

ALTRUISTIC ECONOMICS AND CONSUMER COOPERATIVES
IN THE
DNA MARKETSPACE

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ABSTRACT

Collective consumer action, especially in online communities, has been of interest to marketing theorists since the late 1990s. Usually these communities are studied in terms of their creative contributions to industry; however, increased attention is turning to consumer production of valuable resources for direct consumption by other consumers. Because such production-consumption activities may occur outside the range of commercial economic exchange, we propose that a novel form of economic theory – altruistic economics – be utilized to comprehend the phenomenon. Through by-passing the traditional marketing system, such cooperative consumer endeavors may act as sources of empowerment to consumers, and therefore have relevance for public policy and consumer welfare.

We apply this novel theoretical perspective to the service category of direct-to-consumer DNA testing products, examining the longitudinal development of both commercial and altruistic economic networks among companies and consumers. Using embedded case analysis, we show that this marketplace is characterized by several innovative forms of collective co-production, varied commercial and altruistic economic motives on the part of both consumers and companies, and multiplicatively networked “intellectual factories” capable of producing new knowledge.

Keywords: Altruism, altruistic economics, consumer co-production, consumer cooperatives

INTRODUCTION

As several marketing theorists have noted (Etgar 2007; Firat and Venkatesh 1995; Ostrom 1996; Prahalad and Ramaswamy 2004; Wind and Rangaswamy 2001), consumers have become resource *co-producers* within both commercial and altruistic economic systems (Vargo and Lusch 2004). We report the results of a longitudinal study of an innovative service industry – commercial DNA testing – that has spawned a network of co-productive economic activities. Within this network of co-productive sites, the roles of producer and consumer are found to overlap and blend in novel ways. We document the longitudinal development of multiple forms of consumer-originated production processes and the establishment of an ongoing system of altruistic economic exchange. Such networks are found to increase consumer empowerment and the more rapid spread of useful knowledge through affected consumer communities.

Early Economic Theorization on Co-production Networks

Often overlooked in the economics literature is early work which examined co-production networks in a public service or public welfare context. For example, Brudney and England (1983) defined the phenomenon as follows, “Co-production... envisions direct citizen involvement in the design and delivery of services with professional service agents” (p. 59). They present a three-category typology of consumer co-production. The first category includes *individual* co-production activities, in which the service provider (e.g., an elementary school teacher) interacts with a recipient (student) in the co-creation of education. This type of co-production closely adheres to the marketer-consumer model most often studied within the field

of marketing (viz., Etgar 2007; Prahalad and Ramaswamy 2000). For example, Bendapudi and Leone (2003) describe examples of consumer co-production of services that are primarily *individualistic*, such as checking out of hotels, scanning items, and bagging groceries. They depict co-production largely as an opportunity for consumers to create a “customized consumption experience for themselves” (p. 15).

Brudney and England also identify *group co-production* which “involves voluntary, active participation by a number of citizens and may require formal coordination between service agents and citizen groups.” They give as an example a neighborhood association where “individuals join together in an effort to improve the quantity and/or quality of [municipal] services consumed” (1983, p.63). They note that such group co-production efforts serve to aggregate consumer demands and pool consumer resources (e.g., political contacts, expertise) in ways which may be more effective than individualistic actions (and see Dalli and Corciolani 2008).

Third, Brudney and England describe *collective co-production programs* in which “co-productive activities result in *collective goods* whose benefits may be enjoyed by the entire community.” For example, volunteers may construct or repair playground equipment for a local park, take turns cleaning up litter on neighborhood streets, or plant flower bulbs along roadsides. They observe, “Regardless of which citizens participate in the service delivery process, the benefits accrue to the city population as a collectivity” (1983, p. 64). These collective co-production programs may have their ideological origins in the utopian communities of the 1600s – 1800s in North America (see Kanter 1972) and more recently in the hippie movement of the 1960s – 1970s (see Kanter 1972). Common to all of these settings is the coalescence of voluntary efforts by multiple persons to gain self-sufficiency in some significant area of life, e.g., spirituality, intellectual stimulation, economic welfare.

Consumer Co-Production Communities

The primary enabler of consumer co-production activities independent of marketers has been the Internet (see for example, Muniz and Schau 2005; Geisler 2006; von Hippel 2005). Pellegrini (2007, p. 2) states,

While the internet has always been a place of social interaction, the increasing spread of internet connections and improvements in... web applications have lowered the participatory barriers for... virtual communities. The tremendous success of Wikipedia ... and the increasing popularity of blogging as a low cost personalized editorial activity has drawn attention to how user generated content (UGC) is affecting and altering orthodox business models...UGC is embedded within an economic architecture... based on the principles of bottom up networks, self-service, openness, self-regulation and decentralization.

