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How Economics Shaped Human Nature: A Theory of Evolution

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Abstract

Humans make a living in thousands of ways (dentist, carpenter, etc.), unlike any other species. This chapter tries to explain how this specialization evolved. Long ago, the mental tendencies that now cause procrastination caused specialization. The sequence was: 1. Specialized foraging. 2. Specialized use of free time (resembling hobbies). 3. Part-time jobs. 4. Full-time jobs. Language began and grew because it increased trade. Single words helped the two sides of a trade find each other. Gifts, ceremonies, festivals, connoisseurs, collectors, decoration, art and fashion evolved because they increased innovation. By creating demand for hard-to-make "useless" things, they shifted resources to skilled artisans, who innovated more than other people. Desire for novelty (fashion) and small improvements (connoisseurs) pushed artisans to innovate.

Happy is the man who can make a living by his hobby! -- George Bernard Shaw, *Pygmalion*

When two people meet, they often ask each other *What do you do?* There are thousands of possible answers: artist, banker, carpenter, dentist, and so on. Only humans specialize like this. In all other species, all members of the species make a living the same way. (With tiny exceptions, such as queen bees.) For example, all coho salmon search for and eat the same food. All house sparrows search for and eat the same food. In particular, chimps, our closest relatives, do not specialize. The common ancestor of humans and chimps lived about six million years ago. Presumably our genes changed since then to produce specialization. The benefits of specialization are obvious. Adam Smith wrote about them in *The Wealth of Nations*, calling specialization "division of labor". How did the change from no specialization to great specialization take place?

In this chapter, I try to answer this question. The answer also explains the evolution of several other activities unique to humans, including hobbies, procrastination, language, gifts, ceremonies, festivals, connoisseurs, collectors, decoration, art, and fashion.

Most adult humans spend much of their time doing their job. They also spend plenty of time on activities that all mammals do: sleep, food gathering, eating, mating, parenting, and so on. These activities (job, sleep, eating, etc.) shed little light on how specialization evolved. But if you look at what humans do during the remaining time, during "spare" time, there are many clues to what our ancestors did before specialization (full-time jobs) became dominant.

Constraints on a Theory

To explain human evolution is to explain the differences between humans and chimps. One is language. A few years ago, in a cafe, I met a linguistics professor. "Why did language evolve?" I asked. "We'll never know," he said. This belief is common. "We do not and never will know . . . much of anything about [the first language] at all," wrote McWhorter (2001, p. 9). "It seems impossible to know, then, why language developed," wrote Janson (2002, p. 8). This belief overlooks the fact that theories of human evolution, including language evolution, are constrained in several ways.

I was guided by four constraints:

1. *Reichenbach's Common Cause Principle*. If two events are correlated (e.g., fires are more common in hot weather) either one causes the other or they have a common cause. Applied to rare events, it implies lightning doesn't strike twice in one place for different reasons (Roberts, 1987). For example, one night you hear a strange sound (rare). The next morning, you find you've been robbed (rare). The burglar probably caused the strange sound. This principle implies that the many ways that humans differ from all other animals must be explained with one story, one series of events in which one thing leads to another. For example, an explanation of how language evolved must fit within a larger story that explains other behavior unique to humans, such as art.

2. *Humans are the only animals that trade*. To use Reichenbach's Principle you need

to start somewhere. Jacobs (1992) drew my attention to the fact that humans are the only animals that trade, which Ofek (2004) used as the center of a different theory of human evolution. It's obvious that trade and specialization go together. Causation goes both ways: Trade makes specialization more profitable, specialization makes trade more profitable. Here is a starting point. Explanations of other unique human traits must fit within a story that explains specialization and trade.

3. *The difficulty of trade*. Amsel and Roussel (1952) reported that if a rat expects food but fails to get it, it will run faster a few seconds later. This effect, called *the frustration effect*, has been observed in many forms (Amsel, 1992). I believe it reflects an anti-theft mechanism: *if you take my food I will attack you*. Preparation to attack increases running speed. The following story shows the underlying mechanism more fully:

> The pair [of raccoons] were accustomed to being fed peanuts from Charlie's hand every afternoon. . . . As usual, [Charlie] unlocked the door of the cage and climbed right in with the raccoons. The male [raccoon] dove for the pocket where the peanuts usually were. Finding no food, the animal went wild, attacking the boy, biting his hands and elbows and tearing his clothes. Eyes bulging in anger, the raccoon ripped the cage door off its hinges and jammed it against the frame. [LaPlante, 1993, p. 49]

Along similar lines, a friend told me her usually-gentle dog would growl if it thought you were trying to take its food. The common ancestor of chimps and humans probably possessed something like this anti-theft mechanism. Because trade involves loss (the thing traded away), such a mechanism would hinder trade. Weakening it would make trade easier. Indeed, the endowment effect (Kahneman, Knetsch & Thaler, 1991) is a weaker anti-theft device. The endowment effect is observations that imply that soon after we possess something, we value it more. For example, before you own a certain coffee mug you think it is worth $3. After you own it, you value it at $6. You are going to try harder to keep something worth $6 than something worth $3. The frustration effect and related observations suggest that the common ancestor of chimps and humans had a strong tendency against trade. The endowment effect suggests that as humans evolved, that tendency became weaker. The broad point is that mental tendencies control economic behavior. To explain modern humans, we shouldn't just explain anatomy and physiology. We should look for mental tendencies that promoted specialization and trade.

4. *Features of a healthy economy*. Jacobs (2000) emphasized that a healthy economy has three features: 1. Diverse goods and services. 2. Easy trade. 3. Innovation, meaning that new goods and services are developed. A healthy economy makes it easier to specialize. It provides customs/rules (that tell people how to trade), practice (in trading), and income. This suggests that the changes that led to specialization were accompanied by changes that produced those three features.

These four constraints led me to the theory I describe here.

