Is a Novel a Model?

Tyler Cowen
Department of Economics
George Mason University
Fairfax, VA 22030
tcowen@gmu.edu

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I defend the relevance of fiction for social science investigation. Novels can be useful for making some economic approaches -- such as behavioral economics or signaling theory -- more plausible. Novels are more like models than is commonly believed. Some novels present verbal models of reality. I interpret other novels as a kind of simulation, akin to how simulations are used in economics. Economics can, and has, profited from the insights contained in novels. Nonetheless, while novels and models lie along a common spectrum, they differ in many particulars. I attempt a partial account of why we sometimes look to models for understanding, and other times look to novels.

"Why don't those authors just come right out and say what they mean?" One of my economist colleagues offered this query when we were discussing the so-called "Great Books." Shortly thereafter the question came why we need the classics when we can work with formal models. Few economists today read Homer, much less work on the problems he raised. On the other side of the divide stand many individuals from the humanities. These individuals spend much of their careers reading the Great Books. They may not reject the idea of formal modeling in the social sciences, but it is distant from their concerns. These individuals believe that models are forced to oversimplify in a way that a literary text does not.

Addressing this difference in perspectives, I consider how novels and stories differ from formal models. By novels I mean written full-length fictional stories that are designed to inspire, entertain, or otherwise stimulate the reader. I do not mean to dismiss the distinctions among various fictional forms, or the importance of those distinctions for literary theory. Nonetheless I start by posing the question in the grossest possible way, namely by comparing models and a generic concept of fictional stories, as represented here by novels. While there is a massive literature on what novels are all about, there is virtually nothing comparing novels to models.[1]

[1] Morgan (2001) and Ingrao (2001) both argue that economists can learn something from literature. Morgan stresses how models are embodied in a broader narrative, which I discuss more below. Ingrao (2001) consider the lessons in some particular novels. Watts (2002) considers the use of implicit models in literary works; see also the collection edited by Watts (2003). Henderson (1995) studies the presentation of economic ideas, through the literary medium, by such classical economists as Maria Edgeworth and Harriet Martineau. Roback (1985) examines the economics of George Orwell, Rockoff (1990) draws out the monetary economics in The Wizard of Oz. Levy and Peart (2002) have been working on how pictures, images, and paintings might differ from formal models. Paulos (2002) offers some very brief remarks comparing stories to mathematical logic. On novels alone, Booth (1961) is one classic place to start. See also Frye (1990), Hirsch (1967), Lentricchia (1980), and Gadamer (1989), among many others. Norris (1982) surveys deconstruction. Shell (1993) studies the use of economic metaphors in literature. Oatley (1994) treats the novel as analogous to a computer simulation, and argues this view has its roots in Aristotle's theory of mimesis. On the comparison between literature and the law, see the essays in Ledwon (1996). The neo-Kantian philosopher Vaihinger (1924) argued that the fundamental constructs of science resemble fictions; see also van Fraassen (1980).

By models I mean economic models with a formal mathematical structure, most typically in the form of exact assumptions about utility functions and production technologies, or in the case of game theory, behavioral conjectures. These models typically embody a social science mechanism about how a series of initial conditions give rise to a final result. Models are not typically realistic in their details or degree of abstraction, but rather they attempt to portray some stylized features of how the world works. I will not consider every possible kind of economic model (the possibilities are vast), but rather I will focus on the kind of rational models taught in the first year or two of a typical graduate sequence in economics. These models form the core of the discipline.[2]

I will draw on two additional concepts. I refer to data as facts, numbers, or true stories about the real world. I refer to simulations as artificially generated ("false") data, produced by estimating a model. Models, data, and simulations hardly exhaust the entirety of social science, but they form my initial categories for asking where and how novels relate to the social sciences.

My inquiry has several purposes. First, I wish to argue for the benefits and long-run complementarity of novels and models. Of course at any single point in time they are substitutes -- today should I read a novel or study a model? But in the larger picture social scientists should consider, for research reasons, spending time reading novels, and humanities professors should consider spending time with formal models. The two methods of investigation, despite notable and persisting differences, have more in common than is commonly supposed. Since this article is directed at social scientists, it should be thought of as pro-novel, relative to economic science as a whole, although individuals from the humanities may experience discomfort at seeing novels compared to models at all.