We next discuss a novel economic perspective for theorizing about such communitarian production activities – altruistic economics. We propose that they are an important form of consumer empowerment and contribute to consumer welfare.

Public Goods and Altruistic Economics

Cooperative communities make it possible for consumers to bypass the commercial economic sector and produce desired services *for and among themselves* (see e.g., Von Hippel 2005). Such consumer-produced services fall into the category of *non-commercial public goods*

(Samuelson 1954). Public goods are an economic anomaly in that their consumption by one person – or group of people – does not preclude their consumption by another person or group.

For example, publicly accessible databases and user commentary, such as those in on-line consumer DNA communities, are public goods. Persons who have purchased personal DNA tests from marketers may choose to *share* their results on web-based DNA community boards or personal websites; they may *donate* their results to national and international data bases for the use of others around the globe. They may even *conduct original analyses* on publicly-available data bases and post the results of their findings on publicly accessible sites..

Such consumer co-production activities often constitute *collective goods*: that is, public goods that could be delivered as private (i.e., for-profit) goods, but instead are provided free of charge within the producing community, itself, or to the public at large (see also Geisler 2006; Kollock 1999; Muniz and Schau 2005; O’Mahoney 2003; von Hippel 2005). The production of public and collective goods demonstrates the vulnerability of traditional commercial markets in which microeconomic gain seeking is effectively constrained by consumer-to-consumer production and collective sharing; profit-making companies may be effectively disintermediated in such circumstances (see Dalli and Corciolani 2008). Sometimes termed a Coasian economic solution, consumer production communities represent a mechanism whereby the potential beneficiaries of a public good engage in collective production, using their combined skills and competencies to produce desired services (Coase 1937, 1960).

Further, if the community chooses to make its collectively-produced services available to all persons, regardless of their participation in the production of those services, the community negates the so-called *free-rider* problem of classical economics (Samuelson 1954). That is, the community does not concern itself with attempting to extract resources or revenue from non-contributors, but rather makes a public gift of its productions. Analogously, *altruistic economics* (Upton 2005) proposes that, contrary to neoclassical economic theory, persons do not always seek to extract value from others in exchange transactions. For example, information, assistance, ideas, and advice may be given away to others without the expectation of receiving any resource in return (see Hardy-Vallee 2007). Internet sites that are open to the public are considered examples of altruistic economics (see e.g., Benkler 2006; Jenkins 2006; Tapscott and Williams 2007).

DNA CONSUMER COMMUNITIES

DNA ancestry tests are a byproduct of the Human Genome Project which identified genetic markers unique to specific human lineages (Sykes 2001). Approximately 460,000 people had taken these tests by 2006 (Bolnick et al. 2007). That number probably exceeds 1.5 million in 2011. Annual sales for all DNA testing companies, including the laboratories that support them, but excluding paternity testing, were estimated to be approximately \$60 million in 2006 (personal communication, Terrence Carmichael, founder of GeneTree, 6 June 2006). At a growth rate of 20 percent per annum, the market will be worth nearly \$150 million in 2011. The industry came into being in 2001, when Brian Sykes, an Oxford University geneticist, published *The Seven Daughters of Eve*, popularizing the notion of tracing one’s ancestral origins through DNA. The number of firms offering tests and the number of consumers ordering them rose rapidly during the 2000-2009 time period. The number of firms has reached the fairly stable level of about 35 (ISOGG figures, 2011). The industry has completed the introduction, early growth stages and consolidation phase of its life cycle. It is a mature field facing few new technology thresholds, and it is still very much confined to the United States, Canada and England.

DNA Test Users and Consumers

DNA testing consumers have established a variety of production communities by creating blogs, surname projects, listservs and other on-line sites. Perhaps the primary consumer collective action DNA site, however, is the Rootsweb Genealogy web-board. Since its inception in October 2000, the website has gained a membership of 800+ subscribers, making it the largest public electronic forum for discussing DNA in the world. Subscribers are drawn from Europe, Central Asia, India, Scandinavia, Russia, Central and South America, the Caribbean, South Africa, New Zealand, Australia, and Canada, as well as the United States. Managers of the major commercial testing companies regularly monitor the site, as well as contribute postings. Most subscribers have had various DNA tests performed, and many are seeking advice and guidance in interpreting their results. Some are the administrators of large-scale ($n = 100+$) surname DNA studies or geographic DNA studies (e.g., the Shetland Islands, Puerto Rico, Mexico, Cuba, Ireland, Scotland, the Bahamas, etc.). We traced the development in intellectual expertise from October 2000 to September 2009 on this site and mapped its members' involvement in a network of related co-production activities, most of which were grounded in the proposed altruistic economic framework.

