



Automating prosumption: The decline of the prosumer and the rise of the prosuming machines

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Abstract

This essay builds on and expands the domain of the burgeoning literature on the human prosumer and the process of prosumption. Just as the prosumer and prosumption are finally getting the attention they have always deserved, a dramatic technological change – the rise of smart prosuming machines – is taking place that is reducing the importance of the human prosumer. While the impact of these machines on producers (here conceived of as prosumers-as-producers) has long been obvious, what has changed the most is the explosion, and the growing impact, of these machines on consumers (or prosumers-as-consumers). A number of examples are offered of smart prosuming machines for humans. The latter are often unaware of the prosumption being done by smart machines, especially on the Internet. While smart prosuming machines offer many advantages, the danger lies in the replacement of human by non-human technologies and the control exercised by them. This is especially the case on the Internet of Things where many smart prosuming machines function, interrelate, and operate as autonomous, self-organizing devices.

Keywords

Prosumption, prosumer, smart prosuming machines, production, consumption, Internet of Things

Introduction

The concept of prosumption (and the prosumer) was introduced by Alvin Toffler (1980) over three decades ago, but it took years for scholars in various fields to begin to understand and appreciate the importance of the idea (and related

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concepts such as the “produser” (Bruns, 2008) and “co-creation” (Prahalad and Ramaswamy, 2004; Ramaswamy and Ozcan, 2014)). In recent years, I (and many others) have dealt with prosumption in a number of publications (Rifkin, 2014; Ritzer, 2014; Ritzer et al., 2012; Ritzer and Jurgenson, 2010). The past inattention to, as well as the more recent heightening of interest in, prosumption is traceable to the fact that the process itself has both changed and expanded enormously in recent years. In fact, it is now possible to think in terms of a “new world of prosumption” (Ritzer, in press). Before getting to the focus of this article – the “prosuming machines” that are a major aspect of that new world – the concept of prosumption requires clarification.

Defining and conceptualizing prosumption

As a term, prosumption is formed out of the combination of the concepts of *production* and *consumption*. In fact, prosumption is defined as the interrelated process of production and consumption. For much of recent history, especially since the Industrial Revolution, the popular and academic focus within the economy has been on production (e.g. Marx, 1867/1967; Veblen, 1914/1964). More recently, especially after the end of World War II (WWII), the focus began to shift to the increasingly dominant process of consumption (e.g. Baudrillard, 1970/1998; Galbraith, 1958/1984). While these are certainly important processes and worthy of continuing attention, the focus on one or the other has tended to obscure the fact that *both* are better seen as processes of prosumption. That is, much production takes place in the process of consumption; there can be no consumption without some production (e.g. of that which is to be consumed such as a home-cooked meal; of the meaning of, for example, a home-cooked meal as opposed to a one eaten in a fast food restaurant or in a five-star restaurant). Similarly, much consumption is associated with the process of production (e.g. of the raw materials and labor time needed to produce an automobile; of the meanings of the work involved). Thus, prosumption is seen here as the generic process, one that subsumes production and consumption. Indeed, the latter, as we will see, should be viewed as extreme sub-types of prosumption.

Figure 1 offers a view of prosumption not as a single process (or phenomenon), but rather as a wide range of processes existing along a continuum. The poles of the continuum involve production redefined (a bit awkwardly, but more accurately) as “prosumption-as-production” (p-a-p) and consumption as “prosumption-as-consumption” (p-a-c). This means, among other things, that production and consumption, at least in their pure forms devoid of prosumption, do not exist on this continuum.¹ *There is no such thing as either pure production (without at least*

Prosumption-as-Production (p-a-p).....“Balanced”Prosumption.....Prosumption-as-Consumption (p-a-c)

Figure 1. The prosumption continuum.

some consumption) or pure consumption (without at least some production); the two processes always interpenetrate. In the “middle” of the prosumption continuum, production (-as-consumption) and consumption (-as-production) are more or less evenly balanced; it is there where something approaching “balanced” (between p-a-p and p-a-c) prosumption exists (see Figure 1).

Although they are usually seamlessly intertwined, we also need to distinguish between the “consumption” and “production” phases² of p-a-p (as well as of p-a-c) (see Figure 2). The utility of this distinction, as well as of the prosumption continuum more generally, will be clarified in the ensuing discussion.

P-a-p involves those (typically workers) who consume what is needed in order to be able to produce things (goods, services, etc.) with what they have consumed. In this, we are distinguishing between the time during, and the process in, which prosumers-as-producers (p-a-ps) consume and produce. It takes p-a-ps³ time and energy both to produce and to consume during the prosumption process. For example, in putting hubcaps on a car in the assembly process, it takes time and energy to put the hubcaps on the car (the production phase), but also to retrieve them from where they are stored (the consumption phase). This distinction seems trivial, but it is important to the general conceptualization of prosumption.