[2] Morgan (2001) surveys some contrasting definitions of model. For the debate on the realism of economic models, see Mäki (2003).

Two hundred years ago, the social sciences and the humanities were very closely linked, but they have moved increasingly apart. I hope to make some progress in reuniting these disparate fields of investigation. Similarly, we find a battle, often vitriolic in form, in American law schools. The so-called "law and economics" movement uses models to analyze the law. The alternative "critical legal studies" tradition rejects these models and places greater stress on narratives and the methods of the humanities. "Law and literature" classes are now commonplace, but there is no consensus among rational choice theorists on what kind of value they add.[3]

A comparison of novels and models might start with categories from literary criticism (allegory, metaphor, mimesis, etc.) and see how they relate to models or how they might be found in models. Deirdre McCloskey (1985, 1990), for instance, argues that that economic techniques have more in common with rhetoric than is commonly acknowledged.[4] In contrast, I start with categories from the modeling literature (models, data, and simulations) and see how novels fit into those categories. This is the investigation of an economist, not a literary theorist.

The presumption that novels ought to be given justification in terms of social science categories may offend some, but I do not see this question as reflecting skepticism about novels or discriminating against novels, relative to models. Nor am I attempting to "reduce" the value of novels to economic or rational choice categories. We can recognize that novels stand on their own as works of art, while still wishing to focus on how novels fit into rational choice categories. My account seeks to add to the value of novels, rather than explain that entire value in reductionist terms, or force all of that value into the boxes of rational choice social science. I also will consider why we should read “false” novels, instead of concentrating on the true descriptions of historical research.

[3] Posner's (1998) account of law and literature takes an eclectic, pragmatic, and sometimes skeptical account of how literature helps us understand jurisprudence.
[4] Ankersmit (1996) argues that many political models rely ultimately on aesthetic concepts.

An investigation of novels and models also may help us better understand how the public thinks about economic issues. Economists typically use formal models to think about the world. We cannot help but notice that most members of the general public do not appear to think very scientifically about policy, in the sense of deferring to the established expert bodies of knowledge. Instead most citizens are heavily influenced by stories, movies, and popular culture. They think in terms of narrative, often false narrative, and spend little time learning economics. Economists naturally wonder whether citizens and voters spend too much time thinking in terms of stories and not enough time thinking in terms of models.

How should we think about this difference in approach? Is model-based thinking unpopular for some specific reason, or is it simply too hard for most people? Or does the "common man" in fact use a different model, rather than rejecting model-based thinking altogether? To pursue these questions, we need a better sense of exactly how models and stories differ.[5]

II. What exactly do we learn from novels?

I will proceed by citing three points -- all relevant for economics -- that we might learn from novels. After discussing each point briefly, I will then return to the more foundationalist question of exactly how novels might have brought us to these insights.

A. Assessing behavioral economics

[5] The reader will notice, of course, that I am trying to construct a "model" of the difference between models and stories. Had I been born with different talents or inclinations, I might have written a novel about the difference between models and novels. The economist Russell Roberts (2001) has in fact written a novel, called The Invisible Heart: An Economic Romance, contrasting economistic and literary ways of approaching the world. Or perhaps I should produce (better yet, commission) a painting of the differences between novels and models. At the same time this paper is asking how much and why those alternative approaches would differ.

A large literature on behavioral economics has arisen over the last twenty years (see Rabin 1998 for a survey). This line of research suggests that human behavior is far more complex than standard models of utility maximization dictate. More importantly, behavioral economists argue that understanding the complexity of choice will give us a better grasp on many economic phenomena.

A familiarity with novels increases the plausibility of behavioral economics. Most characters in novels have complex motivations and show a variety of behavioral quirks. For instance, Flaubert's characters often exhibit a "grass is always greener" approach to romantic choice, rather than rationally assessing their current and future prospects. Madame Bovary seems to want every man but the one, her husband, who adores her. The lead characters in Bronte's Wuthering Heights (Heathcliff and Catherine) consider themselves connected by a sense of common fate and destiny, and they pursue disastrous courses of action. Captain Ahab, from Melville's Moby Dick, is obsessed with taking his revenge against the white whale, which eventually leads to his death.