Data Sources

We used multiple data sources, including corporate and consumer communications, consumer-authored research reports, online DNA discussion boards, business press reports, corporate website presentations, and consumer-academic collaborative projects to investigate the multiple types of commercial and altruistic economic exchange occurring in this marketplace. Both researchers are themselves directly involved in the DNA marketplace. For the past ten years, we have served as group administrators for multiple large-scale population genetics projects. One researcher additionally is the founder of a DNA consulting firm which offers testing and assists consumers in interpreting their testing results.

IDENTIFYING TRADITIONAL ECONOMIC EXCHANGES

Most current marketing research is conducted on traditional economic exchanges, and even the majority of studies conducted on consumer cooperatives adopt a commercial theoretical perspective (see e.g., Pitt et al 2006). These forms of exchange are well represented in the DNA marketplace, first, through the purchasing of scientific/intellectual capital by commercial DNA companies, for example, by hiring biogenetic scientists to process and categorize human DNA samples; and then selling this expertise in the form of personal DNA tests to consumers. For example, the front web-page of the industry's dominant company, Family Tree DNA, (FTDNA), emphasizes both the company's scientific credentials and consumer popularity. At present, FTDNA has over 250,000 DNA records on file.

Most of the scientists affiliated with FTDNA are concurrently employed at university research centers. This coupling of Big Science and Big Business is under-investigated in the marketing literature and brings to the fore issues about the commercial underpinnings of scientific inquiry in academic settings. Certainly to consumers, the presentation of highly credentialed scientists as corporate advisors is likely to enhance the perceived validity of DNA testing conducted by a company.

There are also altruistic and mixed economic exchanges available on this commercial website. For example, FTDNA has made the haplotype profile of the thirteenth-century Asian conqueror Genghis Khan publicly available so that persons having Y-chromosome DNA testing

can compare their results to it. This exemplifies what Pellegrini (2007) would term *business altruistic synergy* – the giving away of information valued by consumers, but having little or no cost to the corporate donor. Typically these public ‘donations’ are used to generate goodwill in the marketplace and stimulate future sales. An economically mixed offering by FTDNA is its collaboration with the National Geographic Genographic Project, a seven-year effort to collect a worldwide DNA database of indigenous populations. The company benefits commercially from this collaboration since its lab processes the tests, and gains international visibility from the publicity surrounding the Genographic Project; yet it stores and makes available the results of the tests without charge.

Altruistic, Mutually Synergistic Exchanges

As early as 2000, consumers of DNA testing services had begun forming electronic communities for sharing information about their test results. As noted earlier, one of the first online forums, and currently the largest, is the Rootsweb Genealogy-DNA web-board.. This web-board now has over 800 subscribers and has accumulated 200,000 messages over its 10 year history. The first poster, Ann Turner, became the site manager. Her initial post, Saturday, October 21, 2000, contains several of the elements that came to characterize this online community: enthusiasm, information sharing, and scientific competence:

I submitted DNA samples for myself and my cousin... to Oxford Ancestors for analysis and the results came back with a perfect match! We both go back in a straight line of females to our most recent common ancestor Pamela Nims, born in 1794 in Shelburne, MA.... I was so excited about the results... that I decided to start an e-mailing list...DNA is a long molecule composed of 16,569 smaller units (bases) abbreviated ATCG. A sequence is reported as a string of letters, ATTAGCTCA.... I’ve uploaded a scanned copy of my report in PDF format.

Others soon responded with commentary and their own results. By October 30, 2000 a testing company executive, Bennett Greenspan of FTDNA (itself started up only a few months earlier), posted this message:

My name is Bennett Greenspan, and I am one of the founders of FamilyTreeDNA.com. FTDNA looks forward to the opportunity to answer questions related to DNA testing in general and as it relates to genealogy in particular. Our company offers...DNA testing, databasing of the results, a matching service for people who share the same haplotype, and a host of other services to be rolled out in 2001.... If I can answer any questions, please do not hesitate to contact me.