The same distinction between phases needs to be made for prosumers-as-consumers (p-a-cs), and in this case, it is of much greater consequence, especially in today’s world. However, it is difficult to conceive of p-a-cs as producers. My earliest thinking on this issue was in my work on the McDonaldization of society (Ritzer, 1983, 1993/2013) in a discussion of the ways in which fast food restaurants are “putting customers to work.” Rieder and Voss (2010) (see also, Dujarier, 2014) have built on this in their work on “working customers.” Of course, the process of putting customers to work was not invented by the fast food restaurant. Customers have *always* worked in restaurant settings (e.g. in the most traditional of restaurants by, for example, reading and ordering from menus), but there has been a long tradition of refining and expanding that work. For example, the late 19th and early 20th century cafeterias led consumers to perform a wide range of tasks on their own such as retrieving trays, utensils, and napkins; lining up and wending their way through a line where they obtained the food they desired; and then paying at the cash register at the end of the line (Hardart and Diehl, 2002). In traditional restaurants, these tasks are performed by paid employees such as wait- and buspersons.

There are a series of broader senses in which p-a-cs are producers (or working customers). First, they are producing awareness of, and desire for, various products (e.g. a meal at a cafeteria; a Big Mac at McDonald’s) long before they ever enter a setting in which they can consume them. Traditionally, this awareness is produced

P-a-p: Production and Consumption Phases Balanced Production and Consumption P-a-c: Consumption and Production Phases

Figure 2. The prosumption continuum with phases of production and consumption.

when p-a-cs encounter someone who has consumed something that they conclude they would like to have. In the contemporary context, this production of desire is even more likely to occur in encounters with advertisements about various products (Baudrillard, 1970/1998; Schudson, 1986). However the desire is produced, p-a-cs then must produce the actions required to get them to the brick-and-mortar location (or the web site) where the products are available for sale. Once there, the initial desire needs to be reproduced (or possibly altered) and translated into the more specific steps needed to actually obtain and purchase the product. While all of this is accomplished in cafeterias or fast food restaurants, much additional work is required when consumers use the drive-through windows at fast food restaurants. Among the required tasks are ordering the food at one point in the drive-through lane and picking it up at another, driving away with food and unwrapping it (likely in the car), and then disposing of the debris (engaging in the work of garbage disposal and saving the fast food restaurant the work and the expense involved in having paid employees do that work).

Much the same process occurs in other brick-and-mortar contemporary consumption settings such as, for example, Wal-Mart. First, a desire for a specific product (and there are many) on offer at Wal-Mart needs to be created by p-a-cs. More importantly, at least from Wal-Mart's perspective, a desire to purchase that product there rather than from a competitor also needs to be created. Second, there is work involved in the trip, often lengthy, to Wal-Mart and the negotiation of the parking lot and entrance to the store. Third, once in the usually huge and labyrinthine store, p-a-cs must obtain carts and make their way through it to find what they came for. Inevitably, they will find and pick up other products that they did not have in mind before they arrived. Fourth, when they are done, they must pay for their purchases, increasingly by doing all of the work themselves at self-checkout lanes. Then, the purchases must be transported to (usually) one's car and then home where additional work is needed to unload, unpack, and perhaps construct (as in the case of IKEA's famous Billy Bookcase) the final product. Various steps are then required to use, and in some cases use up, that which was purchased. Throughout this phase of the process, p-a-cs are doing much (re-) definitional work as they reassess the feelings that led to the initial desire to obtain the product. Once the product is gone (used up, disposed of, or relegated to a storage area), a final assessment occurs which may (or may not) lead to the same or similar purchases. If the assessment is a positive one, the process may begin again.

The above is little more than a brief sketch of the many acts that can be seen as being involved in the production phase of p-a-c. Given that, in what sense is there a consumption phase of p-a-c? In what senses are p-a-cs consumers? These are much easier questions to answer since p-a-cs are what we usually consider consumers and it seems abundantly clear that they are engaged in the process of consumption. Much of what has been described above as production (e.g. the acts involved in using and using up products) is closely related to, if not indistinguishable from, consumption or, in the terms used here, the consumption phase of p-a-c. However, a distinction can be made between the steps taken to produce consumption and

those involved in the consumption process itself. In most cases, these are simply different ways of looking at the same steps. For example, one produces the various steps involved in eating a bowl of cereal (getting the cereal box from the cabinet and the milk from the refrigerator; retrieving a bowl and a spoon; combining the cereal and milk in a bowl) at about the same time one actually consumes (eats) that cereal. Whether or not they are separated in time or place, the production and consumption phases need to be distinguished in order to make it clear that both occur in p-a-c (and p-a-p).