Utility maximization may describe the behavior of these characters ex post, but it does not help us understand or predict their behavior very much. Instead their behavior appears best described in terms of complex psychological mechanisms. Their biographies, and the social contexts they live in, lead them to perceive realities in ways that are not captured by traditional economic models. Their behaviors appear irrational in some regards but we are supposed to imagine, for instance, that Ahab faces an utterly compelling sense of mission to hunt down the white whale.

The standard criticism of behavioral economics is that it offers too many varying accounts of human behavior, with no unified framework or no ability to offer useful ex ante predictions. A reader of novels, who is used to complex portraits of multi-faceted characters, is less likely to find such a criticism persuasive. Such a reader is less likely to see simplicity as an explanatory virtue, and is less likely to look for unified accounts of complex social phenomena.

Novels also may point our attention to some behavioral mechanisms rather than to others. Homer's The Odyssey portrays a world where most people are struck with self-deception and confusion about their motives; Rabin and Schrag (1999) and Tirole and Benabou (2002) have integrated the self-deception idea into behavioral economics. Ingrao (2001) surveys writings of Dickens, Melville, Dostoyevksy, and Balzac, in support of the claim that people choose their own budget constraints; this idea runs contrary to standard theory but is familiar to behavioral economists (e.g., Thaler 1994).

B. Welfare economics and human welfare

At the margin, pure Pareto improvements are scarce. For this reason, applied welfare economics typically focuses on some form of the Kaldor-Hicks compensation rule. If the gainer's gains, as measured in dollars, exceed the loser's loss, economists are inclined to recommend the policy. This rule can be modified to take distribution into account, thus weighting the dollars of the poor more heavily, but economists still link wealth and welfare.

A separate literature has developed on the empirics of happiness (see Oswald 1997 and Frey and Stulze 2002 for surveys). Drawing on techniques of empirical psychology, researchers ask individuals to report their subjective well-being. These subjective measures are then correlated, for purposes of reliability, with more objective measures of happiness, including health, propensity to smile, expected longevity, reports from peers, and number of friends.

These researchers find that more wealth, above a certain baseline level, does not make most individuals much happier. Employment (after adjusting for wealth), health, married status, volunteer work, and religious participation, among other variables, have a positive correlation with happiness. Insofar as a wealth effect is found, it tends to be for relative wealth. People enjoy having more wealth than their neighbors. This wealth effect, of course, does not translate into net social value, since one person's loss is another person's gain.

When evaluating economic welfare, the question remains whether we should use a wealth-based view or a happiness view. Novels make the happiness-based view more plausible, both by portraying the complexities of human welfare, and by showing how the rich are not always happy. When the very poor escape extreme poverty, they are better off. It is never fun to starve. Yet literary figures are not generally happier as they become wealthier. Instead we often find that money and avarice corrupt happiness, as expressed in tales by Balzac, Dickens, Proust, Flaubert, and many other writers. Less intellectual "popular" novels, such as Harlequins, focus on love and togetherness as a source of happiness, not money. More generally, when literary characters report their happiness, or lack thereof, they rarely cite changes in wealth as a reason, again barring the case of escape from extreme poverty and privation.

These novelistic portraits suggest that readers find it plausible that happiness does not increase much with wealth, at least above a certain level. Readers presumably have experienced the same phenomenon in their lives. So reading novels increases our skepticism about the relevance of the Kaldor-Hicks rule for economic welfare, and increases our appreciation for the happiness measures of welfare.

C. The plausibility of signaling models

Many famous fictional characters take great care to control the presentation of their image to the outside world. They invest significant resources so that other people will have a more favorable opinion of them. We find this theme in George Eliot, Jane Austen, Tolstoy, Proust, and numerous other novels of note. Proust's aristocrats go to great trouble to show that they are accepted in the proper social circles. Austen portrays elaborate mechanisms for signaling properness, chastity, upbringing, and property. Tolstoy presents an explicit recognition of the signaling mechanism. War and Peace presents the characters of Sonya, the Count, and Countess as fussing over the health of Natasha (chapter 16). They wish to show that they are doing something, and to signal their own status as caring people. Hanson (2002) modeled this idea many years later.