By October 2003, the list had grown markedly, not only in numbers of active subscribers and messages posted, but also in genetics expertise and population history sophistication. Several members established their own websites, complete with analyses of specific populations. Using software technology identical to that utilized in academic DNA research, they constructed population analyses that rivaled – or even surpassed – those in the scholarly literature, sometimes coming to different conclusions from professional biogeneticists and engaging in detailed critiques of published studies. For example, one subscriber posted the following sophisticated queries and received equally competent responses from moderator Ann Turner.

- 1) What is... Haplogroup P* (xR1a*, and R1a1)?

*The * is like a wild card (everything and the x means “eXcept”, so P* (xR1a) would be everything under P except for R1a (that is, it would include Q, R2, and all other R1s).*

- 2) I cannot find haplogroups Y* (xBR,A3b2) and BR* (xDE,JR) on Family Tree DNA's Y Haplogroup Phylogenetic Tree; what haplogroups are these?
Y is the top level – all males. Y (xBR, A3b2) is all Y, except for groups B through R and A3b2. So that wouldn't leave much: just A1, A2, and A3b1.*

In the excerpts given above, Turner advises a list member about a recently published academic study on Ashkenazi Jewish Levites who possess the R1a haplotype. She explains the various sub-haplotypes falling into this group. Later on-line discussion of this same study focused on shortcomings in the data analysis and the authors' interpretation of the data – indicating a level of competence at least equivalent to that of the journal's editor and reviewers, who had not caught the errors. Consistent with von Hippel's thesis (2005), this altruistic consumer-to-consumer knowledge diffusion greatly democratizes the flow of scientific information, permitting consumers to exercise individual and group-level judgment in assessing the validity and utility of findings produced by the academic community. Community critiques are also directed toward the commercial companies conducting the actual DNA testing. Consider the posting below:

One of my major complaints with OA [Oxford Ancestors Company] is that... they mailed me my results and only included a very small information packet. [And] I still haven't gotten access to their database after a month of waiting ... It would have been much better for OA to have provided me and their other clients a lot more information than they did.

This consumer's testimony illustrates well the rising expectations directed toward commercial vendors and the competitive advantage afforded by providing high quality, accessible information as an auxiliary to the basic service offering.

Rootsweb Activity

Over the next four years, remarkable progress was made within the consumer community in mapping human migrations, all of which was produced on an altruistic (non-monetary, volunteer) economic platform. The posts below document how two community members of Spanish descent succeeded in mapping a rare haplotype, which first occurred in the Mexico DNA Project. They engage in a nuanced discussion on the various ethnic populations possibly responsible for introducing the original haplotype to Iberia. Their findings surpassed the state of knowledge then extant in concurrent academic DNA research.

One of our Mexico DNA Project members has just been notified that he is S28 positive. He appears to be 27 steps away from the S28 modal [haplotype score] listed on Y-Search [a male genetics database].

To which a Spanish list member responds:

This can be an interesting breakthrough, even a major breakthrough. Could this [rare haplotype] be related to old groups like the Vettones, as Dale Bricke [another community member] wrote? In terms of a possible *longue duree*, we could think of S28+ [being] related to the Visigoths and J1b-M365 to the Alans. By 500CE, the Visigothic Kingdom... controlled Aquitania and Gallia Narbonensis and most of Hispania.... The Visigoths became the dominant power in the Iberian Peninsula, crushing the Alans and forcing the Vandals into North Africa, wikipedia.org/wiki/Visigoths... We urgently need to test ... people from different Iberian regions to draw conclusions...

Consistent with the observations of von Hippel (2005), these consumer-producers are able to act in a cooperative, voluntary manner, melding together information obtained from a fellow

member, Dale Bricke, and incorporating a Wikipedia article on the Visigoths [also co-written by a community member] with testing results received from EthnoAncestry, a commercial DNA testing company founded by community members.

By late 2007, collective community expertise had increased to the point that members were posting female haplogroups for Native American women in as-yet-unpublished academic papers and spreading novel DNA findings within their online community *prior to* its formal presentation within the academic community. At this point, the Rootsweb DNA community was functioning as an autonomous, altruistically-grounded engine of research capable of moving faster and with greater efficiency than many academic or commercial DNA projects.