Given this conceptual groundwork, we turn to a brief discussion of the broad historical background of the process of prosumption (for much greater detail, see Ritzer, 2014).

Perspectives on the history of prosumption

Prosumption can be seen as a “primal” process, one that has always characterized human life and recurs throughout history. For example, hunter-gatherers consumed the food they produced through their productive activities. In this view, prosumption is not a new phenomenon (Bruns, 2008; Vargo and Lusch, 2004). In previous work, I dealt with this possibility under the heading of “the eternal return, or recurrence, of the prosumer” (Ritzer, 2014).⁴ However, although today’s economy involves such a recurrence, it is possible that there is something different, maybe very different, about prosumption today.

Prosumption can also be seen as an evolutionary process. That is, it is continuous with a number of recent developments which are, in turn, built on their predecessors. For example, an Internet shopping mall such as Amazon.com dominated by prosumption (e.g. we order our own products, write the reviews on the site) can be seen as continuous with, and as a logical outgrowth of, shopping malls, which relied, albeit to a lesser extent, on prosumers. The latter, in turn, evolved from earlier prosumption sites, including arcades where prosumption was even less prevalent (Benjamin, 1999). Prosumer-based fast food restaurants, as well as the food courts in, among other places, shopping malls, are clearly heavily reliant on prosumers, that is, on putting customers to work (e.g. cleaning up after their meal). These restaurants evolved, at least in part, from cafeterias where paid employees did more of the work. Thus, from this perspective, prosumption is evolving and its current manifestations are not inconsistent with past realities.

The third perspective, an aspect of which will be the focus of the remainder of this article (for a broader discussion, see Ritzer, in press), is that we are now witnessing a revolutionary change that involves, among other things, the emergence of a *new world of prosumption*. This is not to negate the other two perspectives – prosumption *is* a primal phenomenon that is subject to eternal return and it *has* evolved and continues to evolve. However, the recent developments have been so dramatic that it is possible to identify a revolutionary change leading to the emergence of such a new world.

The new world of prosumption and the rise of smart prosuming machines

The new world of prosumption is clearest, and most obvious, in the digital domain⁵ of the Internet where the process is increasingly clear and the norm. The Internet has not only made prosumption more common, but it has also made new forms of prosumption possible. For example, on the web site Wattpad, readers of serialized stories can post public comments on them, offer casting suggestions, and insert in-line commentary directly into the text (Streitfeld, 2014: B3). However, prosumption, even in its newer forms, is also increasingly common in the material world where, for example, automated teller machines (ATMs) have transformed people into prosumers. That is, they have become consumers of banking services who simultaneously produce those very services on the ATM rather than relying on a paid employee (a teller) to produce the services for them.

However, it is now clear that even the most recent forms of prosumption are undergoing dramatic changes that need to be taken into account in discussions of that process. One of the most important of those changes involves the beginning of a potentially large-scale process by which the prosumer is increasingly assisted, and ultimately replaced, by “smart machines.” The process of prosumption is being automated so that the prosumer, or at least the agential prosumer, grows less and less important. It is even possible to glimpse the demise of the prosumer, at least of the human prosumer (see below for a discussion of this issue in terms of the Internet of Things (IoT)). For example, diabetics, even with today’s advanced technology, still need to prick their fingers, but on the horizon is “a one-device-does-all that automatically performs the pricking, measuring and dosing” (Rosenthal, 2014: 20). Ironically, the decline of human prosumers is underway just as we are beginning to know and understand them. The goal of this article is to deal with the various ways in which smart machines and automation are affecting, and may someday come to dominate, prosumption. In the process, they may relegate human prosumers to secondary status, if not eliminate them completely.

Of course, much of prosumption, or at least some aspects of it, has long been automated to some extent and been involved with at least rudimentary smart machines. For example, while a human actor is needed to set a smart machine like an ATM (which first appeared in the early 1960s) in motion, once the process begins it proceeds automatically. Similarly, a person is required to order a product on Amazon.com (founded in 1994), but much of the rest of the process also occurs automatically. A wave of one’s foot under the rear bumper of a Ford Escape causes its rear hatch to open. These and many other types of prosumption require an agent consciously and intentionally choosing to set the process in motion.

Of perhaps greater interest in the context of a discussion of the changing nature of the new world of prosumption, especially the development of smart machines and the automation of prosumption, is the increasing number of instances in which this process occurs unbeknown to the prosumers involved. One of the major examples of this is the fact that various companies and agencies are registering and

accumulating people's, prosumers', keystrokes (Zwick and Knott, 2009). Prosumers are producing those keystrokes, perhaps with the goal of prosuming an Amazon.com product or a Facebook page. However, once those keys have been struck, the impulses are likely to flow into all sorts of databases to be used automatically on the basis of various algorithms. In other words, a series of automated processes are unknowingly set in motion by agential prosumers who quickly lose control over them as well as of the data they are providing unconsciously.