Hobbies and Procrastination

I propose that the path from all members of a species foraging for the same food (the common ancestor of chimps and humans) to occupational specialization (modern humans) had four steps:

1. Specialization in foraging. Some early humans foraged for X, others for Y.
2. Specialization in use of free time. Some early humans did X during their free time, others did Y.
3. Part-time jobs. Hobbies become jobs when used to get necessities, such as food.
4. Full-time jobs.

Specialization in foraging (Step 1) led to everything else. It became adaptive, I suspect, when our ancestors discovered an abundant steady supply of food. How this might have happened I discuss at the end of this chapter, in Relationship to Other Work. Under normal conditions (occasional food shortages), specialization in foraging is dangerous. It is a kind of bet. If you specialize on Food B while everyone else eats both Food A and Food B, you are betting there will always be enough Food B. If B runs out, lack of experience with A will put you at a disadvantage. If supplies of A are low -- and if B is absent, A is likely to be low -- such a disadvantage could be fatal. When there is plenty of food and a steady supply, the advantages of specialization (you are more efficient) could outweigh the disadvantages. Your neighbors also gained. If you specialize on B, that leaves more A for them. This win-win situation allowed a gene for specialization to spread through a population and for that population (better fed) to out-perform neighboring populations lacking that gene.

Specialized foraging (Step 1), like all foraging, is now rare. We can see traces of it in mushroom hunters, bird watchers and butterfly collectors (who catch the butterflies they collect). These activities are done for fun. They require considerable specialized knowledge. They suggest we enjoy learning in depth about one part of nature and enjoy using that knowledge.

Specialization in use of free time (Step 2) is easy to see. Abundant food and specialized foraging provided substantial free time. Specialized uses of that time began, probably due – at least at first -- to the gene or genes behind specialized foraging. Peter did X during his spare time, Sam did Y. Nowadays we call X and Y hobbies. Modern hobbies, I propose, resemble this ancient specialization in several ways:

1. *Low priority*. Hobbies are done during spare time. They are lower priority than obviously useful activities such as eating, working, and sleeping.

2. *Repetition*. Hobbies are done repeatedly. Calling something a hobby implies repetition: It is not a hobby if you do it only once. The time between repetitions is on the order of days. Perhaps you do your hobby on weekends. The repetition may last years.

3. *No obvious benefit*. Hobbies have no clear value to the hobbyist. They don't generate income, improve health, or make you more attractive. They're done because they're enjoyable.

4. *Diversity*. There are thousands of hobbies.

5. *Narrowing*. Hobbies involve specialization in the sense of exclusion: one person usually has just a few hobbies, perhaps only one. The common phrase *my hobby* ("my hobby

is drawing") indicates this.

6. *Specialized skill or knowledge*. Hobbies also involve specialization in the sense that many of them involve learning an unusual skill or esoteric knowledge. A large fraction of hobbies involve making things not easy to make: wood working, restoration, model building, skilled cooking, photography, jewelry making, painting, scrapbooking, sewing, quilting, and gardening, for example. Likewise, a large fraction of hobbies involve esoteric knowledge: the hobbyist becomes an expert in something more or less useless. Trainspotting, amateur astronomy, and contract bridge are examples. In America, hobbyist experts are called *buffs*: *wine buff*, *Civil-War buff*, *train buff*. In England, *anorak* means something similar; in Japan, the term is *otaku*.

Modern hobbies, I am saying, reflect ancient mental tendencies. Because hobbies are not done for profit (and, indeed, cost time and money), they show what our brain structure pushes us to do. Hobbies are a plausible intermediate step in the evolution of occupational specialization because they have some but not all of the features of specialized jobs. Like most jobs, they involve repetition (you do it again and again), specialized skill and/or knowledge, and diversity (many possible jobs). As knowledge accumulated, specialized uses of free time became more productive. Eventually things made during free time (e.g., spear points) became so useful that others would trade necessities (such as food) for them. At this point, hobbies turned into part-time jobs (Step 3). As part-time jobs became more productive, there came a time when you could use your specialty to get everything you needed. That's when full-time jobs (Step 4) started.

How did specialized foraging and specialized use of free time come about? Both require two factors. 1. *Intense repetition*. To become a specialist requires practice. Practice at X makes you better at X -- with enough practice, an expert. 2. *Diversity of what is repeated*. You can become an X specialist only if those around you do *not* repeatedly do X. Yet you and your neighbors live in the same environment, have similar genes, and need the same things to survive. It isn't obvious how to produce diversity of what is repeated. To do so by increasing genetic diversity – thereby increasing diversity of proteins that perform essential functions -- would surely have many bad effects. Better to increase diversity of repetition in a way that leaves genetic diversity unchanged.

Repetition was not new to the common ancestor of chimps and humans. Ordinary foraging requires repetition (and learning) but the repetition involved is not appropriate for specialization. Foragers have two tendencies to repeat: (a) *Short-distance*. When an animal gets close to food, it learns what to do next - what food looks like (e.g., what to peck), how to process it (e.g., how to open a nut). This sort of repetition is studied in rat bar-press experiments, for example. (b) *Long-term*. When a primate searches for food, it learns that some places are better than others. It will return to those places year after year. But it will not return immediately. If you pick all the ripe fruit in a certain tree on Monday, you should not return to that tree on Tuesday. Before returning, you should visit many other trees. A popular rat memory test takes advantage of their tendency to avoid revisiting one food source until all other food sources have been visited (Olton & Samuelson, 1976).

The two sorts of repetition learned by foragers (short-distance and long-term) do not encourage within-species diversity. Because all members of a species eat the same food, all of them learn the same "tricks" -- the same methods of food processing, the same trees to visit. They repeat *without* specialization. And the lack of day-after-day repetition (foragers do not return to the same tree day after day) is also bad for specialization: To become an expert, you need to do the same thing day after day. To become an expert basket maker, you make baskets as often as possible. You do not return to making baskets only after you have tried to make many other things (= revisiting a tree only after you have visited many other trees). If you make baskets day after day you will have a big advantage over someone who makes baskets once a month.