One primary reason for this, we propose, is that the community's creativity is less encumbered by the need to obtain bureaucratic clearances, the necessity of seeking external funding, or professional consideration of the 'publishability' of the findings in an academic journal. The consumer-producer community taking shape around DNA testing seems to represent a return to research practices common in the seventeenth and eighteenth centuries, when private projects were conducted by individuals or groups (e.g., Benjamin Franklin, the Royal Society, Rene Descartes) motivated to pursue personally interesting research questions outside of formal institutional structures. Echoing the title to Kozinets et al (2008) paper, "Collective Innovation in the Age of Networked Marketing," it is important to recognize that consumer production communities, *because* of their lack of formal structure, eliminate many of the obstacles to creativity inherent in formal knowledge production industries.

During this same week in late 2007, Charles Kerchner, an early community member, posted a news release from the fourth annual FTDNA Genealogical Genetics Conference. The special role of group administrators as 'privileged' consumers and conduits of commercial scientific information is apparent in this post, as well as the large emphasis placed by this testing firm on publicizing the scientific credentials of its advisers.

Family Tree DNA... is once again breaking new ground. At its 4th International Conference on Genetic Genealogy, Family Tree DNA announced the launch of the first comparative database for full mitochondrial sequences, [and] the world's first personalized interactive genetic mapping system... Among the speakers... were Dr. John M. Butler of the National Institute of Standards and Technology, Dr. Michael Hammer, Director of Genomic Analysis at the University of Arizona, Dr. Theodore G. Schurr, Assistant Professor of Anthropology at the University of Pennsylvania, [and] Dr. David Soria of National Geographic. Project Administrators... were given a first look at the database for full mitochondrial sequences...

The press release clearly assumes an advanced level of scientific knowledge within the audience and well illustrates the iterative ratcheting upward of sophistication on the part of both the commercial providers and the consumer community for DNA testing services.

Populist Science versus Professional Science

Perhaps one of the episodes demonstrating most clearly the empowerment of consumer communities in producing their own knowledge occurred with the Rootsweb DNA list response to a multi-authored article in the academic journal *Science*. The article in the October 19, 2007 issue, titled "The Science and Business of DNA Testing," and authored by fourteen academically-employed professors, sharply criticized commercial DNA testing companies. The authors were concerned about consumers having personal access to DNA test results because "(1) the tests can have a profound result on individuals and communities, (2) the assumptions

and limitations of these tests make them less informative than many [consumers] realize, and (3) commercialization has led to misleading practices that reinforce misconceptions” (Bolnick et al. 2007, p. 399). The academicians also expressed skepticism about the motives of the scientists and companies providing DNA testing to the public. “Market pressures can lead to conflicts of interest, and data may be interpreted differently when financial incentives exist (p. 400).” An ideology of this sort assumes that consumers *require protection* from scientific information, because they may misinterpret it and suffer personal and/or social distress. Most community members rejected being portrayed as victims, however. One wrote:

“ All the opinions expressed paint a negative view of DNA-genealogy. The article lacks objectivity.. ..I don’t think the writers took into consideration that some of us may have formal education in genetics or informally have gained far more knowledge about the field than many experts.

One of the *Science* article authors responded, defending their position:

... While you and others in this group may not be professional geneticists, you certainly know as much as many professional geneticists about this area of genetic research.... While there are many individuals like you who have learned a great deal about population genetics..., there are also a lot of individuals who take these tests without knowing much about them. Our article was focused on that group of people, because we feel it is important for every test-taker to have a clear understanding of what DNA tests both can and cannot tell us. . Deborah A. Bolnik, Ph.D.

Some subsequent editorials, e.g., Foster and Sharp (*Nature*, 2008), have supported the rights of consumers to inform themselves about the positive and negative aspects of genetic testing, arguing that such knowledge might encourage consumers to take a more active role in their own health care. Other academicians, e.g., Prainsack et al (*Nature*, 2008), argue for greater investigation of how consumers actually use the genetic knowledge they obtain, noting that the “intensification of collaboration” between consumers, scientists and testing companies effectively pre-empts traditional models in which the academic community controls science.

Indeed, the bureaucratic format of traditional academic knowledge production – often with several years transpiring between the conduct of research and its public reporting in refereed journals – may render some results moot or even false by their actual time of publication. Conversely, the process of creative thought, commentary, and critique within the consumer community is spontaneous and largely democratic (although status hierarchies are apparent here, as well). Further, ideas can be presented, evaluated, tested, revised, challenged, accepted and so forth within a fraction of the time required for academic or commercial research (see Von Hippel 2005 for examples). In keeping with the altruistic economic model proposed here, data used in the knowledge production process are freely contributed by community members and their analysis is observable by community members. In general, the production process, itself, is more transparent than that characterizing academic or commercial information creation (see Kozinets et al 2008, p. 341). Community-based knowledge production additionally benefits from the diverse skills, competencies and experiences of its members. More and different intellectual ingredients can be tossed into the communal ‘soup,’ potentially yielding a richer and more useful outcome.