Then, there are the instances in which an agent neither knows about the process nor takes any clear overt actions in order to set it in motion. For example, smart phones divulge anonymized data on their users' physical location. Human agents are doing nothing more than carrying those phones on their person.

However, what is of interest here is a whole series of very recent and emergent social changes that are serving to give even greater power to smart machines. While smart machines have all sorts of large-scale implications (e.g. the impact of smart machines on how cities function), our concern here is the implications of smart machines for the prosumer. These machines are helping to increasingly automate the process of prosumption. This goes beyond the preceding examples of automated processes kicking in once the prosumer intentionally or unintentionally initiates the process. Rather, a variety of technological changes are occurring that result in the process of prosumption being initiated and even controlled by non-human technologies. As a result, the process of prosumption, as well as the study of it, is likely to shift from the human prosumer to smart machines. However, in the context of this discussion, the focus is not on all smart machines, but on the subset of such machines that relate to prosumption – that are *smart prosuming machines*. Such machines are already increasingly able to operate on their own, at least once they are set in motion by humans. However, it is also the case that *we are beginning to see the emergence of smart prosuming machines that increasingly operate on their own without human intervention*. Thus, just as we have begun to see increasing awareness of the importance of humans as prosumers, they seem to be growing less important as at least some of what they do is being increasingly controlled, if not replaced, by prosuming machines.

This discussion of smart machines can be put in the context of a distinction made in *The McDonaldization of Society* (Ritzer, 1993/2013) between *human* and *non-human technology*. Human technologies are controlled by people. A paradigmatic human technology is a hammer. A hammer does exactly (at least most of the time) what the human wants it to do. In terms of prosumption, hammering primarily involves acts of production (putting a nail in the wall), but it also involves at least some consumption (purchasing the hammer; retrieving it from the tool box). This kind of prosumption involving the use of human technologies is primal. However, it has evolved over time from, for example, the use of stone to steel implements. What is new and revolutionary is not the use of human technologies but the increasing importance of non-human technologies.

A smart machine is clearly a non-human technology in the sense that control lies largely with the machine and not the person using it. For example, once workers in

fast food restaurants place raw French fries in the fry machine, much of the remainder of the process is controlled by the machine which, for example, lowers the fries into the boiling oil, “decides” when they are done, and lifts them out of the oil. There is a similar relationship between bank customers and ATMs. However, of primary concern here is the most recent, even the next, generation of smart machines which require little, or even no, input from prosumers. We will soon discuss a number of examples of these smart machines such as wearable technologies with sensors that monitor various dimensions of a person’s health, as well as automobiles that park and will soon drive themselves. Thus, we are moving away from hybrid technologies involving both human and non-human inputs in the direction of those that operate with no overt and intentional input from humans.

Rey (2011) has discussed this development, at least in part, as “ambient (or incidental) production.” Ambient production is a byproduct that “simply occurs as a result of one’s presence.”⁶ The smart machines discussed here certainly involve ambient production as opposed to active production. However, while Rey is well-versed in the literature on prosumption and has been a contributor to it, he chooses to distinguish clearly between production and consumption and to focus solely on ambient production. In doing so, he continues to reflect the “productivist bias” or tendency to privilege production over consumption that has plagued thinking in this area (Ritzer and Slater, 2001). Ignored by Rey is ambient consumption and, more importantly, ambient prosumption. In terms of the concepts used here, ambient production can occur in p-a-p as well as in the production phases of p-a-c, while ambient consumption occurs in p-a-c, as well as in the consumption phases of both. For example, one’s presence in a particular locale can lead to the consumption of alerts through Foursquare of friends in the area. Ambience characterizes both p-a-p and p-a-c as well as prosumption more generally.

In discussing non-human technologies, specifically prosuming machines, we are clearly dealing with a topic of central concern to actor–network theory (ANT) (Law, 1999). The focus of this theory is not on the human agent, in this case the prosumer, taking some action, but rather on the networks in which those agents and actions exist (see below in the discussion of the IoT). That network likely involves other human agents as well as a wide range of non-human objects. Of great importance is the fact that ANT has “opened the social sciences to nonhumans” (Callon, 1999: 182). Beyond that, ANT has emphasized the idea that both the human and non-human components of the networks of concern to them, and in which they are enmeshed, are *actants*. Both human and non-humans are enmeshed in networks and have the capacity to act. However, the non-human actants’ ability to act is different from that of humans. As we saw above, while humans usually (but far from always) act agentially (consciously, intentionally), non-human actants, especially material artifacts, are “*devoid of agency*” (Brown and Capdevila, 1999: 40). Whether or not they act agentially, material artifacts (including smart machines) are actants; they do act.

