstream neoclassical model in economics, hereafter abbreviated SSSM) and a particular appreciation of F. A. Hayek's intellectual work on constructivism and the "fatal conceit" of social sciences. Smith credits Norman, Gigerenzer et al., and Hayek whose work and the use of the qualifiers, "constructivist" and "ecological" have led Smith to the distinction between the two types of rationality in economics.[12] These types do not exist in strict opposition to one another but rather coexist within each individual and inform and influence each other. It is the interaction of these two types of rationality that has led me to combine them into "integral human rationality."

In Smith, "*constructivist rationality*, applied to individuals or organizations, involves the deliberate use of reason to analyze and prescribe actions judged to be better than alternative feasible actions that might be chosen."[13] The SSSM is an example of constructivist rationality. The natural attraction of any scientist, including economists, to the study of constructivist rationality is because it provides rational predictive models of human decision-making, which can then motivate research hypotheses to be tested. Experimental economists have been testing the SSSM since the mid-twentieth century, finding that the results support the predictions of constructivist rationality in impersonal supply-demand market exchange under "weak" conditions of incomplete information. As mentioned earlier, a neoclassical rational utility-maximizer is assumed to act under full, complete information—a strong condition.

Accordingly, competitive market equilibrium is achieved when many rational self-utility-maximizing agents, buyers, and sellers interact in the market and exchange at the market-clearing price that maximizes the group's welfare: sellers' surplus plus buyers' surplus. Smith's experimental study of the competitive market equilibrium and subsequent research have found that markets converge to a competitive equilibrium price—a victory for economic theory of markets—but do so under the weak conditions of private information (each agent only has private information about his or her own value), fairly small number of buyers and sellers (3 or 4 of each), and the market participants do not have to be economically sophisticated in order to achieve equilibrium price in the market.[14] When I teach principles of economics to my freshmen students, I conduct a classroom experiment prior to teaching the supply and demand model. The results are the same each time: students responding in a self-interested manner (maximizing

own payoff), knowing only their own private values, fairly quickly converge to the equilibrium market price and maximize group welfare.[15]

Smith defines ecological rationality as one that arises from "emergent order in the form of the practices, norms, and evolving institutional rules governing action by individuals that are part of our cultural and biological heritage and are created by human interactions, but not by conscious human design."[16] This definition echoes the social thought characteristic to moral philosophers of the Scottish Enlightenment: David Hume, Josiah Tucker, Adam Ferguson, and Adam Smith, among others.

In the above-described market experiment, the "order" (competitive market equilibrium price) emerges, and the group welfare is maximized even though each participant is not aware of nor is pursuing the group welfare. In other words, it is a result of human interaction within a given institution of exchange, but it is not part of conscious human design to achieve the maximum group welfare. The two rationalities play out in experimental studies: "the experimenter applies the tools of constructivist reason to solve for the benchmark CE (competitive equilibrium), but in repeat play this 'solution' emerges from the spontaneous order created by the subjects trading under the rules of the double-auction market institution."[17] Similar patterns of convergence are found in other experiments with more than one simultaneous interdependent market.[18] Summarizing, Smith brings to our attention that investigating the underlying dynamic processes for human coordination and cooperation will help foster better understanding of social phenomena and move the science beyond the anthropocentric limitations of constructivism.[19]

In impersonal market experiments, the parties to exchange do not know each other personally, do not see each other, and may never exchange with the same person again—the exchange is completely anonymous and there is no reputation-building. The institutions that are guaranteed in these experiments are the property rights and the integrity of the exchange (contract enforcement). The subjects do not have to worry whether someone will steal their property nor whether they are going to receive payment after the sale has been concluded. These are underlying enforced characteristics of the exchange environment that are more or less common to the economies with an established and enforced rule of law. Consequently, the results of competitive equilibrium under the double-auction market institution prevail given the rule of law. This brings us to another crucial point about economies: There is no such thing as institution-free economics. Any economist has to use caution when applying the results of market institutions obtained under a particular environment (the rule of law) to another environment, such as an economy in transition from the rule of man to the rule of law.