2009 Rootsweb Activity

We looked again at the DNA community production process in May and September 2009 and found a continuation of its prior activities, one of the most common of which is inducting novices into the knowledge base of the community. For example, Roberta Estes, a long-term member and organizer of the Roanoke Lost Colony DNA Project to be discussed shortly, advises a new member regarding the interpretation of test scores indicating Native American ancestry, “Use this DNA information as ... data points and tools, nothing more. If they provide consistent information from different sources, there is probably something to it.” Her advice essentially mirrors the validation procedures of traditional science.

The scientific expertise of the volunteer community continues to increase dramatically during this time period. Mathematical comparisons are now being made by members to determine the accuracy of models developed by very prominent academic geneticists. Steven Bird, one of the earliest volunteers on the web-board, for example, examined the different human generational lengths proposed by Cavalli-Sforza, Zhivotovsky and Fenner (three very prominent population scientists) against the statistics now available in the extant worldwide DNA databases, concluding that calculating human generational lengths at 31 years, closest to the model suggested by Fenner, was the most accurate.

Additionally, an entirely new direction of inquiry now seems underway in the community. Because current medical research is linking specific DNA markers to particular disease probabilities, community members are on the lookout for new findings relating to ‘their’ markers. In one case, a biogenetics article was posted which found that women having haplogroup J ancestry had a lower risk of having children with genetic abnormalities. Another member posted a medical journal article reporting that “allele A of rs7927894 on chromosome 11q13.5” was linked to an increased risk of skin infections. The marker is found in about 13% of Europeans. The movement into medical research by this volunteer collective-action community may presage an entirely new instance of altruistic consumer-producer creativity and bears future monitoring.

Expert Consumer Blogs and Personal Production

Community members, as individuals, also have initiated investigations into particular geographic areas or haplogroups of personal interest. Typically they establish little ‘intellectual factories’ or knowledge production centers and then link them back into larger community websites. We take a closer look at one of these to show how altruistic economics can be grounded in individual endeavors, as well as emerging from collective community effort.

James Elliott’s Scottish Border Reivers website grew out of his personal experiences with DNA testing. Having Border Scots ancestry, Elliott was interested in learning not only about his own genetics, but also those of the geographic region his ancestors came from. Four years down the road, he has developed a sophisticated, multi-theoretic presentation which draws upon not only his own creativity, but also the work of other consumer DNA bloggers, academic researchers, and testing companies. Rather than pursuing one ideological agenda, as may occur in academic settings, Elliott’s website presents nine alternative interpretive scenarios for haplogroup R1b, giving the current DNA evidence in support of each. We provide excerpts from two below to illustrate the analytical depth and articulation of ideas:

1. **The Oxford Ancestors Approach.** Oxford Ancestors’ [the first DNA testing company] method of interpreting deep ancestry [in Britain] seems guided by the following principles: Y chromosome DNA profiles mutate too often to

distinguish geographical origins among them.... Since R1b prevails across the indigenous population of the British Isles, then any Briton who belongs to R1b is considered to be a descendant of [the indigenous] population until proven otherwise.

Here Elliott critiques the theoretical robustness of the earliest DNA testing company, Oxford Ancestors, which also happens to be located in Britain and therefore has a vested ideological interest in deciding 'who' is to be considered British. Notably, Oxford Ancestors' reluctance to accept critical feedback and input from its customers has led to a marked decline in commercial sales for the company over the past five years.

2. The North Sea Celtic Approach. Population geneticists have observed high proportions of the R1b haplogroup in all parts of the British Isles, with the highest appearing in Western Ireland and Wales. Since the Basques of Spain exhibit similarly high frequencies of R1b, scientists concur that R1b is peculiar to the original population of Western Europe. They also seem to believe not only that R1b populations have existed in Europe since the Paleolithic, but that they have largely stayed put ever since. This is perhaps an oversimplification. The fact that R1b is indigenous to Western Europe is not incompatible with the likelihood that distinct tribal groups ... moved from one place to another within Western Europe for thousands of years.

In the above analysis, Elliott takes the academic genetics community to task for not considering alternative scenarios that could account for the distribution of the most common male haplogroup, R1b. Elliott, like many others in the DNA consumer community, is hyper-vigilant and deeply curious about genetic data linked to his own ancestry. This intense desire to know 'the truth' about one's origins underlies the high level of knowledge-seeking by many DNA test consumers. Whereas to an academic researcher DNA data may be professionally interesting, to a directly-implicated consumer, they represent personal identity.