ANT is closely tied to movement in the direction of both a posthuman (Franklin, 2007) and a postsocial (Knorr-Cetina, 2007) world. The posthuman

perspective denies the clear distinction between the human and the non-human. To the postsocial analyst, social relationships are declining in importance while relationships with and among objects such as technologies and consumer goods are increasing. The interaction between prosumers and ATMs is one example of a postsocial relationship of interest to us in this analysis. Clearly, people relate to ATMs and just as clearly those machines act. The following discussion of smart prosuming machines should be seen in the context of ANT and more generally of a posthuman and postsocial world.

Toward smart prosuming machines

If one can talk about a traditional view in such a new domain of study as prosumption, it focuses on human prosumers and the process of prosumption controlled largely by them. For example, as mentioned above, prosumption can be considered a “primal” process in which the earliest humans produced (gathered berries; hunted game) as they consumed (the berries and the game). While we can now see the berries and the game as actants, this primal process was clearly initiated and controlled by humans. Their quarry “acted” – berries grew vibrant in color and increasingly attractive, game moved giving away their position to hunters – but gathering and hunting were clearly initiated and controlled by human actants.

While such primal processes of prosumption continue to exist (many people still hunt and gather berries), they have been altered innumerable times over the centuries. For example, fast -forward to the Industrial Revolution, the era of industrial capitalism, and the rise of the modern factory. In this case, factory workers were (and are) prosumers (p-a-ps) in that they produced objects (say automobiles) as they consumed other objects (the raw materials and components needed to build the car). However, it is also the case that the objects, both those that were consumed and produced, were themselves actants in the larger network that involved the production process.

More recently, we can be seen as having entered the era of prosumer capitalism in which prosumers rather than “producers” (who are themselves prosumers – p-a-ps) or “consumers” (also better seen as prosumers – p-a-cs) have increasingly come to fore. This is clear in many modern developments in the (largely) material world (see above), but it is even clearer in the digital world where, for example, those who consume products on eBay produce the orders for them and on Facebook where the consumers of material on its “walls” are the producers of that material. It is in prosumer capitalism that we are now seeing a boom in smart prosuming machines. In the following section, we discuss those machines in the context of the continua outlined above.

Smart machines and prosumers-as-producers

Smart machines and automation alter and in many ways improve the process of p-a-p. In many cases, they make p-a-p easier by conceptualizing and performing

tasks that are quite onerous to human workers such as welding and painting cars on the automobile assembly line. However, they also can be seen as deskilling work by taking skills from humans and building them into the technology. Thus, there are pluses and minuses as far as the implications of these changes for p-a-p are concerned. At the extremes, however, smart machines (Kelly and Hamm, 2013) can, and increasingly will be able to, replace human workers (the p-a-ps). In fact, the literature on producers, or in our terms p-a-ps, has been primarily concerned with the issue of job loss as a result of the introduction and later expansion of smart machines (Brynjolfsson and McAfee, 2014; De Groote, 2014).

Smart machines will themselves become p-a-ps through the use of sensors that will, for example, ascertain that there are problems with a particular phase of the production process (a part does not meet specifications; the paint on the car is the wrong color or applied unevenly) or even with a finished product. Eliminated in these cases, at least in part, is the need for human p-a-ps to make these judgments (involving further deskilling). Because of the reduced need to take time to attend to such matters, fewer human employees will be needed. Reductions in the number of workers are also occurring, and will occur more frequently in the future, as smart machines literally do the work themselves without human intervention. Such robotization has already occurred in many production settings, including, among others, BMW's automobile assembly line in Munich where robots put fenders on cars, weld and paint the cars, and so on.

Overall, the increasing sophistication and utilization of smart machines in p-a-p have been going on for some time and have been the subject of much analysis, albeit *not* from the perspective of prosumption. When we look at it from that point of view, we can see that both the production and consumption phases of p-a-p are affected by smart machines and automation. In the case of automobile production, today's robots both pick up (consume) a fender needed by the car under construction and put the fender on the car (produce). An understanding of prosumption adds greater nuance to our understanding of what is transpiring since both the consumption and production phases of p-a-p are profoundly altered by smart machines and automation.

Of course, we are in the infancy of the development of smart machines. As they grow increasingly sophisticated, they will acquire a greater ability to "think" on their own and to take on more tasks now being handled by humans. Thus, it is easy to predict that smart machines will do more things, gain more control over people, and eventually replace many – perhaps even all – of them in the workplace. In the end, looking at producers as p-a-ps does not really add a great deal to our understanding of what is happening, and is likely to happen, to them. This is because much of this has been studied and thought about under the heading of production. Where adding prosumption to this analysis is most illuminating is in the case of what we traditionally think of as consumption (p-a-c). It is p-a-c that is now in the process of being altered dramatically by smart prosuming machines.