When the former-Soviet republics embarked on their transitions away from command economies, no one had the slightest idea of what the real process of transition in a social system would look like or what to expect. Yet the policies of macro-stabilization, economy liberalization, and property privatization were supposed to transition these economies into capitalist ones. The biggest mistake with the transition was to assume that any country could seamlessly shift to another socio-economic system just by wishing so or by forcing certain policies into place. The importance of embedded institutions, the process of an emerging new order and human capacity—cognitive, material, and moral—for a swift social and economic change were simply not considered until the "unintended" consequences of transition started to arise.

The only thing that everyone living through "perestroyka," the collapse of the Soviet Union, and the ensuing chaos of transition, knew how or what to do was to "truck, barter, and exchange."[20] Perhaps, this profound yet elementary human propensity is the foundation and the starting point of any economic activity, and consequently, economic analysis and the design of economic institutions and systems. If exchange is a necessary condition for human betterment, then the sufficient condition for it is that it has to be voluntary in order to be mutually beneficial. In other words, we do not have to worry about whether the exchange will be mutually beneficial for everybody, which might be an impossible task. The task for a society is to establish the rules of voluntary exchange. This process of enforcing and guaranteeing the exchange to be voluntary is why it took our human civilization ages of trial-and-error to figure out the best rules and conditions.

However, even in voluntary exchange, one party may cheat another (short-sighted self-interest) and as a result the voluntary exchange is not good enough to make it mutually beneficial. What has experimental economics demonstrated to us about voluntary personal exchange, cooperation, and deception and the resulting interplay of the two rationalities? Do individuals necessarily cheat and steal (act in their own narrow self-interest, according to the assumption of constructivist rationality) in anonymous one-time transactions, especially when there is no punishment involved?

Personal Exchange in the Laboratory

There are two rationales for studying personal exchange in the laboratory as an anonymous interaction between two individuals. One of them is based on constructivist rationality: the game-theoretic model of nonrepeated interaction between two strangers without a history or a future.[21] The other is based on ecological rationality: Anonymity "provides the greatest scope for exploring the

human instinct for social exchange, and how it is affected by context, reward, and procedural conditions that vary elements of *social distance*."[22] Smith concludes the paragraph with a profound thought: "studying what is not helps us to understand what is." This means that through the laboratory experimentation we can create the necessary counterfactuals that we cannot observe in naturally occurring interactions. Studying anonymous exchange provides the strongest test of social interaction and the underlying integral human rationality.

There are three types of games commonly associated with studying personal exchange in the laboratory: ultimatum, dictator, and trust. I will briefly explain each one and relate the game-theoretic predictions with observed results in the lab. An ultimatum game is a two-stage, two-person game, in which Player 1 (the first mover in the game) receives a fixed sum of dollars, m (e.g., ten one-dollar bills), and then decides to offer $0 \leq x \leq m$ units of the money given to Player 2 (the second mover in the game); Player 2 can accept x or reject the offer altogether, in which case each player receives nothing.[23] According to a game-theoretic concept of subgame perfect equilibrium (SPE), Player 1 offers the minimum unit of account, 1 dollar, if $m = 10$ dollars, and Player 2 accepts the offer. This prediction is based on the assumption of constructivist rationality yielding that each player is self-interested in the narrow and shortsighted sense of always preferring the largest of the two immediate payoffs. Thus, any minimally small offer amount is always better than 0, and Player 2 should always prefer anything greater than 0. Applying such backward induction to the decision problem faced by Player 2, Player 1 should only offer $1 (smallest possible unit out of m). Yet Güth et al. report results that the majority of Player 1 subjects offer a lot more than the minimal possible unit of money.[24]