Again, it is plausible to think that novelists use descriptions that resonate with the intuitions of their readers. The fictional depictions of signaling illuminate our own behavior to ourselves, and make us more aware of how others around us are signaling as well. So reading novels will make us more receptive to the signaling arguments used in economic theory. We are more likely to see those models as intuitive, rather than as requiring some leap of the imagination.

The bottom line can be explained as follows. Economic theory is rigorous, or at least attempts to be. Yet how we evaluate economic theory, and how we choose economic theories, is often highly intuitive. A knowledge of novels can refine our intuitions in these tasks.

III. Novels as models?

Having outlined some insights from novels, relevant for economics, how should we think about the sources of this knowledge? How can we put both novels and models into a broader spectrum of how human understanding is generated?

Clearly novels are not data, as a social scientist would use that term. By definition novels do not narrate true events. A novel may be "true data" about the mind of its creator, and the proclivity of that mind to draw connections and tell stories. But a novel remains a constructed tale. If novels cannot be data, I therefore consider two other major categories in economic theorizing -- models and simulations -- to see how novels might fit in.

Novels as models

Some kinds of fiction resemble models. Some science fiction stories, for instance, embody model-like thinking. The author writes down a description of some new technologies to be found in a hypothetical world. The author then traces through the effects of these technologies and outlines how things would work, or outlines an

equilibrium, in economic terminology. That equilibrium is then “disturbed” by some new change, such as alien invasion or a new technology. The bulk of the novel then traces through the effects of the change, performing a kind of comparative statics exercise. The works of Ayn Rand, which portray capitalistic and collectivistic societies, offer a similar exercise, although they focus on changes in individual freedom, rather than on technologies more narrowly.[6]

In other cases the behavior of a particular character fits an economic model. Defoe's Moll Flanders, for instance, appears to maximize wealth. When one line of activity promises higher returns, she is keener to pursue that activity. Another major character of Defoe, Robinson Crusoe, responds to incentives and property rights. The treatment of signaling in Tolstoy, mentioned above, fits this category as well.[7]

I take these novels (or parts of them) to literally be models, albeit of the informal sort. They use a stylized setting to show how one set of causes lead to particular effects, working through a mechanism of some generality. The mechanism is not always spelt out explicitly but can be seen in the examples. They are like the models from earlier in the history of economics. Before the mathematization of the economics profession, economists offered verbal models without explicit mathematical forms and without rigorous proof. It is no accident that contemporary model builders sometimes refer to earlier, non-formal economists as "telling stories."

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[6] Ingrao (2001) considers some anti-commercial examples from Zola and Balzac, and Watts (2002) surveys some examples more generally. Cowen (1998, chapter two) considers some examples from eighteenth century British fiction. On the didactic functions of novels, see Boyd (1980), and chapter seven with reference to the views of Samuel Johnson in this regard.

[7] Murder at the Margin, written under the pseudonym of Marshall Jevons (a compendium of two nineteenth century economists' names, Alfred Marshall and William Stanley Jevons, but actually William Breit and Kenneth G. Elzinga) has every character behaving in terms of an explicit logic of choice. This novel, written by two economists, then uses economic reasoning to solve the murder.

Nonetheless these model-like novels are not the primary cases for our comparison. Despite the examples given above, most novels do not offer much in the way of model-like reasoning. Most novels relate many particulars but make no overall theoretical pronouncements about the motivation of their characters or the results of those motivations. If we look, for instance, at James Joyce's Ulysses, it is hard to model any of the particular behaviors. We read about a character doing forty-seven different things. The actions may fit together to form a coherent portrait in our minds, but we are given no general account, in the sense required by the economist, of how all those behaviors fit together. What are we to make of this kind of novel?

Novels as simulations

Many novels are more like economic simulations than models. In other words, the novel is made-up data. To see why studying made-up data may be useful, let us first step back and consider some basic information about simulations.

In economics a simulation typically takes a previous model and assigns particular values to the open parameters. One of the free variables is then tweaked or changed, so that the results may be traced. Imaginary time is played out and the simulation generates information on prices, quantities, and other measurable economic variables.