Smart machines and prosumers-as-consumers

Much more attention has been paid to producers (or in our terms, p-a-ps) than to consumers (p-a-cs) because of the long-term “productivist bias” mentioned above. More specifically, the possibility of a major change in the nature of work, and more extremely of substantial job loss, has had far greater priority than changes wrought in the consumption process (although these two sets of changes are, as we have seen, connected). Furthermore, the focus on production has led to earlier, quicker, and more dramatic applications of smart machines to p-a-p. It is clear that as a result of the development and use of such machines, tasks can be performed more quickly and efficiently yielding greater profits. It has not been nearly as clear that increased use of smart machines in p-a-c will lead to greater profits. It is also the case that it is far easier to bring in smart machines to change what p-a-ps do than it is in the case of p-a-cs. Because p-a-ps are generally paid employees, employers can more easily implement whatever innovations they deem necessary with little or no resistance from employees. However, p-a-cs are not employees; they are not being paid; businesses cannot afford to anger or alienate them by imposing smart machines (or much else) on them. The implementation of such technology in p-a-c has to be done much more subtly. Furthermore, these kinds of changes need to please, or at least seem to please, p-a-cs while there is no such requirement in the case of p-a-ps. Thus, the introduction of smart machines in p-a-c tends to be done covertly or to be made to seem highly appealing. While the changes in p-a-c may seem less important than changes in p-a-p, *it is in p-a-c that the biggest changes are being made, and are likely to be wrought, by the increasing number and sophistication of smart prosuming machines.*

The human p-a-c is beginning to be controlled, and perhaps eventually replaced, by smart machines or, more specifically, *smart prosuming machines*. Critical here is the development of increasingly powerful sensors (using nanotechnology) that can be attached to objects worn by (“wearables”), or otherwise associated with, p-a-cs. They can also be inserted in the body of the prosumer. In fact, one Silicon Valley scientist says, “The reason we are talking about wearables is because we are not at implantables yet,” but “I’m ready. Others are ready” (Ortutay, 2014: 3D). Implanted prosuming machines would serve to turn p-a-cs into a new type of cyborg (Haraway, 1991). Whether they are carried or implanted, the sensors involved will accompany the prosumer everywhere and do much of the prosuming for the p-a-c. Some examples of smart prosuming machines, as well as the ambient prosumption associated with them, are discussed in the ensuing paragraphs.

One’s smartphone is, unbeknown to most, collecting (consuming) data on one’s location and transmitting (producing) those data, at least anonymously, to computers that collect it all as part of “big data” (Davenport, 2014). Google Glass and other wearable technologies (e.g. smartwatches) have the potential to prosume an enormous variety of information.

Foursquare not only consumes information on friends in a given area, but will also produce an alert for them on one's location, as well as indicate information on that location to those friends who are able to consume it. In this sense, Foursquare and the smartphone on which it is downloaded are prosuming machines that perform the tasks of finding one's location, narrowcasting it, and finding the locations of others without any overt actions (other than downloading the app and carrying a smartphone) by the human prosumer.

Instead of producing money to pay the toll needed to consume more miles on a toll road, e-tolls allow people to glide through toll-taking areas and have the charge debited electronically to their E-Z pass accounts. This is made possible by advanced technology at toll areas and transponders in cars. On some roads, no humans any longer work in toll-taking areas. Thus, drivers who do not have an E-Z pass or the correct change will automatically be sent a bill or ticketed. Transponders also allow cars, as well as types of vehicles subject to different charges, to be identified automatically.

The automatic payment of tolls may soon involve cars that drive themselves. Google is developing and testing such automobiles. In today's cars, the human driver constantly consumes all sorts of relevant information (speed, road conditions, nearby cars) and uses that information to produce a variety of actions (slow down, veer around other cars). Those actions lead to additional acts of consumption, leading, in turn, to yet other acts of production. In fact, there are already sensing devices in many of today's automobiles (especially hybrids) that consume some of that information and automatically cause the automobile to make various adjustments. In that sense, today's cars are, at least in part, prosuming machines. However, in order to drive themselves and to avoid mishaps, tomorrow's automobiles must, of necessity, become much more complex and effective prosuming machines.

Universal product codes (UPCs) have the potential to alter dramatically the nature of prosumption. For example, instead of p-a-cs unloading products to be scanned at the checkout counter, the UPCs associated with those products can be read directly by the computer as one checks out. Alternatively, the shopping cart can be equipped with a transponder that reads the UPCs during the process of shopping. Final bills can be tabulated automatically and be ready for shoppers as they leave the store or the bills can be e-mailed to them.