Furthermore, Hoffman et al. extended the original ultimatum game to study the effects of four different instructional/procedural treatments (think context) but have the same underlying abstract game structure.[25] First, the mean amount offered by Player 1 is 43.7 percent of the total pie of $10, which is much larger than the prediction based on self-interested game theory. What could be the explanation for such high offerings, an almost equal split of the pie? Ecologically, the subjects are interpreting the interaction as a form of social exchange, in which we are reading into the intentions of others even if we are anonymously matched. In other words, Player 1 subjects might be trying to figure out what the minimal acceptable amount will be to a Player 2 subject, using his or her own social experience from real life. In this way, each subject brings in his or her own life experience to bear on their individual responses in the game. As the authors vary the context setting with regard to "entitlement" (the subjects first "earn" the right to be the first mover in the game by answering a general-knowledge

quiz and earning a score for it) and "exchange" (framing the exchange in terms of selling/buying context; Player 1 is a seller, while Player 2 is a buyer, and the price is from $0 to $10; the profit to seller is the chosen price, while the buyer would receive the $10 price if the buyer accepts the price). When the context of the interaction changes to entitlement, the mean offer decreases to 36.2 percent of $10 offered to Player 2. When the game context changes to exchange context, the Player 1 sellers, offer less: 37.1 percent mean offer with no entitlement, and 30.8 percent mean offer when the right to be the first mover is earned.

In the dictator game, the right of the second mover to veto the offer of the sender is removed. Forsythe et al. study whether the tendency toward a more-equal split of the pie is due to a social norm of "fairness" or due to the possibility of the offer being rejected and being punished for a "selfish" offer.[26] Thus, removing the veto right could answer this question. If the first movers on average offer less in the dictator game than the average in the ultimatum game, then the motivation for equal splitting of the pie is driven by the prospect of "punishment" in the form of zero payoff to each player if the offer is perceived as "unfair." The authors find that the mean dictator offer is 23.3 percent out of $10, which is significantly less than the 43 percent mean ultimatum offer. The conclusion is that considerations of "fairness" alone cannot explain the behavior in ultimatum games.

A further question that Hoffman et al. consider is why the dictators give almost a quarter of the pie at all.[27] They ask whether the experiment participants perceive "anonymity" as complete or incomplete: each player pair are anonymous to each other but not to the experimenter. As a result, they introduce a double-blind technique in which the experimental protocol made it transparent that no one, including the experimenter, could learn the decisions of any players. Then the mean dictator offer declines to 10.5 percent out of $10 pie. They conclude that context of perceived social distance matters for dictator offers. Importantly, these experimental results translate into implications for exchange in real life.

The third game that studies characteristics of anonymous personal exchange is the investment or, as more commonly known, the trust game. Berg et al. introduce an investment trust two-stage game (also using double blind protocol), in which the first movers send any portion of the $10 ($0 to $10) to their randomly matched Player 2.[28] The amount sent, x, is tripled, such that the Player 2 receives 3x$, and it is common knowledge. Therefore the most generous offer of $10 will yield $30 to Player 2. Player 2 then responds by sending any of the amount ($0 to 3x$) received back to Player 1, the sender. The game-theoretic analysis of this game is no different from the one-stage dictator game: according to backward induction Player 1 can induce that Player 2 in self-interest would keep all the money received, and therefore should send nothing. The tripling of

the amount should also be irrelevant to the decision analysis. Here the question is whether the subjects perceive the interaction as one of trust extended by Player 1 to Player 2 and trustworthiness on behalf of Player 2. The authors report in this game set-up that the first movers send on average 51.5 percent ($10) when the transfer is tripled, compared to 23.3 percent when it is not (as reported above in the dictator game). The most generous of the senders send 74.4 percent of the money, much higher than the most generous offers in the dictator game, 38.3 percent. Consequently, allowing the amount sent to be tripled changes the size of the offers made to Player 2 and changes the perception of the game itself in the mind of the players when Player 2 is given an opportunity to respond to the offer by Player 1.

Summarizing the experimental results from anonymous impersonal and personal exchange experiments, the participants demonstrate their integral human rationality at work. In a market setting, they act according to their own self-interest and personal values to maximize their own profit, and, importantly, they correctly anticipate everyone else to do the same in the market. In anonymous personal exchange experiments, the participants act more ecologically, trying to anticipate the responses of their randomly matched counterpart, even though they know that they can get away with pursuing very narrow and short-sighted self-interest.