It is now well understood that the difference between a regression and a simulation is one of degree rather than of kind (Hansen and Heckman 1996). Any regression contains an implicit simulation. Consider, for instance, $y = 2x + k$ as a least squares estimation fitted around actual data points. This regression also suggests imaginary, simulated alternate histories, based on varying values for the independent variable. Similarly, simulations contain implicit (or explicit) regressions. The assigned parameter values for the simulation are typically taken from real data, or from econometric estimates of that data. We make the regression a simulation simply by exploring alternative realizations for the independent variables. To put this point in other words, the regression fits the data points

we know, and the simulation uses that information to speculate about the data points we do not observe.

Economists use simulations in two differing ways, either to resolve uncertainty about possible data or to resolve uncertainty about the explanatory power of a model. In the first case economists trust the underlying estimated model, but wish to obtain information about alternative scenarios for the independent variables. We might, for instance, have an acceptable model and then ask what will happen if the price of oil goes to $60 a barrel, $70 a barrel, and so on. I will refer to simulations of this kind as estimations.

Second, economists may already know the data, and wonder whether a particular model can describe that reality. For instance, economists already know the data series for a macroeconomic downturn. Inventories move so much, the unemployment rate moves so much, investment moves so much, interest rates move so much, and so on. These facts are rarely disputed. It remains a question, however, whether any theory can account for that data. By simulating a theory we see whether it can generate and thus perhaps explain the magnitudes in question. This second use of simulation is sometimes called calibration, or calibrating an artificial economy, and is common in contemporary macroeconomics.[8]

Simulations thus require either a good sense of the model, to judge the data (estimation), or a good sense of the data, to judge an underlying model (calibration). Simulations do not require a firm sense of both data and model, and indeed they would be superfluous if we knew both the data and proper model.

Along these lines, if we are to fit novels into the boxes offered by rational choice theory, they can count as either estimations or calibrations. Let us consider each in turn.

Simulation estimations

[8] For discussions of simulations in macroeconomics, see Prescott (1986), Hoover (1995), Kydland and Prescott (1996), Hansen and Heckman (1996), and Sims (1996).

We have a novelistic estimation when the author plays out the implications of his or her underlying worldview. It may be a political worldview but is more likely some understanding of society, psychology, and human behavior. Think of a novel as resulting when that worldview is filled in with particular characters, a particular historical era, a particular conflict or choice, and so on.[9]

A novelist, for instance, might believe in the universal human desire for status and recognition. He can then ask, as did Proust, how this desire will play itself out in French social circles at the time of the Dreyfus Affair. The resulting story then offers us some vision of how an underlying worldview applies to a particular setting. Similarly, we can think of Tolstoy's Anna Karenina, in part, as a story of the prevalence of self-deception, set among the Russian nobility.

The portrayal of happiness in many novels, as cited above, fits into this category. In Charles Dicken's Bleak House, for instance, the pursuit and prospect of a sizeable inheritance damages the well-being of a number of characters, most of all Richard. The text suggests that the happy characters (such as Esther, in the latter part of the story) learn to come to terms with what they have, and set their expectations accordingly. Modesty, a core minimum of autonomy, and freedom from legal hassles are all shown as more important for happiness than is money.

So we might learn by studying a novel just as we might learn from running an estimation simulation. The analogy is not exact, since the starting framework of "the novelist's worldview" does not correspond exactly to the alternate starting framework of "an economic model." Nonetheless in both cases general principles and insights are used to generate more specific outcomes, namely stories that do not describe reality directly. We

[9] Levy and Peart (2002) remark that a painting is a model without the error term. Perhaps this point can be understood within the context of simulation. Economic simulations never have error terms because the theorist is creating the "data" herself. The same is true for a novel.

look at the stories, which are of interest in their own right, and to illuminate some underlying general principles. Novels and simulations – both false in the literal sense of that term -- give us ideas of how differing scenarios are likely to play themselves out.

Simulation calibrations

Alternatively, readers may use novels to test underlying theories, as with calibration. Readers, for instance, may feel they already know what is a plausible story and what is not. In other words, readers may know what kind of replicated data a novel needs to generate. If the worldview behind a novel can generate plausible data, that worldview will increase in plausibility, otherwise not.