I propose that the mechanism that causes the two necessary features (intense repetition and diversity of repetition) now causes procrastination. Procrastination is a modern side effect of a mechanism that was at the center of human evolution. By *procrastination* I mean not starting an important task, such as doing your taxes or writing a term paper. Not doing something new makes you more likely to repeat – to do today what you did yesterday. The mechanism behind procrastination causes repetition. I think the mechanism works something like this. All tasks have a mental hedonic tag, anywhere from "painful" to "blissful". When we consider doing a task, we retrieve its tag. The more positive the tag, the more likely we will choose to do the task. Most tasks, especially unfamiliar ones, have a slightly negative tag, which makes them harder to do. When we actually do one of these tasks, however, the fact of doing it makes its hedonic tag more positive. The task becomes seen as more pleasant. The change wears off after a few days so the task must be done daily or almost daily to remain tagged as "pleasant" and thus easy to do. This is illustrated by a novelist who found she had to write seven days a week. If she stopped on weekends, getting back to work on Monday was too hard (a true story but I cannot find the reference).

Three facts about procrastination support these ideas. The first is the great range of things that procrastinators avoid doing. Diversity of specialization requires diversity of avoidance. If you want to have experts at Tasks A, B, and C, the persons who do A must avoid B, and C; the persons who do B must avoid A and C, and so on. The second is the ubiquity of procrastination. "Procrastination is extremely prevalent," wrote a reviewer (Steel, 2007, p. 65), and "has been reported for thousands of years" (Steel, 2007, p. 81). The third is the lack of linkage of procrastination with other problems (Steel, 2007, 2010).

The explanation of procrastination I propose can be tested in a simple experiment. On Monday, randomly assign half of the subjects to Task A, half to Task B (two tasks roughly equal in desirability). The next day (Tuesday), give them a choice between the two tasks. This explanation predicts they will tend to choose the task they did on Monday. It also predicts that the preference shift will disappear. If you test subjects four days later, there should be much less effect of what they did on Monday.

Language

To understand how language evolved I make two assumptions. 1. The first use of language related to specialization (Reichenbach's Principle). 2. The first use of language involved single words.

One use of single words clearly relates to specialization: facilitation of trade. Single words make it easier for the two sides of a trade to find each other. Nowadays, with buyers and sellers, single words help buyers broadcast what they want and help sellers broadcast what they sell. In Antigua, Guatemala, I wanted to buy contact lens solution. Before I knew the Spanish name for it, I couldn't find it. After I learned the Spanish name, I found it in a few minutes. It was enough to say "contact lens solution" in Spanish. Likewise, at an outdoor market in Antigua, I heard a seller say the Spanish word for toothpaste over and over.

I propose that the first use of language was to help the two sides of a trade find each other. This idea is supported by several facts:

1. *Single words are still used this way*. I can go to a store and say the name of what I want ("bleach"). Store signs often use single words ("newspapers") to say what the store sells. Sellers at outdoor markets and on bikes shout single words to tell others what they are selling.

2. *Single words still have this effect*. Invention of the word *toothpaste* makes toothpaste easier to sell (because advertising is easier) and easier to find.

3. *Single words are not needed for trade*. The first word could facilitate trade only if trade already existed. You can trade without words, using gestures. When I first visited China I discovered I could easily buy things without knowing any Chinese.

4. *Easy expansion*. When a new good is invented, a new word can easily be invented because we can distinguish far more words than exist. When something comes in different versions, you can invent adjectives to distinguish them (*small*, *large*). When services are traded, you can add verbs.

5. *Pidgin languages*. Pidgin languages are tiny languages that develop between two groups of people who speak no common language. In all examples I know of, the two groups wanted to trade with each other. As *Wikipedia* puts it, pidgin language "is most commonly employed in situations such as trade" ("Pidgin", 2011). An example is West African Pidgin English, which began in the 1600s during contact between West Africans and English slave traders. It was later used by Africans to trade with other Africans. "Africans who picked up elements of pidgin English for purposes of trade with Europeans along the coast probably took the language up the river systems along the trade routes into the interior where other Africans who may never have seen a white man adopted it as a useful device for trade along the rivers," says *Wikipedia* ("West African Pidgin English", 2011) -- showing how a simple language facilitated trade.

6. *Creole languages*. Pidgin languages sometimes develop into more complex languages called *creoles*. This shows that a language originally developed for trading can be extended into other uses, as I propose happened with the first language.

I can think of seven other uses of single words: 1. Agree or disagree (*yes*, *no*). 2. Express emotion (*wow*, *cool, ugh, damn*). 3. Count (*one, two*). 4. Insult (*jerk*). 5. Tell others what to do (*stop*, *go*, *sit*, *enter, careful*). 6. Call someone (*Peter*, *Mary*). 7. Answer description questions (*red, far, left*). The first four uses (1-4) are not easily expanded to hundreds of words. Few people know a hundred single-word insults, for example. The last three uses (5-7) do allow hundreds of words. There are hundreds of verbs (Use 5), hundreds of names (Use 6), and hundreds of adjectives (Use 7). Verbs, names and adjectives are all useful for trade. Verbs allow the trading of services; names help you find the right person to trade with ("Toothpaste?" "Jim"), and adjectives help you say what you want ("green toothpaste"). It is easy to see how Uses 5-7 could have been *caused by* trading. That agrees with the explanation I propose. But how Uses 5-7 could *cause* trading or *have the same cause as* trading -- as Reichenbach's Principle requires if they were not caused by trading -- is unclear. In summary, among the other ways single words are now used, I cannot find another plausible first use.

Innovation

A healthy economy needs innovation, meaning new goods and services. In the beginning, when humans still spent most of their time foraging, innovation must have been rare. Our ancestors could not have learned to innovate by trial and error because success (a useful innovation) must have been very rare. Perhaps thousands of years separated instances. Ordinary trial-and-error learning (successful actions are more likely to be repeated than unsuccessful ones) requires a success rate noticeably above zero. If you always fail, you will stop trying. If our ancestors did not learn to innovate by ordinary trial and error (which selects among behavior), apparently they "learned" by natural selection – selection for genes that produced innovation. A more innovative population would surely have had a competitive advantage over a less innovative one.

