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People have the power

Appropriate technology and the implications of labour-intensive making

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Within sustainable development discourse, the issue of energy is particularly powerful – no pun intended. Reliance on fossil fuels has a multiple impact on the ecosystem, from the blight often inflicted on natural landscapes when oil and gas are extracted and shipped around the planet up to the quantity of carbon released in the atmosphere when they are burnt. When fossil fuels are turned into other forms of energy, they power machines that easily outdo humans in productivity, just as the Luddite conservatives lamented in the age of the Industrial Revolution. Appropriate technology (AT) is an approach proposed to escape both energy-intensive lifestyles and unemployment-yielding mechanization. First formally articulated by the economist E. F. Schumacher, AT favoured labour-intensive approaches to production as opposed to capital-intensive ones, and labour-intensive modes of use as opposed to energy-intensive ones. Less mechanization, and more muscle power. Less state-level planning, and more decentralized management of production. This decentralization would happen, thanks to the creation of smaller units that relied on self-sufficiency and identification with one's local community (Schumacher [1973] 2011).

E. F. Schumacher was a German-born exile who took refuge in the UK during the Second World War. In the 1930s and 1940s, while a research fellow in economics at the University of Cambridge, he worked with John Maynard Keynes and became acquainted with the Aston family, the owners of the *Observer* newspaper. After the conflict, he naturalized as a British citizen and worked for the National Coal Board for two decades. In 1947, he started regularly contributing to the *Observer* on planning and economic matters. AT's vision was originally suggested as a means to support a gentle, considerate industrialization of former colonies with the formal dismantlement of the British empire after the Second World War. Schumacher perceived the introduction of manufacturing models borrowed from Europe and North America as a danger for the social structures of countries where labour was abundant and inexpensive. Energy-intensive machinery needed fewer workers to produce large amount of goods, leaving many unemployed. His first-person analysis and his personal opinions were translated into the proposal for an intermediate application of technology

in the form of small-scale manufacturing tools and techniques. Schumacher did not find surprising that this would cause a decrease in the pace of production, but he considered achieving an increase in employability much more desirable (Schumacher 1975).

In the first part, this chapter looks at the genealogy of AT and the Intermediate Technology Development Group (ITDG), the organization Schumacher founded in 1966 as an instrument to implement the theory in actual projects. It will then examine some examples of AT artefacts and pieces of machinery designed for the so-called developing world. This review will also allow us to come to a set of conclusions about the implications of this centre-periphery – or more precisely North-South – approach to design for labour-intensive use. Schumacher's own reading of historical processes such as modernization and industrialization raises the question as to what extent his labour-intensive model can be said to empower the individual, as opposed to confirming the preexisting social, political and economic structures. If social forces shape artefacts and technology (Bijker and Law 1992), and communities are built around shared technical knowledges (Leroi-Gourhan 1945), then the material environment a society builds around itself is ultimately a projection of its aspirations.

Appropriate technology in the context of decolonization

In April 1976, the chair of the UK's Royal Commission on Environmental Pollution, the physicist Brian Flowers, was invited to pronounce the opening address to a symposium on 'Design for Need: The Social Contribution of Design', held at the Royal College of Art, London. The symposium was promoted by the International Council of Societies of Industrial Design (ICSID), an international organization that unites a series of national design agencies and institutions, and aims to represent the voice of the design profession worldwide. Flowers started his intervention by expressing his disappointment around the absence from the event of his colleagues of the Imperial College, London – engineers and scientists who were at that very moment working on technologies aimed to solve the very issues listed by ICSID as topics of discussion during the symposium: environmental technology, prosthetics, conservation of energy resources, even technology literacy in India. He proceeded to lament the fact that technology was seen by his contemporaries more as a threat than as an opportunity, admittedly because the most recent advances in technology had been intimately associated with warfare. He then appealed to designers for helping to bridge this gap: 'You use your privilege of being artists to question the established rightness of things, you subvert the industrial society, you propose alternatives' (Flowers 1977, p. 12). The remark might have sounded quite unfortunate to the audience in a moment in which design education and design theory were intensively absorbing methods and concepts from disciplines such as anthropology, semiotics, cybernetics and ecology. Also, Buckminster Fuller preferred to speak about 'design science'.