To return to Marcel Proust, he portrayed many of his characters as receiving their primary pleasures from anticipations and memories, rather than from actual events, and drew our attention to the distinction between voluntary and involuntary memory. His novel Remembrance of Things Past strikes a chord with many readers, and therefore has increased the plausibility of models that embody the enjoyment of memories and anticipations, such as the work of George Loewenstein (1987). We can think of the Proustian account as providing one piece of evidence for behavioral economics, as discussed above in section II. If the story of the novel resonates with our intuitions, we will see the author's postulates as relevant.

Along similar lines, the novels of Camus and Sartre have convinced many readers of the philosophic virtues (and vices) of existentialism. Camus's The Stranger, or Sartre's The Age of Reason, reflect elements of the existentialist worldview. If a reader finds the final psychological portraits convincing, and to match his intuitions, he may conclude there is something to existentialism after all, as an account of the human condition.

We again see an imperfect analogy with economic models. If, in the economic context, simulated data do not look right (imagine a model in which a dollar a gallon rise in the price of oil would cut gdp in half), we conclude that something is wrong with the model.

In the novelistic context, if we find the story implausible we discriminate against the worldview of the novelist. In the novelistic case the link of course is looser. In economics, short of scientific fraud or computer error, we know that ridiculous estimates reflect a problem with a well-specified model. But say that we do not find Sartre's The Age of Reason to be either plausible or interesting. How sure can we be that existentialism is at fault? Perhaps Sartre is simply bad at writing characters, bad at dialogue, or whatever. Our ability to judge inputs by the plausibility of outputs is much looser when we are looking at a novel, as compared to examining a simulated economic model.

The novelistic narrative as false

It is not unusual to defend the use of narrative in the social sciences (see Mink 1970, Roth 1989) and indeed this topic is prominent in the philosophy of history and elsewhere. But the value of novels suggests a more radical position, defending the use of deliberately false narrative.[10]

Given the above discussion, we now have a better sense of why we should study novels and not just some combination of models and history. First, the number of possible constructed stories is far larger than the number of true stories. Fiction allows us to consider new and different possibilities. Novelists therefore run many more simulations than would be found in history. A novel can construct settings that are not possible or easily accessible in historical investigation. Even when a novel is set in an historical era, the novelist can create new masses of detail and narrative. History, by definition, attempts to present only true scenarios. This is an obvious virtue but it also limits the use of history to create simulations, as discussed above. A novel, for instance, can offer the stream of consciousness reasoning of its characters, whereas history usually cannot.

[10] Of course many novels also contain true historical fact. To this extent the case for learning social science from novels is straightforward.

Second, a constructed story, by its nature, sheds light on the author's underlying worldview. The plausibility of the story allows us to "test" the plausibility of the author's framework. A true historical narrative cannot, by its construction, do the same, as we already know that historical stories are both possible and real. Historical interpretation allows for a test of a historian's underlying worldview, but history per se does not. Models, like novels, but unlike history, are fictions. And this use of fiction gives us insight into our abstract constructions behind the fictions.

The dangers of novels and models

Viewing novels as simulations draws our attention to some of their virtues and flaws, relative to models.

On the negative side, many readers judge the plausibility of novels by using their introspection. If we believe that self-deception is rife in human affairs (see Cowen forthcoming), this test is not in every way a good one. We will tend to like those novels that affirm what we think we already know, and reject novels that provide disconfirming messages. Novels also can mislead when introspection provides no guide to truth. It is easy to point to novelistic simulations (just about any novelistic utopia will do, from Thomas More to Edward Bellamy) that are plain, flat-out wrong about how individual human behavior translates into social outcomes. Readers are nonetheless attracted by the emotional resonance of the story. An introspective test may be able to distinguish true and false propositions about human behavior, but certainly it cannot judge factual claims about the world very well. Similarly, Upton Sinclair's The Jungle continues to convince people of the merits of food and meat regulation (for better or worse), despite its openly fictional status.

Novel-reading runs the risk of confirmation bias in this regard. No one reader can read any more than a small fraction of the published novels; few people have enough time to read even most of the classics. So what one takes away from novels will depend, in part, on which novels one chooses to read. To some extent we can expect people to read

novels that confirm their ideologies and preconceptions. So a left-wing reader may prefer Upton Sinclair, while a libertarian may read Ayn Rand.