However, innovation is hard. There are two reasons, shown in Figure 1:

1. *The value-versus-knowledge function is close to a step function*. To innovate you need knowledge. But much of the knowledge you will need will have seemed useless when it was learned. The left panel of Figure 1 illustrates this. It shows value as a function of knowledge for a hypothetical tool (e.g., a basket). Until knowledge reaches a certain level (Level X in Figure 1), you can't make even the most primitive version of the tool. From Level X to Level Y, more knowledge pays off: It allows you to make a more valuable version (e.g., more durable) of the tool. As knowledge increases, however, you eventually reach a point (Level Y) where further improvement is difficult. More knowledge helps only a little. With a payoff structure like this, how do you get to X? Before you reach X, there's no incentive to increase knowledge, nor can you tell when you have increased knowledge in a useful way. Likewise, how do you get past Y? There's little payoff for further improvement.

2. *Gaps between tools* (right panel of Figure 1). Within knowledge space, tools are spread out. Their value-knowledge functions are like islands here and there. When you reach an island (Tool Z), progress across the island happens in an obvious way: You try to improve Tool Z. How to go between islands is not obvious. How can trying to improve stone tools lead to the discovery of bronze?

The gaps between tools needed to be crossed to reach our current state of knowledge. I propose the gaps between tools were crossed because of the evolution of two sorts of mental tendencies, shown in Figure 2: (a) Those that caused tools to be made better than necessary (Type A tendencies, left panel of Figure 2) and (b) those that caused useless things to be valued (Type B tendencies, right panel of Figure 2). Type A tendencies pushed knowledge ahead after it reached Level Y. Type A tendencies produced gift-giving traditions, ceremonies and festivals, and collectors and connoisseurs. Type B tendencies pushed knowledge across the gaps that remained. Type B tendencies led to decoration, art, and fashion.

Type A and Type B tendencies shared two things. Both shifted resources to likely innovators – subsidized them, you could say. And both favored innovation in material science -- discovery/creation of new materials and new ways to control materials.

Gifts

One Type A tendency is a tendency to give gifts. As far as I know, all cultures have gift-giving traditions. In America, for example, people give gifts on Christmas and birthdays.

Plainly a gift should be "special" and have useless elements (features that don't make it work better), such as wrapping paper or an attractive box. How gift-giving traditions promote innovation is shown by a product called the Rotary Nutcracker that I found in a kitchenware store. It cracks nuts in a new way. The sales clerk gave me a few nuts to test it. It didn’t crack any of them. *A nutcracker that doesn't work*, I thought. *Who would buy it?* The sales clerk said they had stocked it for less than a year. I was the first person to test it. It had sold well during holiday season (November-December). Now I understood: People bought it as a gift. As a gift, it hardly mattered how well it worked. No wonder I was the first to test it. It was a new and different product. The novelty made it a better gift. Gift-giving traditions caused its flaws to be overlooked. New things are often inferior to old things in the beginning. If enough Rotary Nutcrackers were sold, the inventor could afford to improve it. Desire for gifts to give to others was like a research grant to inventors.

Gifts have the curious properties that (a) they tend to be something you would not buy for yourself (because you are giving it to someone else) and (b) they tend to be something the recipient would not buy (you should not give someone something they already have). So gift-giving tradition cause new sorts of products to exist. If you have been to a gift store, you have noticed that gifts differ considerably from ordinary goods. The Rotary Nutcracker illustrates some general truths about gifts. They usually have four properties:

1. *Useful*. They are special versions of ordinary things, such as clothes or food. Few gifts are completely useless. The Rotary Nutcracker was a nutcracker.

2. *Useless*. To something useful is added something useless, such as a gift wrapping, a fancy box, or an expensive card. In Japan, gifts may be wrapped in elaborately-decorated pieces of cloth called *fukusa*. The addition makes the item a better gift, but not more functional. The package of the Rotary Nutcracker did not say it was a better way to crack nuts. It was just a new way. Novelty for the sake of novelty is useless.

3. *New*. A gift should not duplicate what the recipient already has. A gift of liquor, for example, should not be liquor they already have. Some duplication is inevitable. Recipients of the Rotary Nutcracker probably had a nutcracker, but the Rotary Nutcracker was a new kind of nutcracker.

4. *Well-made*. Gifts should be high quality and look nice. The Rotary Nutcracker looked futuristic.

Long ago, these restrictions promoted innovation. They had several effects. *They made it easier for the most skilled artisans to make a living*. Desire for gifts (suitable to give to others) created demand for certain goods. Only skilled artisans could satisfy that demand. To make a giftable nutcracker, you had to be able to make a nutcracker. Higher-quality things make better gifts. Suppose Weaver A makes high-quality baskets, Weaver B low-quality baskets. B's baskets take less time to make and therefore cost less. In the ordinary market, perhaps B's baskets are more desirable than A's. In the gift market, A's baskets will be more desirable. *They pushed those artisans to innovate*. Novelty helped. Sales of the Rotary Nutcracker as a gift will presumably decline year by year as it becomes less new. *They lowered the bar for successful innovation*. Before gift-giving traditions, a new nutcracker, to be successful (to continue to be made, year after year), had to work better than existing nutcrackers. That was hard. Look at the nutcracker in your kitchen. Imagine trying to improve it. To benefit from the gift market, however, you didn't need to invent something that *worked* better than usual, you only needed to invent something that *looked* better. That was easier, but still required new knowledge. The Rotary Nutcracker did not work better than ordinary nutcrackers, but it looked pleasantly different.

Economists have not yet noticed that gifts promote (or at least promoted) innovation, but they have noticed that gifts differ from other goods. Waldfogel (1993) measured what he called the *deadweight loss* of gifts, meaning the difference between what the giver paid and what the recipient would have paid. It was about one-third of the price. If you paid $60 for a gift, the recipient would have paid $40. Calling this difference a loss fails to make clear that it was a subsidy to the maker of the gift -- especially to those responsible for details that made it more of a gift, such as makers of wrapping paper.