Translating the results of impersonal market exchange to real-life interactions, it is not unreasonable to expect each person going to the supermarket to pursue their own self-interest, income constraints, and values in purchasing goods and services. Prices act as coordinating devices by allowing only mutually beneficial transactions to take place. We expect the store manager and the producer of goods and services to act in their own self-interest and to be prudent (cost-minimizing) in their production and hiring decisions because they know they can attract more customers if their goods and services are more affordable and competitively priced. They also care about the quality of their goods and services because they want to keep their customers satisfied and, as a result, purchasing their products.

Therefore, reputation in free markets goes a long way, leads to long-term profitability, and makes it in the seller's and producer's own self-interest to act honestly. Those who try to profit through deception can only do so once in a free market. Having lost their reputation, market participants can no longer profit. They have to move to other markets where they are not known. This increases transaction costs of doing business, and market participants quickly learn the disastrous consequences of their initial fraud. Reputation in free markets is a self-disciplining force in the marketplace. As a result, we have seen emerging institutions that provide services for the credibility of the products in the markets. The age of information and communication technologies has allowed the reputation

information about sellers and products to spread quickly and with minimal cost. Before we buy goods on Amazon, we read what others have said about them and Amazon's services. Similar institutions are needed in the market for financial instruments and services to make sure that credit-rating institutions are objective and unbiased, that is, not funded by those whose products they rate.

Conclusion

The inspiration for integral human rationality came from two sources: Benedict XVI's encyclical *Caritas in Veritate* that emphasizes integral human development and Smith's works on constructivist and ecological rationalities, in which he calls for a deeper understanding of how the two rationalities work together, inform each other, and in combination (integration) serve to better explain human action and behavior.[29] From the experiments discussed in this article, one can conclude that people care about not just their own narrow self-interest and payoff but also about their social interactions, how they are perceived by their counterparts, even if the exchange is anonymous, and how they respond differently when social distance between the counterparts changes.

We learn to act and interact socially from the time we are born. What we are and who we are as economic and social agents traces back to our experiences and the lessons we have learned individually and as part of a group, be it our family, schools, churches, or the playground. All of these experiences develop and motivate our integral human rationality. The successful policies, or institutions, or characteristics of our surrounding environment, will be the ones that emphasize the role of the family and early childhood education, the continuous role of the church and moral upbringing within the family that stress personal responsibility for actions and beliefs, social and economic institutions that promote and encourage self-reliance (as opposed to expecting someone else, government or another person, to deliver desirable outcomes), and understanding that true freedom only comes with responsibility. Finally, they will be the ones that we can understand first through careful study in the laboratory and the field (small scale) before implementing them on the large scale for yet another natural experiment with human lives.

Notes

1. Benedict XVI, encyclical letter *Caritas in Veritate* (June 29, 2009), 36. Italics are original.
2. Vernon L. Smith, *Rationality in Economics: Constructivist and Ecological Forms* (New York: Cambridge University Press, 2008), 1.
3. Benedict XVI, *Caritas in Veritate*, 18.
4. Benedict XVI, *Caritas in Veritate*, 21.
5. Benedict XVI, *Caritas in Veritate*, 21.
6. See the official website of the Nobel Prize for The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2002 to Vernon L. Smith: "*for having established laboratory experiments as a tool in empirical economic analysis, especially in the study of alternative market mechanisms*," http://www.nobelprize.org/nobel_prizes/economics/laureates/2002/.
7. Vernon L. Smith, "Experimental Methods in Economics" in *The New Palgrave: A Dictionary of Economic Theory and Doctrine*, ed. J. Eatwell, M. Milgate, and P. Newman (New York: Macmillan, 1987).
8. See also Robert Henry Nelson, *Economics as Religion: From Samuelson to Chicago and Beyond* (University Park: Penn State Press, 2001).
9. Smith, "Experimental Methods in Economics."
10. Vernon L. Smith, in his "Constructivist and Ecological Rationality in Economics," *American Economic Review* 93, no. 3 (2003): 465–508, refers to the standard neoclassical economic model as the "standard socioeconomic science model." For a definition of neoclassical economics, see E. Roy Weintraub, "Neoclassical Economics" in *The Concise Encyclopedia of Economics* (2007), http://www.econlib.org/library/Enc1/NeoclassicalEconomics.html.
11. Smith, "Experimental Methods in Economics."
12. Smith, "Constructivist and Ecological Rationality in Economics"; idem, *Rationality in Economics*; Joel Norman, "Two Visual Systems and Two Theories of Perception: An Attempt to Reconcile the Constructivist and Ecological Approaches," *Behavioral and Brain Sciences* 25 (2002): 73–144; G. Gigerenzer, P. Todd, and the ABC Research Group, *Simple Heuristics that Makes Us Smart* (New York: Oxford University Press, 2000); Friedrich A. Hayek, *Studies in Philosophy, Politics, and Economics* (Chicago: University of Chicago Press, 1967); and idem, *The Fatal Conceit* (Chicago: University of Chicago Press, 1988). This discussion is largely based on the two works by Smith.
13. Smith, *Rationality in Economics*, 2.