Populist Publicity: Taking a Page from the World of Commerce

An example of highly-focused, community-produced knowledge is provided by the Worldwide E3B Project, a website and forum focusing on the E3b genetic haplogroup (a male lineage). Appearing to mimic the promotional style of the FTDNA newsletter which earlier had been posted to the Rootsweb List, the E3b Project news report proclaims:

The worldwide E3b Project proudly announces a new milestone: reaching the 700 member mark. Since its launch this past June, the E3b Project's website has been steadily growing and is being transformed into a dynamic place of learning, collaboration, and research... Here are some of the new developments: The V-Series SNP tests have proven very popular among our E-M78 subclade participants, and we have been very successful in further dissecting the E3b1a subclade into several distinct branches. The fall edition of the *Journal of Genetic Genealogy* [an on-line consumer-produced scientific journal] has published the much anticipated research paper by E3b Project member Steven Bird, "Y-Haplogroup E3b-V13 as a Possible Indicator of Settlement in Roman Britain by Soldiers of Balkan Origin." Our database [now] includes Elise Friedman's extended haplotype cluster analysis, an in-house system which enables us to classify E3b haplotypes into well-defined clusters based on allele similarities.... . .

Contributors to the E3b Project are volunteers who bring varied competencies to bear in producing this altruistic service (see e.g., Kozinets et al 2008 and Von Hippel 2005 for other examples). Steven Bird's research paper – produced without commercial or academic funding – was published in the online *Journal of Genetic Genealogy*, an all-volunteer, peer-reviewed journal available online at no cost. Consumer volunteer Elise Friedman developed a software clustering algorithm with which to form bio-geographical groupings of persons carrying the E3b haplotype. All results from this and other analyses are available free of charge to the public, and therefore represent another form of altruistic economics. Rather than hoarding or secluding new findings, as is often the case in both commercial and academic research contexts, their goal is to diffuse knowledge broadly and quickly. This is empowered – and empowering – collective action within a virtual (i.e., electronic) consumer community context (see e.g., Geisler 2006; Muniz and Schau 2005). Challenging the neoclassical economics model, it demonstrates that the more people 'give away' of their personal knowledge resources, the more knowledge they, and the entire community, may receive in return (Simon 1986).

The Lost Colony Project

A final example is the Lost Colony Project, a multi-method collaborative effort structured around the Roanoke 'Lost Colony' of 1587-1589 established by Sir Walter Raleigh on the coast of Virginia. Approximately 100 English colonists were set ashore near Cape Hatteras in 1587; in 1590 when a supply ship from England came to check on them, they had vanished. Historians have proposed various theories as to their fate, but definitive answers are few. In 2005 a volunteer group formed to bring multiple research perspectives to bear on solving the mystery. A description of their goals and motivations taken from the Lost Colony website is given below.

The Lost Colony Center for Science and Research is using DNA testing, archaeology, oral histories, and satellite technology to uncover the fate of the first English settlers.... The Center is poised for the next stage of discoveries – DNA evidence of possible living descendants and archaeological findings of a presumed English fort. The Center's mission is to be self-funding to ensure this research continues well into the third millennium.

The DNA research portion of the effort is being overseen by Roberta Estes, a subscriber to the Rootsweb DNA List, who has family roots in the eastern North Carolina area of the U.S. where the colony was established. Thus her participation is motivated in part by the desire to possibly locate her own ancestral origins among these 'lost' colonists. And indeed the webpage for the DNA portion of the Project plays upon this hoped-for "link to greatness" (O'Guinn 1988) that may motivate others to participate as well.

Are you one of the Lost Colonists? Find out by using a combination of DNA testing and genealogy... If your family descends from the eastern [North] Carolina area, if your family has an oral tradition of Lumbee or other Native American ancestry from the eastern United States, or if your family includes one of our 'most wanted' surnames, please join our Lost Colony DNA Project.

Notably, projects such as this one and the E3b Project are not undertaken without a strong element of self-interest, which is probably a primary motivation for consumer involvement in any collaborative production effort (see e.g., Geisler 2006). However, what is also key to understanding them is that the contributions are *voluntary and freely-made* on the part of participants, who are estimating that by donating resources they, and other community members, will likely be better off, than if each person had retained his or her information and kept it private

(see e.g., Muniz and Schau 2005). On the other hand, those who cannot or will not share their private data or skills typically are not excluded from participating in the community and obtaining its services, because the additional cost for their participation is deemed negligible. Further, it is always possible that the lurker who monitors the community, but does not contribute, may one day toss something valuable into the knowledge pot.