A recent example of the promotion of innovation by gifts is the introduction of chocolate into China (Allen, 2009). In the 1980s, the Chinese consumer market opened up to non-Chinese companies, including chocolate manufacturers. At the time, chocolate was rare in China. Large chocolate manufacturers, such as Hersheys and Cadbury's, hoped to sell plenty of chocolate there. The first company to succeed, however, was Ferraro, a smaller company, which managed to sell large amounts of Ferraro Rocher, a spherical hazelnut chocolate wrapped in foil. The large companies had far greater resources, but a small company was the first to succeed. The successful product differed in one big way from what the big companies were trying to sell: It made an excellent gift. It looked nice. It was new. Whether the recipient liked chocolate didn't matter much. It sold well only before gift-giving holidays. The big companies, trying to enter the ordinary (non-gift) market, had to make chocolate that tasted good, because the buyer would eat it herself. That was hard, it turned out. If China resembles America, the potential gift market for chocolate in China is much smaller than the potential ordinary market. But it was easier to enter.

Ceremonies and Festivals

Ceremonies include weddings, funerals, tea ceremonies, graduation ceremonies, coronations, ground-breaking ceremonies, coming-of-age ceremonies (e.g., Bar Mitzvahs), and many others. Festivals include Christmas, Thanksgiving, Easter, the Mehregan Festival (Iranian), the Ghost Festival (Chinese), the Lantern Festival (Chinese), spring festivals, and so on. *Wikipedia* lists 38 harvest festivals ("List of harvest festivals", 2011).

Like gift-giving traditions, ceremonies and festivals create demand for special products, which are usually fancy versions of ordinary products. Weddings need wedding invitations (fancy printing), a wedding ring, and a wedding dress. *Brides* magazine is thick with ads for wedding products. Most ceremonies I attend, such as graduations, require dress clothes. The Japanese tea ceremony requires a long list of tools called *dogu*, including decorations, tea-making tools, tea-serving tools, meal items, waiting-room items, and preparation-room items. "A wide range of *dogu* is necessary for even the most basic tea ceremony" ("Chanoyu: Japanese macha tea ceremony", 2011). Coronations require regalia. Funerals require caskets or coffins. Burial customs often require special versions of ordinary goods.

Festivals also create demand for special products, which may not be sold at other times of year. Christmas creates demand for Christmas tree ornaments, Christmas cards (fancy printing), Christmas lights, and the elements of nativity scenes. Halloween creates demand for costumes, Valentine's Day for chocolates, Valentine's Day and Mother's Day for flowers. Japanese New Year is celebrated with special postcards (similar to Christmas cards) and special foods. The Fourth of July and Spring Festival (in China) are celebrated with fireworks. Many festivals, such as Christmas, are associated with gift-giving. In China, Mid-Autumn Festival is celebrated with moon cakes.

Ceremonies and festivals create demand for gift-like objects. They are useful well-made everyday objects (e.g., clothes) with useless additions. For example, moon cakes are food (useful) with decoration (useless). (Fireworks, which have no everyday function, are an exception. Whether typical Mother's Day flowers have useless additions is debatable.) There is one difference from gifts: lack of novelty. The objects required by various ceremonies and festivals remain the same over the years. Maybe this was inevitable: A ritual by its nature remains the same. Inevitable or not, demand for ceremonial and festival products helped provide those who made them, the most skilled artisans, a predictable income. This made their profession more attractive. Skilled artisans were more likely to innovate than other people.

Collectors and Connoisseurs

Collectors and connoisseurs pay more for well-made things than other people and buy things that others wouldn't. By doing so, they help skilled artisans make a living.

By *collectors* I mean people who collect many versions of an everyday object. A friend of mine has a collection of several hundred pennants. Someone else I know collects Star War toys. Robert Gottlieb, a New York editor, collects plastic handbags from the 1950s (Gottlieb, 1988). Joe Gorleski, a woodworker in Bel Air, Maryland, has a collection of 2,000 erasers (Wilson, 2001). The Australian television show *Collectors*, which began in 2005, covers one collection per episode ("*Collectors* (TV series)", 2011). One recent collection was "40 amateur clockwork movie cameras made in the 1940s and 50s" ("Movie cameras", 2011). Another was a collection of Barsony Black Lady lamps, a kind of ceramic lamp ("Barsony lamps", 2011).

Most collections involve objects at least slightly intricate, such as plastic handbags. The difference between items (e.g., between purses) is usually decorative, and decoration is usually intricate. The intricacy makes them more difficult to make. Collectors encourage the creation of variants, a kind of experimentation. They make experimentation more profitable.

By *connoisseur* I mean "one who enjoys with discrimination and appreciation of subtleties <a connoisseur of fine wines>", as one dictionary puts it. In addition to wine connoisseurs, there are connoisseurs of tea, cheese, beer, coffee, chocolate, cigars, Scotch, and other consumables. Collectors are a type of connoisseur. Sometimes *collector* and *connoisseur* refer to the same people. An old magazine called *The Connoisseur* had the subtitle *an illustrated magazine for collectors* and said it "will include in its scope anything that any reasonable person collects, not only furniture, porcelain, pottery, prints, books, manuscripts, fiddles and old silver, but also coins, medals, autographs, posters and stamps" ("*The Connoisseur*", 2011).

Connoisseurs appreciate small differences -- differences that appear small to non-connoisseurs. They express their appreciation by paying unusually high prices for the very best wines, teas, or whatever it is they appreciate. By doing so, they push the most skilled artisans to become even better and they help them make a living. As I've said, the most skilled artisans are more likely to innovate than everyone else.

Decoration, Art and Fashion

We decorate the surfaces of ordinary objects (e.g., furniture, clothes, tableware, towels) and create special objects whose only function is decoration (e.g., jewelry, lanterns, posters). Decoration that is especially elaborate, original, or expensive may be called art (painting or sculpture).