Patients can be released from the hospital with wearable monitoring devices that consume information on vital signs and notify hospital computers and/or personnel that something is awry. Thus, instead of patients prosuming this information (by, for example, taking their own blood pressure), it is prosumed by monitoring devices. We can expect many innovations in this area in the future. For example, Google is already working on contact lenses that monitor the glucose levels of diabetics (Ortutay, 2014; also see above). In the not-too-distant future iPhones and iPads will include a new app, Healthbook, which will gather health-related data and *could* eventually collect and report data on heart rate (Basis Science's Basis band already monitors a user's heart rate, as well as calories burned) and skin

temperature. With additional sensors, Healthbook could do the same for blood sugar levels and the like (Gilbert, 2014). There are now ingestible sensing systems that can gather and transmit information to patients and caregivers about whether pills, and their proper dosage, have been taken (Taub, 2014). There is even a dress in development called Intimacy 2.0 which is able to consume information about the wearer's level of sexual interest and, when it is heightened, transform the dress from being opaque to being transparent (Bilton, 2014: B5).

While drugstore computers are already handling refills automatically (eliminating or reducing the need for actions by prosumers), it is also likely that we will see pill bottles equipped with sensors that sense that medication refills are needed and transmit (produce) the order for them to the drugstore.

Three-dimensional (3D) printers consume information (e.g. blueprints), as well as raw materials (e.g. plastics), and use them to produce automatically an increasingly wide variety of end-products (Anderson, 2012).

Robots already prosume and, in the future, will possess a much greater capacity to prosume. One already in existence is the *Los Angeles Times*' quakebot, an algorithm that springs into action when the US Geological Survey sends out an earthquake alert. It extracts (consumes) relevant data and plugs (produces) the data into an extant template. A human editor is still required to determine whether or not to publish the information (Oremus, 2014).

It is in these cases of p-a-c, and those like them, that we see the most recent (but certainly not the last) examples of the emergence of smart prosuming machines. In some cases, this will reduce the importance of, and even eliminate the need for, agency on the part of p-a-cs. It is even possible that we will see the disappearance of large numbers of human p-a-cs in many domains. We have already noted the well-known ways in which p-a-ps are being rendered unnecessary by prosuming machines in the workplace. Thus, just at the time when we are beginning to realize the falseness of the distinction between producers and consumers and becoming cognizant of the existence of human prosumers (as either p-a-ps or p-a-cs), we are witnessing technological developments that are reducing their importance or even eliminating them entirely.

However, even in that extreme case, the concept of prosumption remains important. That is, we tend to think of technologies in this domain as involved in either production or consumption. However, that is as erroneous as thinking of people as either producers or consumers. All machines, like all people, involve production and consumption, and the newer ones are more sophisticated at both and they integrate them better. We have long been aware, even without the terminology, that technological development causes changes in, and even the disappearance of, producers (or p-a-ps). However, what is new is the realization that consumers are better seen as p-a-cs and that technological change is not only affecting them as well, but changing them more dramatically than p-a-ps and promising to supplant them in at least some contexts. We may now live in the age of the (human) new prosumer, but it promises to be short-lived and it will be progressively supplanted in the not-too-distant future by the age of smart

prosuming machines. At the minimum, the new human prosumer will grow increasingly less important as control over much of the process shifts dramatically in the direction of smart machines.

There are, of course, numerous advantages to the rise of smart prosuming machines. Among other things, they are able to perform tasks more quickly and accurately than human prosumers. They also free up people to do other kinds of things. However, these non-human technologies can also be discussed under the heading of the “irrationality of rationality” (Ritzer, 1983, 1993/2013). Clearly, the prosuming machines discussed above are technologies that are highly rational. However, like all forms of rationalization, they produce, and are accompanied by, a wide range of irrationalities. For example, they can fail to operate properly, causing, at the minimum, inconvenience (e.g. getting a ticket because one does not have correct change needed at an automatic toll booth which offers no other way of paying the toll). However, prosuming machines can have more dire consequences when, for example, they fail to accurately measure and report a person’s medical data.

Irrationalities such as these do not mean that we need to be Luddites opposing and rejecting smart prosuming machines. Clearly, they bring with them many advantages, but we should not ignore the irrationalities associated with them, as well as with many other aspects of our increasingly rationalized (or in my terms McDonaldized) society.

While smart prosuming machines will increase in number and diversity and become more important in coming years, human prosumers will not disappear. They will continue to work, albeit in smaller numbers, in settings dominated by p-a-ps, although more as monitors and minders of those prosuming machines. P-a-cs will continue to consume (really prosume), but the nature of that process will be altered radically by smart prosuming machines. Most generally, the synergistic employment and exploitation of p-a-ps, p-a-cs, *and* prosuming machines will lead to a radically different capitalist system that has the potential for unprecedented profitability because, primarily, of the decline of paid human employees.