14. Vernon L. Smith, "An Experimental Study of Competitive Market Behavior," *Journal of Political Economy* 70, no. 12 (1962): 111–37.

15. These results prevail under the institution of double auction: any buyer is free to post a bid to buy and any seller is free to post an offer to sell for one unit of a good, where any other buyer can post his or her bid to buy higher than the "standing" bid and any seller can post his or her offer to sell lower than the "standing" offer to sell. Hence, as a result each seller sees only one "standing" bid from the buyer, which he can accept or not, and each buyer only sees one "standing" offer from the seller, which she can accept or not.

16. Smith, *Rationality in Economics*, 2.

17. Smith, "Constructivist and Ecological Rationality in Economics," 476.

18. C. Plott, "Research on Pricing in a Gas Transport Network," Office of Economic Policy Technical Report 88-2 (Federal Energy Regulatory Commission, 1988); and idem, "Equilibrium, Equilibration, Information and Multiple Markets: From Basic Science to Institutional Design," Nobel Symposium, Behavioral and Experimental Economics (Stockholm, 2001).

19. Smith, "Constructivist and Ecological Rationality in Economics," and idem, *Rationality in Economics*.

20. Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (London: Strahan and Cadell, 1776): "This division of labour, from which so many advantages are derived, is not originally the effect of any human wisdom, which foresees and intends that general opulence to which it gives occasion. It is the necessary, though very slow and gradual consequence of a certain propensity in human nature which has in view no such extensive utility; the propensity to truck, barter, and exchange one thing for another" (bk. 1, chap. 2).

21. Robert W. Rosenthal, "Games of Perfect Information, Predatory Pricing and the Chain-Store Paradox," *Journal of Economic Theory* 25, no. 1 (1981): 92–100.

22. Smith, "Constructivist and Ecological Rationality in Economics," 486, emphasis added. I emphasize "social distance" because I believe it determines the extent of human empathy and the extent of cooperation as some experiments have demonstrated.

23. First introduced by W. Güth, R. Schmittberger, and B. Schwarze, "An Experimental Analysis of Ultimatum Bargaining," *Journal of Economic Behavior and Organization* 3 (1982): 367–88.

24. Güth et al., "An Experimental Analysis of Ultimatum Bargaining."

25. E. Hoffman, K. McCabe, K. Shachat, and V. L. Smith, "Preferences, Property Rights, and Anonymity in Bargaining Games," *Games and Economic Behavior* 7, no. 3 (1994): 346–80.

26. Robert Forsythe, Joel L. Horowitz, Nathan E. Savin, and Martin Sefton, "Fairness in simple bargaining experiments," *Games and Economic Behavior* 6, no. 3 (1994): 347–69.

27. E. Hoffman, K. McCabe, and V. L. Smith, "Social Distance and Other-Regarding Behavior in Dictator Games," *American Economic Review* 86, no. 3 (1996): 653–60.

28. Joyce Berg, John Dickhaut, and Kevin McCabe, "Trust, Reciprocity, and Social History," *Games and Economic Behavior* 10 (1995): 122–45.

29. Smith, "Constructivist and Ecological Rationality in Economics," and idem, *Rationality in Economics*.