An economic model attempts to provide a cluster of related qualities including mathematical formality, transparency, simplicity, and clarity. By no means do all models succeed in offering these qualities. Game-theoretic models, for instance, are known for their messiness and their multiple equilibria. That being said, such qualities are usually held against game theory. Economic models are considered successful to the extent they provide transparency and clarity, and of course some models succeed in this endeavor. Simple models, for instance, help us understand the difference between an income and substitution effect, and such a distinction can be considered a triumph of economics and the model-building method. Clear models thus enable the modeler to state some general principles of behavior with a relatively small number of well-defined assumptions. Both the model and its simulations are replicable and verifiable.

If we think of economic models as "existence theorems," telling us "what could possibly happen" (Nelson 1986), we can get some sense of likelihood by examining the underlying assumptions. A model of a Giffen good, for instance, tells us that if price goes up, people under some circumstances will buy more, not less. Nonetheless playing with the model shows that this can hold only when the price rise is for a necessity, and that necessity takes up a large part of the consumer's budget. A novel cannot easily serve this same function in the same way. We might read a Jane Austen novel, and conclude that various kinds of courtship behaviors are indeed possible or plausible. That being said, it is harder to draw out the underlying assumptions, as embedded in the story, needed to generate this kind of behavior.

On the positive side, when we wish to base our simulations on alternative assumptions about human behavior, novels fill gaps that models cannot. They give up formal exactness and transparency to draw our attention to sophisticated motivations, emotional

mechanisms, and interpersonal relationships. The insights of novelists usually cannot be expressed in a small number of theoretical or mathematical propositions.[11]

The successful novelist also must make his characters live in the mind of the reader. This requires insight into human behavior that goes beyond typical economic postulates about rationality, downward-sloping demand curves, and so on. A novelist must offer the reader an "interior" understanding of what various events, experiences, and stories are like. Novels can appeal to our empathy in a way that models cannot. As noted above, the novelist must "test" the story, and the character portraits, against human intuition and introspection. The novelist invents plausible particulars and explores their ramifications, with an eye towards deeper generalities, often about the nature of the human condition.

Novels spur readers to ask questions, thereby helping readers increase the value of their human capital. The reader turns his implicit, unarticulated knowledge into explicit knowledge. This questioning may generate knowledge above and beyond any particular contribution the author has to offer. In short, novels help generate self-knowledge and help turn self-knowledge into useful forms.

An individual who reads Kafka's The Trial may be led to ponder the nature of guilt, responsibility, and punishment. A good novel is memorable, has story-like qualities, and elicits emotional response, all of which mobilize the human capital and energies of the reader. Devices such as multiple perspectives, changes of voice, and irony all may encourage particular reader questions. Ingrao (2001, p.15) notes that: "in novels plurality of meaning is the rule." Reader "self-deception" -- temporarily thinking the story more real than it actually is -- assists the knowledge generation process. These features also give novels some advantages of factual history.[12]

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[11] West (1996) argues that characters in novels typically have less rationality than economic man, but far greater empathy and sympathy. Ingrao (2001) stresses the complexity of the kind of knowledge found in novels.

[12] There is a substantial philosophic literature on the difference between novels and reality. One central question addressed is why a reader might ever care about the

A variety of questions, ranging from the nature of beauty, the nature of tragedy, the nature of the good or the meaning of life, receive only limited insight from formal models. Economic models (e.g., Arrow's theorem) shed some light on these topics, but they may not elicit reader questions and introspection equally well. The transparency of economic models offers scientific advantages but the models themselves do not interest many people and thus do not motivate those people to ask better questions. Economic models therefore fail to draw out many kinds of internal or introspective knowledge. Novels, in contrast, are most useful where introspection is most likely to provide some insight, relative to measurement and formal scientific experimentation. We might read a novel to better understand the emotion of self-righteousness, but we would be ill-advised to read a novel to discover how the labor market works.