In terms of ANT, the rise of smart prosuming machines adds a new set of actants to the presumption network which also includes human p-a-ps and p-a-cs. The addition of those prosuming machines not only adds greater complexity to that network but also alters it profoundly by reducing the significance of humans as both p-a-ps and p-a-cs. In other words, it moves us still further in the direction of a postsocial and posthuman world.

Prosuming machines and the IoT

To this point, we have discussed prosuming machines largely in isolation from one another. However, many of them interrelate, and will interrelate more and more, on what has been termed the IoT. This concept is usually traceable to a 1999 presentation made by Kevin Ashton (n.d.). A recent Pew Research Center (2014)

Report argues that IoT will boom and defines it as “a catchall phrase for the array of devices, appliances, vehicles, wearable materials, and sensor-laden parts of the environment that connect to each other and feed back data back and forth” (p. 1). To this point, discussion and conceptualization of the IoT have failed to see that smart prosuming machines constitute a large part of what is, and will be, interconnected on the Internet. The IoT will include smart prosuming machines that report to, and get responses from, other smart machines. For example, in the health area, there are contact lenses that measure and report glucose levels to doctors’ computers, bands that report heart rates to hospitals’ computers, and pills that are ingested and let caregivers’ computers know whether the proper dosage has been taken.

While many prosuming machines will communicate with one another, many others will communicate with humans (e.g. bracelets that let users know where they stand in a particular exercise program; electric toothbrushes that communicate with their users about how well they are brushing their teeth). Based on the nature of those communications, humans may engage in p-a-c, p-a-p, or some more balanced combination of the two (more balanced prosumption). Since in this case humans retain agency, even power (they can ignore feedback from their bracelets and toothbrushes), this is a less worrisome scenario than one in which prosuming machines communicate directly with one another and action is taken as a result of that communication (e.g. a quakebot that bypasses a human editor and causes an erroneous alert that panics the population).

A vast web of interconnected prosuming machines will be infinitely more powerful than any single machine or small subset of these machines. We are in the process of creating a system where the human prosumer will have less and less of a role to play in the prosumption process. The machines will produce (p-a-p) and consume (p-a-c) in a seemingly endless loop.

There is no question that interconnected prosuming machines on the Internet will bring with them an endless array of advantages (e.g. heart monitors that indicate an imminent heart attack and that elicit an automatic response from another smart machine inducing an electric shock or administering a dose of intravenous nitroglycerin). However, from the perspective of a critical sociology, these interconnected prosuming machines on the IoT bring to mind a dystopian image of a reified world in which these machines “work largely without human intervention” (Chui et al., 2010). A few years ago, several computer experts conceived of an IoT system, now a reality, which is an “Internet of smart objects” that “sense, log, and interpret what’s occurring within themselves and the world, act on their own, intercommunicate with each other...” (Kortuem et al., 2010: 31, 30). More recently, Whitmore et al. (2014) see IoT “as a vast network of autonomous, self-organizing devices” (p. 2). In fact, another name for IoT is an M2M, or a machine-to-machine, system. As a result, humans will be increasingly dependent on, if not controlled by, smart prosuming machines that communicate with other machines of this type. This promises to create even more extreme posthuman and postsocial worlds.⁷

Notes

1. One implication of this is that *all* economic acts should be seen as forms of prosumption. This would seem to limit our analytical capacity, but the idea of a prosumption continuum with its innumerable points between p-a-p and p-a-c actually greatly enhances that capacity in comparison with the simplistic (and erroneous) production/consumption binary. It is also possible to think even more grandly and go beyond the economy and argue that *all* social acts are analyzable from the perspective of the prosumption continuum.
2. While the traditional terms of production and consumption are employed here for the sake of simplicity and clarity, these phases should also be seen as being subsumed under the heading of prosumption.
3. Throughout this article, I will use prosumption-as-production (p-a-p) and prosumption-as-consumption (p-a-c) to designate prosumption processes and prosumers-as-producers (p-a-ps) and prosumers-as-consumers (p-a-cs) for those who engage in those processes.
4. This view is based on the thinking of Friedrich Nietzsche and Walter Benjamin. Benjamin (1999) is far more concrete and sociological in his work on this topic. He draws on Nietzsche (Benjamin, 1999: 337) and applies his key concept of “eternal return [or eternal recurrence] of the same” (p. 71) to the social world. This means, of course, that Benjamin (1999) is critical “of the concept of progress” (p. 298), especially of revolutionary progress.
5. For the sake of convenience, the digital and material worlds are discussed separately, at least in this context, but it is clear that they “augment” one another (Jurgenson, 2012).
6. Among the places in which I differ with Rey on this issue is on the idea that presence is required in ambient production. For example, wearable technologies can produce results such as a notice to a hospital without the wearer being present there.
7. Similar in many ways to a world dominated by the fictional Skynet system in *Terminator* movies.

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