We enjoy decoration and art. A decorated room is more pleasant than a plain one. We enjoy them, I propose, because this increased material science research. Because we enjoy them, we pay for them. Decoration and art require control of materials. Paying more for a decorated cup than a plain cup encouraged research into control of materials and supported those who knew how to control materials. The connection between art and new uses of materials is clear in many wide-ranging art shows. The 2008 Whitney Biennial at the Whitney Museum of American Art provided many examples of common materials used new ways, which is what Stone-Age material science research must have been. The common materials used in unusual ways included bird excrement, automotive paint, styrofoam, CDs, drywall, and rebar. A 2011 group show called "Unpainted Paintings" consisted of 37 paintings made without paint. Instead, they were made with "rubber, garbage, beads, buttons and burlap, stainless steel, even urine" and chocolate, gold leaf, and Kool-Aid powder (Saltz, 2011).

Fashion refers to changing preferences in decoration and art. Many things, including craftsmanship, texture, and color, make the clothes at a fashion show attractive but also important is novelty. New is more attractive than old. To make fashionable things you have to be a very good craftsman, but you also have to innovate. Fashion evolved, I propose, because it pushed artisans to innovate. An innovation in decoration (e.g., a new color), reflecting a new way to control materials, would fetch a high price at first. As the novelty wore off, the price it could fetch went down. Without fashion, decorators and artists would do the same thing over and over. Improvement with practice would make repetition much easier than innovation.

Many important technologies began with decoration. Cyril Smith, an historian of metallurgy, made this point:

> Practical metallurgy is seen to have begun with the making of necklace beads and ornaments in hammered native copper long before "useful" knives and weapons were made. The improvement of metals by alloying and heat treatment and most methods of shaping them started in jewelry and sculpture. Casting in complicated molds began in making statuettes. Welding was first used to join parts of bronze sculpture together . . . Ceramics began with the fire-hardening of fertility figurines molded of clay; glass came from attempts to prettily glaze beads of quartz and steatite. Most minerals and many organic and inorganic compounds were discovered for use as pigments . . . . Enjoyment of color has inspired the development of many alloys -- for example the famous Mycenean inlaid dagger in the National Museum in Athens, and the exquisite colored metal inlay of Japanese sword furniture. . . . The desire for pigments, dyes, and cosmetics inspired much mineralogical and botanical exploration. [Smith, 1977, p. 146]

Smith (2003) provides more examples. Desire for decoration pushed technology forward as recently as the 1800s, when William Perkin, a British chemist, accidentally created the first synthetic dye. Before this, dyes came from plants. The discovery led to the first chemical factories. Building on Perkin's discovery, other synthetic dyes were developed and made in large amounts.

Desire for decoration increased innovation because it was easier to make something look better than work better. It is easier to decorate a cup than make it work noticeably better. Yet, as Smith says, attempts to make decoration led to accumulated knowledge that led to useful new products -- such as sharper swords and chemical factories.

The power of decoration and art to create technological innovation lies in their value-versus-knowledge function, shown in the right panel of Figure 2. Unlike the value-versus-knowledge function for a tool (left panel of Figure 1), the decoration-art function rises steadily over a wide range of knowledge. With just a little knowledge, you can make something a little attractive. Yet even with great knowledge, there is room for improvement. Nowadays we have great control of materials. Most of the objects in my apartment work fine; it isn't obvious how to improve how well they work. Yet all of them could be more beautiful. The shape of the value-versus-knowledge function for decoration encourages learning otherwise "useless" knowledge because no matter where you are on the function, the more you know the more valuable the things you can make. The slope (derivative) of the value-versus-knowledge function shows payoff for innovation, which you can think of as the pressure to innovate. A tool generates pressure to innovate only over a narrow range of knowledge. The desire for decoration and art generates pressure to innovate over a very wide range.

That enjoyment of decoration encouraged technological development explains why decorative preferences are so diverse, summed up in *there's no accounting for taste* and *chacun à son gout*. Everyone has shopped for clothes or furniture and found that most of what's for sale, at any price, is unattractive. Yet someone buys it. Humans are more diverse in decorative preferences than would be expected based on other measures of human diversity, these experiences suggest.

Dutton (2009) argued that art evolved because art-making signaled fitness to potential mates. The better an artist you are, the more intelligent, wise, dextrous, and so on you are likely to be. This has three problems: 1. It doesn't explain fashion (shifting preferences). Fashion obviously encourages innovation. 2. It doesn't fit into a broader story that explains other uniquely-human traits, as Reichenbach's Principle requires. 3. It doesn't explain what Smith found: that decoration supported innovation. Dutton's main evidence for his idea is that successful artists are attractive to the opposite sex. This observation has an alternative explanation: The attractiveness of artists could have evolved to make being an artist (who innovate more than other people) more attractive, thereby increasing the frequency of art-making genes.

General Discussion

The general picture of human evolution implied by these ideas is of a Race to Riches. Something happened (discovery of seafood?) that made possible a long string of valuable discoveries, one after another. After the triggering event, a great mass of people (genetic variants) started to "look" for ways to exploit the triggering event. The first such discovery was specialized foraging; perhaps that race was "won" by early humans with a gene that now causes procrastination. Early humans with that gene survived; all other early-human lineages died out. Among the survivors, there was again a genetic fanning out, "looking" for another useful discovery. Again, the winners, with the advantage provided by that discovery, pushed everyone else to extinction. And so on.

In the middle of this competition, which probably lasted millions of years, some early-humans dispersed. Discoveries already made helped them live far away. Far away, the local wildlife hadn't been overhunted. Some of them reached Europe. Life was easier in Europe -- less competition and therefore less selective pressure. In Europe, for example, perhaps the gene for connoisseurship barely improved chance of survival and failed to spread. Innovation slowed down or stopped. In Africa, however, intense competition continued. When, much later, a second group of early humans migrated out of Africa, descendants of the first migration were no match for them. This is why the presence of Neanderthals (driven extinct by a later migration out of Africa) in Europe makes sense.