TOWARD A COMPREHENSIVE MODEL OF MIXED COMMERCIAL AND ALTRUISTIC ECONOMIC EXCHANGE

Figure 1 depicts a simplified model of the commercial and altruistic economic exchange relationships we found in the DNA testing marketplace. Beginning in the upper left portion of the figure is shown the traditional production of biogenetic research by professional scientists. Omitted are their traditional funding sources which may include the government, private philanthropies, and universities, but included in the model are monies received through affiliation with commercial DNA testing companies. Professional biogenetic researchers provide testing companies with the services of knowledge, expertise and credentialed validation for the companies' market offerings.

At the center of the figure are individual consumers who have purchased services from a DNA testing company through commercial economic exchange. These companies provide the consumer with information services regarding his or her genetic markers and their interpretation. Several of the DNA testing companies have established 'tied' or 'linked' discussion sites where consumers may interact with one another about their results. Typically, the Group Administrator, a consumer volunteer, serves as the moderator for these forums. Information, expertise, advice and ideas are exchanged within these communities, and they are operated on an altruistic economics platform. There is no additional charge to consumers to participate in or receive information from these forums, once they have made the initial DNA test purchase.

However, some consumers may feel that using a commercially linked forum limits their access to knowledge and advice to that testing company and may seek out independent DNA discussion communities. These independent knowledge production-consumption communities are operated entirely on a volunteer, altruistic economics basis and serve as intellectual factories in creating new knowledge, especially knowledge that is directly consumer-relevant.

Contributors to independent consumer-producer communities may also establish allied intellectual production sites that generate additional knowledge – in some cases surpassing the quality of that produced within the academic and commercial communities. Altruistic sharing of research between the populist science and professional/commercial science communities is beginning to occur, albeit in a very tentative way. Professional scientists – at least from the data collected for the present case – may feel both intellectually superior to and simultaneously threatened by the knowledge production capabilities of consumers. As Bovaird (2007) notes about public administrators and their consumer clients, professionals may be reluctant to acknowledge that consumers could 'know better' what their needs are, than those specially trained to service those needs. In the lower right section of the figure we place multi-method volunteer research efforts. These projects incorporate DNA testing as one part of their community production offering, but provide several other forms of knowledge, as well, for example, traditional genealogies, archaeological data, linguistics, and cultural anthropology findings

DISCUSSION

The present study is intended to provide insight into one area of collective social action; in this instance, consumer cooperatives within the DNA testing marketplace. We provided examples in support of three types of economic production sites – traditional commercial production, altruistic production, and mixed commercial-altruistic production. When combined with other studies on collective social action, our results suggest a set of broader generalizations. For example, substantial overlap in the consumer production and altruistic sharing of knowledge has been documented in the open-source software and kite boarding consumer communities (see Von Hippel 2005). Analogously, prior research on coffee connoisseur communities (Kozinets 2003), the Apple Newton user community (Muniz and Schau (2005), and Napster music sharing communities (Geisler 2006) also display substantial consistency regarding the dynamics of consumer cooperatives grounded in altruistic economics.

Notably, most extant studies document the presence of a willingness to advise and assist others in the community, especially newcomers, and a rapidly moving innovation/knowledge creation curve which is capable of rivaling and even surpassing that in the commercial production sector. The present study on DNA testing consumer cooperatives is consistent with prior research on these characteristics.

Our research extends this body of findings by focusing upon a markedly different type of product category than prior studies, by explicitly calling upon altruistic economic theory, and by applying a longitudinal (10 year) time frame. Whereas earlier inquiry examined technologically-grounded products which are *external* to the consumer, our study looked at biogenetic information that is directly implicated in the consumer's physical being and self-identity. That consumers are capable of creating and sharing information on biomedical topics rivaling that in the academic and commercial science communities is a sign of the remarkable productivity which 'novices' can bring to bear on issues which interest them. What is perhaps even more remarkable is that such rapid innovation development can occur outside of traditional commercial markets and in the absence of traditional economic incentives. Thus, altruistic production sites serve as a significant and growing platform for the enhancement of consumer welfare and empowerment.

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FIGURE ONE
 A MIXED ECONOMIC AND ALTRUISTIC EXCHANGE MODEL