What were the alternatives Flowers was championing? Most of the technologies he mentioned in his talk, he admitted, are energy-intensive, and the 'world is burning up its resources fast' (1977, p. 11). Those technologies implied a way to progress based on labour-saving, energy-consuming, capital-intensive modes of production. 'Could there be something wrong with economic theories that require massive unemployment to solve our problems?' asked Flowers to his audience. 'High technology seems at present to demand such a course. Might it not be better to choose a technological path based instead on full employment and human dignity?' (1977, p. 10). Yet, he added

later, 'We shall need more technology, not less. But it will have to change its direction, towards something the world can better sustain. Is this what this Symposium is about?' (1977, p. 11). Flower's questions tap into the intellectual milieu of the age, with design undergoing an 'anthropological turn': a realignment of strategies and intents in which the overarching rationalist worldview of modernist design was replaced with a social agenda articulated as interventionist vernaculars (Clarke 2016).

AT was one of the theories discussed at the Design for Need symposium, and it offers the opportunity to look exactly into the question of energy within this new intellectual environment. The theory was first articulated by Schumacher as 'intermediate technology' in an article called 'How to Help Them Help Themselves' that appeared in the *Observer* on 29 August 1965, in which he took stock of his experience as visiting planner overseas. In 1955, Schumacher had taken a three-month sabbatical from his position as civil servant at the National Coal Board. He used this period to visit Myanmar, which had then been the independent republic of Burma for only eight years, and since that first trip he had taken an interest in the economic planning of the newly decolonized countries that were then one by one departing from the British Empire. The issue of their industrialization was central, especially at a time when the two main world powers were competing to recruit countries into their blocs and prepared to transfer technology to obtain this goal. In his 1965 *Observer* article, Schumacher's concept of intermediate technology was a response to what he perceived as a problem, namely the implementation of mechanized production in developing countries. In Schumacher's 'us-and-them' narration, the version of the history of technology he adopted was one of a linear progress from less complex machinery and techniques to more complex ones. It also alas implies a moral duty on the part of the most 'advanced' societies to look after the less developed ones.

Schumacher's opinions had been anticipated during the debate on technology choice that had taken place in other former parts of the empire during its dismantlement. Among decolonized countries, the example of India is illustrative, for it saw in the very early years of its existence as an independent democracy the direct confrontation of two contrasting visions on technology and industrial culture. These visions were embodied in the two early political leaders of the state. Mahatma Gandhi favoured a labour-intensive, low-technological approach. This was iconically represented by the charkha, which became the symbol of his political movement and that today figures at the centre of the national flag. The charkha is a light and portable spinning wheel that really allows for mass production only if used by a large number of workers. This vision relied less on government-led planning and allocation of resources and more on the responsibility of the individual to contribute to the national domestic product through the immediate reward of hand-assembled produce – the specular contrary of the Marxian alienation of the labourer on the assembly line (Cotgrove 1972).

On the other hand, Jawaharlal Nehru, the first prime minister of the country, supported big technology and large-scale design interventions on the environment. These interventions included the large-scale dam projects he considered to be the new temples of the country, or the construction of Chandigarh, the new capital of Punjab that was planned and mostly designed by Le Corbusier during Nehru's term of office (1947–64). The founding of a school such as the National Institute of Design in Ahmedabad in 1961 was largely the result of a report on design training commissioned by the government and written by the American designers Charles and Ray Eames (1957). According to the STS scholar Roli Varma, Schumacher also offered his advice to the young democracy, but his recommendations to rely on intermediate technology were ignored by the government (Varma 2003).

Schumacher's proposal could rely on a remarkable amount of social capital. The same year as his article appeared, a formal organization called Working Group on Intermediate Technology was established in London to explore the implementation of intermediate technology in former colonies. The organization was founded by officials from a heterogeneous collection of interest groups made up of philanthropic organizations, government bodies and private corporations. The former included the Freedom from Hunger Campaign, the Society of Friends and the Ariel Foundation. The state was represented by the UK Ministry of Overseas Development, the Commonwealth Development Corporation and the Overseas Development Trust. The industrial partners included the engineering firm Rubery Owen, the oil consultants Walter J. Levy and the Bowater Corporation, among others. The Shell oil corporation was also an early supporter, in what in hindsight could be seen as either an early attempt for a major corporation to polish their public image or a genuine investment opportunity ('Action on Intermediate Technology' 1965). During its inception stage, the group was headquartered in the offices of an organization known as African Development Trust, itself administered by the African Bureau, a non-governmental institution founded and directed by anti-apartheid activist Rev. Michael Scott (Jack 1960).

In 1966 the Working Group on Intermediate Technology was renamed Intermediate Technology Development Group. In 1967 it relocated to new offices near Covent Garden, London. The ITDG at that point was led by Schumacher and two assistants of his, George McRobie and Julia Porter. The former was a Canadian researcher who immediately before the founding of ITDG had studied traditional folk technology in the Canadian Arctic regions, the Scottish Highlands and India. Julia Porter was largely responsible for fund-raising (Porter 1969). Another two members who were notable during the first decade of the ITDG existence were Marilyn N. Carr, who was also a civil servant at the United Nations, and was interested in gender issues, and Peter Stern, an engineer who mostly worked on the development of water and sanitation systems.