We can think of novels and models as relying on tacit knowledge (Polanyi 1974) in differing ways. Both novelists and model builders have tacit knowledge about how the real world works, and they try to articulate that knowledge in the form of either a story or equations. The economist tries to make previously hidden connections more transparent. The hope is that our previously tacit knowledge can be articulated more clearly, and that the knowledge will no longer be tacit. The novelist keeps many of the relevant connections in the sphere of tacit knowledge, and hopes that his initial tacit knowledge can spur some more knowledge, often of the tacit kind, in his readers.

For this reason, any account of what we learn from novels is likely more subjective than a comparable account of what we learn from models. What we learn from novels will be person-specific and strongly tinged with biographical elements, more than will be the case with models.

V. Concluding remarks

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outcome of a novel, given that the reader knows the events are not really happening. On this question, and others, see Hjort and Laver (1997).

Novels are akin to models in at least two ways. Some novels resemble models proper, whereas others can be thought of as simulations of underlying implicit models.

Most of all, I have tried to show that the difference between (economic) models and novels can be modeled. This suggests we have some broader model about the generation of knowledge and understanding, with "economic models," "novels," and other kinds of information as relevant sub-categories.

The general advantages of model-based thinking therefore should not be used to discriminate against knowledge production through novels, through the Great Books, and through the humanities more generally. Those methods of knowledge production have their own advantages, and those advantages can be understood through model-based thinking. In many cases reliance on the Great Books may represent the wrong use of models at the wrong point in time, but this is an empirical question to be answered by context. Those who defend economic models, simply by citing the general advantages of models, are viewing the comparison with the humanities too narrowly. They are also doing injustice to the very broad power of models.[13]

At the same time, we should recognize the power of stories. Many models, especially the most relevant models, are embedded in stories, further illustrating the complementarities between novels and models. Abstract transparency accounts for many of the virtues of the model, but the "sharper" the model is, the harder it is to translate the results of the model into a claim about the messy and complex real world. If a model tells us only that assumptions A, B, and C lead to result X, this is not useful if A, B, and C do not hold in the real world. If we want to know what our model really means, and how it translates into information about the real world, we often fall back on story-like accounts (McCloskey 1985, 1990, Morgan 2001). Economists, for instance, have story-like accounts of the vices and virtues of markets, and often use models (and data) to support

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[13] Hume (1999 [1767], section 3) argues for the unity of poetry, storytelling, and other methods of knowledge, claiming all are based on the idea of resemblances.

one story over another. Similarly economists offer story-like accounts of the rationality, or irrationality, of individual human agents, and again use models in support of their stories about the nature of human beings.

Giambattista Vico (1976 [1744]), in his New Science, struck out the extreme position that myth and "poetic wisdom" are more fundamental means of knowledge than is science. He saw politics and economics as flowing from this more primeval source of wisdom. He writes of myth as a kind of "matrix," in which other categories of the human understanding, including science, are made intelligible. We need not accept Vico's extreme view about the primacy of story and myth, but nonetheless the two methods of communication and discovery -- model and story -- are not so neatly separable.[14]

One commentator on this paper (Alex Tabarrok) has suggested that contemporary computer games break down the distinction between novels and models altogether. If the game has enough sophistication, and is sufficiently entertaining or inspiring, the model becomes like a novel as well. Game characters are "produced by" mathematical equations and programs, as we might find in an economic model. Nonetheless the resulting model has enough story-like properties to make it both a model and novel at once. Arguably the same might be said about chess, at least as played by grandmasters. At the very least the distinctions between models and novels will vary with technologies.

Finally, the above categories may help us understand why so many individuals fail to find model-based thinking, in the narrow economistic sense, to be so persuasive. These people are not simply the unwashed masses, or fuzzy-minded English professors. Rather they are people who, either implicitly or explicitly, recognize that novels have some potential advantages over traditional economic models. No matter how anti-model their rhetoric may be, in reality they prefer models of a different kind. [15]

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[14] For a recent interpretation of Vico, see Mazzotta (1999).

[15] Levy and Peart (2002) consider a different but related question. Should a person with a story trust an expert with a model? They find some circumstances under which the

Many economists believe that people spend too much time thinking in terms of stories, and not enough time thinking in terms of models. The more likely problem is that these individuals need better and more informed stories.

answer is no. Anecdotal evidence, as used by non-experts, is often a relatively efficient way of estimating the median of a distribution.

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