In the final sections I discuss how these ideas can be tested, how they can be used, and how they relate to other work on human evolution.

Tests

How can this theory be tested? Its simplest prediction is that the features of human behavior I have used as evidence (hobbies, etc.) will be found in most cultures. Like all complex behavior, they require a certain context, but the necessary context should be common. A second sort of prediction is hedonic. The human behavior I've used as evidence presumably occurs because of what we find pleasant and unpleasant. For example, something about hobbies is pleasant. These hedonic effects should be universal.

Other uniquely-human traits should be explicable the same way -- as part of the evolution of specialization.

The theory would become less plausible if a better explanation of the same facts comes along. It would become more plausible if it turned out to be useful. In the next section I describe two applications.

Applications

One reason I believe this theory is that it explains why classroom teaching is so hard. Children learn all the time – yet teaching is hard. Inside of us, says the theory, is something that pushes the twenty children in one classroom toward twenty different jobs. If the twenty students in your class want to learn twenty different jobs, it will be nearly impossible to teach all of them any one thing simply because many of them won't want to learn it, no matter what it is. An educational system that accepts this diversity and takes advantage of it should do much better than the current system, which struggles against it. Gatto (2003) contrasted the calm of libraries (where everyone reads different books) with the chaos of classrooms (where everyone must read the same book).

Another application is to understanding economic development, especially innovation. Over the last several thousand years, workers have become far more productive. To buy a candle in the 1800s cost 6 hours work; to buy the same amount of light today costs 1 second of work (Ridley, 2010). Unmentioned in these comparisons is that the tools, knowledge, and networks that made work more productive also made free time more productive – and free time is an especially fertile source of innovation. I have never come across an economist who considered free time productive. But this theory says that hobbies -- and the innovations they produced – were in a sense the beginning of where we are now. In the beginning, all innovations came from free time. It is entirely possible that people are more innovative during their free time than during their job. People have more freedom during their free time. They are under less pressure to produce fast results. They are under less pressure to please others. It is entirely possible that the most important innovations in the next fifty years will come from what people do in their free time.

A look at history suggests that what people do in their free time is a far more important source of innovation than economists have realized. The most obvious manifestation of the innovative power of free time is books. Few people write books to make a living or even to make money. Textbooks, for example, are usually written by people who make a living teaching. Only genre books, such as romance, horror and science fiction, employ a significant number of people, and they are formulaic. Textbooks are kind of free education; so are other non-fiction books. A better-educated person is in a better position to innovate. Not only do books raise general understanding, they can take risks that newspapers and magazines (whose owners want to protect their investments) do not. *Uncle Tom's Cabin* was written by a schoolteacher. *The Origin of the Species* was written by an invalid.

The innovative power of free time has also been apparent in science (Roberts, 2010). Charles Darwin, as I said, created his theory of evolution in his free time. Gregor Mendel made his discoveries during his free time. Unlike professors of biology, who might lose their jobs if they offended or failed to publish often enough, Darwin and Mendel could take as long as they wanted to write whatever they wanted. The theory of continental drift was created during free time. Its main proponent, Alfred Wegener, made a living as a meteorologist.

Nowadays blogs show the innovative power of free time. There are millions of bloggers; almost none make a significant amount of money. This leaves them free to say whatever they want. In Italy, the blogger Beppe Grillo has exerted substantial anti-corruption pressure on the government (Mueller, 2008). The Canadian blogger Steve McIntyre has had an enormous effect on the global debate about climate change. His requests for archived data led to Climategate. His examination of the famous hockey-stick graph led to its dismissal (Montford, 2010). He did this work during his free time.

Relation to Other Work

The theory proposed here does not explain the visible differences between humans and chimps. Unlike chimps, humans walk upright, have little hair, and have subcutaneous fat. That these were caused by occupational specialization makes no sense. What is plausible are the two other possibilities: (a) something caused bipedalism, etc. *and* specialization and (b) bipedalism, etc., caused specialization. How do the ideas of this chapter fit with earlier theories of human evolution that have tried to explain physical changes?

The only coherent explanation of bipedalism, hair loss, and subcutaneous fat I've come across is the aquatic-ape theory of Hardy (1960) and Morgan (1990, 1997). It says that for a long time our ancestors lived near water and ate mainly food from the water, such as shellfish and fish. Bipedalism makes it easier to wade in water. Hair loss makes swimming more efficient. Subcutaneous fat reduces heat loss during swimming. Hardy was a marine biologist; the subcutaneous fat of humans reminded him of the subcutaneous fat of mammals that spend most of their time in the water, such as seals and whales.

Whatever the explanation of bipedalism, hair loss, and subcutaneous fat turns out to be, the explanation I've proposed implies that our ancestors found a new food source so accessible and abundant that it provided plenty of free time. This is consistent with gathering seafood. Evolution is often described as an arms race, with predator and prey evolving back and forth (Vermeij, 1987). The picture of human evolution I paint here is closer to a surprise attack, from which the prey never recovered. Hands evolved to swing through trees. This was so different from their later predatory use (e.g., gather and open shellfish) that when hands began to be used that way the advantage they conferred was so large and sudden that the prey were unable to evolve fast enough to restore balance.

The light shown by current human behavior on what happened six million years ago is very dim, but to the extent it suggests anything, it suggests there was an "abundance event" -- something happened to make food far more abundant than usual for a long time. The abundance encouraged specialization in foraging, which led to specialization in use of free time, and so on. One possibility is that our ancestors discovered they could gather and eat seafood. Fish and shellfish could not evolve fast enough to escape overwhelming predation. I cannot think of another plausible possibility. With the flexibility provided by hands, the free time provided by abundance, and the division of trial and error provided by specialized use of free time, our ancestors were able to innovate fast enough to maintain an overwhelming advantage. Armed with this advantage, they killed too many of their prey. In search of places not yet overhunted, they spread all over the globe.

A common view of human evolution is that humans became smarter than other animals. Humans developed big brains that could solve complex problems, reason symbolically, and so on. That isn't what I propose. My proposal is that humans became *collectively* -- not individually -- smarter than the competition. They *divided* knowledge acquisition and use. They triumphed over competitors for the same reason we have a world of personal computers rather than a world of mainframes. Given this view, it is no surprise that Neanderthals, who went extinct, had larger brains than modern humans (Ponce de Leon et al., 2008).

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Figure Captions

Figure 1. Barriers to innovation. Left panel: The value-versus-knowledge function for one tool. Only between X and Y does more knowledge pay off. It isn't clear how to get to X nor how to get past Y. Right panel: The gaps between tools. Learning how to make an excellent gun won't teach you enough to make even the most primitive computer. It isn't clear how to cross the gaps between tools.

Figure 2. Changes that increased innovation. Left panel: The effect of gift-giving. Making something nice enough to give as a gift increases its value. The increase in value provided new motivation for innovation. Right panel: The value-versus-knowledge function of decoration and art. Even with a only little knowledge, an artist can produce valuable decoration or art and has incentive to learn more. No matter how much is learned, there is always incentive to learn more.

Figure 1

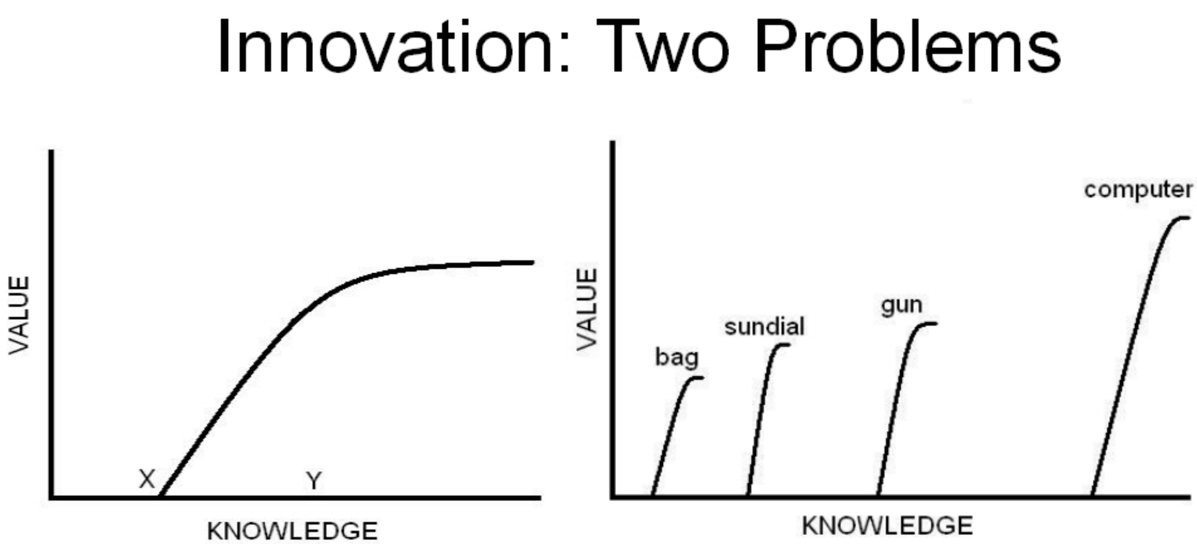
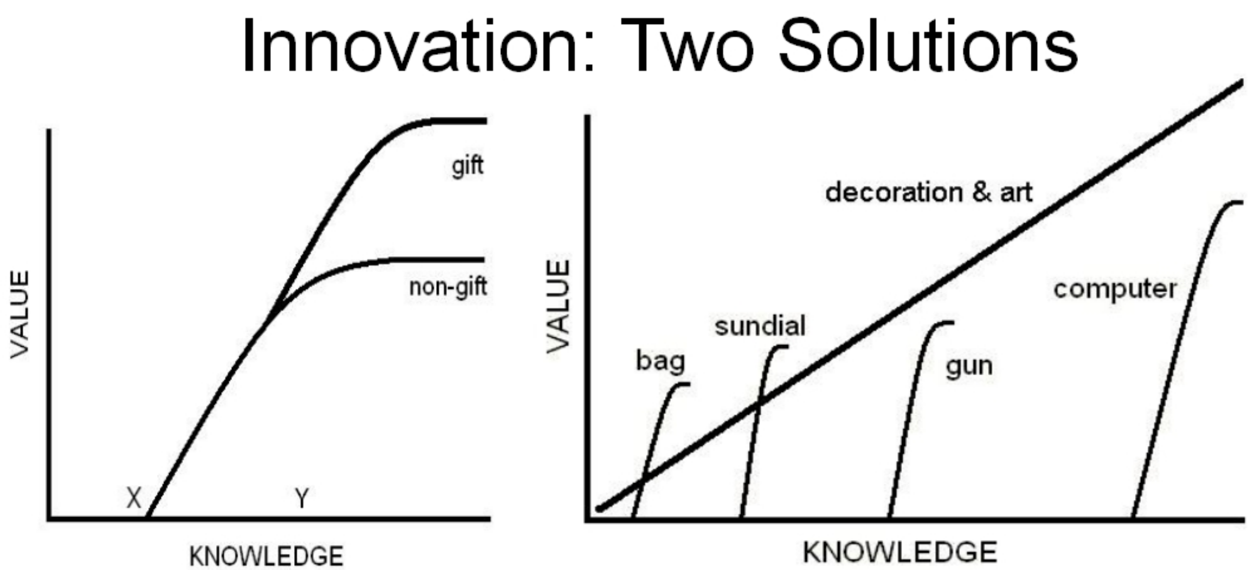

Innovation: Two Problems
VALUE
X
Y
KNOWLEDGE
VALUE
bag
sundial
gun
computer
KNOWLEDGE

Figure 2


Innovation: Two Solutions
VALUE
gift
non-gift
X
Y
KNOWLEDGE
VALUE
decoration & art
computer
sundial
bag
gun
KNOWLEDGE