We shape our machines: Making and empowerment

Where not only colonial powers but also their companies were being identified as part of the machinery of colonization, their leaving could be called for as part of the decolonization process. Within this landscape, intermediate technology potentially provided an opportunity for former colonial ties to be maintained under a different name. This could happen both at governmental level with the involvement of official bodies and in terms of the personal network commonwealth officers had previously built and could continue to rely on as consultants for the ITDG. Most importantly, it was also an occasion for British industry to supply developing markets with basic, simple pieces of machinery and tools. A review of the titles of the articles the press in Britain and beyond dedicated to the new sensation paints a picture of the expectations placed upon the whole enterprise.

In 1966 the *Financial Times* published two articles about intermediate technology. The first, on 28 July, was unequivocally entitled 'Old Technology – A Possible Boon to the Emerging Nations' and went under the section heading 'U.K. Machinery':

> A recent British export mission to Nigeria took with it a booklet listing hand-operated machinery being made in Britain … Dr. E. F. Schumacher, the National Coal Board economist

> who was formerly a consultant to the Indian government, argues that the setting up of modern factories in these countries can even harm their backward populations by ruining their traditional craft trades and discouraging them from progress … [The] encouragement of intermediate technology could do more than anything else to raise demand for all kinds of goods in the countries where it operates, and this can only benefit the British export drive. ('Old Technology' 1966)

The booklet mentioned in the *Financial Times* article was then gradually expanded and eventually printed for sale in 1967 with the title 'Tools for Progress'. The publication was a catalogue of products and designs that could be mail ordered from British companies. The other article was published four months later, on 14 November 1966. It was titled '"Simplified" inventions for the developing world' and featured a photograph of a hand-operated washing machine designed and manufactured by Colgate-Palmolive for the Mexican market. The US corporation was one of the early funders of the ITDG. The article also made a first connection between the work done by George McRobie in Scotland, implying that the potential of intermediate technology could be put at use also in less developed areas of Europe and North America.

Other stories featured in magazines or newspapers occasionally had even more crude titles, which reflect views that were common currency at the time. A feature entitled 'Inexpensive Technology' appeared in the December 1966 issue of the science magazine *Nature*. Another one entitled 'Simple Equipment for Simple People' was published in *The Statist* on 16 December 1966. Another early supporter of Schumacher's ideas was the Catholic Church. A conference on intermediate technology and development was held in Rome at the Vatican City in October 1968. The official newspaper of the Vatican City, *L'Osservatore Romano,* ran several stories on the event. In these news items it routinely reminded the reader that the rationale behind all the contributions to the conference was to focus on human well-being as the main objective for development.

Between 1968 and 1970, *Tools for Progress* managed to be enthusiastically reviewed in outlets as diverse as the July 1969 edition of the *Whole Earth Catalog*, the *Standard Bank Review* in 1969 and the Shell oil corporation's magazine *Span* in 1970. The hat-trick is particularly remarkable because the *Whole Earth Catalog*, edited by countercultural superstar Stewart Brand, was an extremely respected publication within the North American countercultural movement for its dedication to self-sufficiency, do-it-yourself, holism and ecological design. Any form of liaison with big corporations was, by them, categorically ostracized. Like *Tools for Progress*, the *Catalog* was also a mail order catalogue that featured information and product reviews. Remarkably, its subtitle was 'Access to Tools'. The common investment in this phrase is a marker that they bought a shared affinity with a humanistic milieu that aimed to reappropriate the machine to man, and make the alienating industrial means of production a means of individual self-development. This is how the *Catalog* praised *Tools for Progress*:

> Great Britain does it again (I'm beginning to feel like a Loyalist) way ahead of the let-General-Motors-do-it U.S. Here in one tasty catalog are all the 'equipment and materials for *small*-scale development available in The United Kingdom'. Pictures, description, prices, and detailed access information on all manner of do-it-ourself tools, from hand ploughs to air houses. (Whole Earth Catalog, 1969, p. 91)

The photograph that accompanies the review features what seems to be the cover of a provisional print proof of *Tools for Progress*, with a series of black squares where the images would then actually be printed. Thus, it might be the case that the *Whole Earth Catalog* review was actually informed more by enthusiasm for a project only superficially known and less by an actual familiarity with it.

In 1971 ITDG commissioned a study to Bridge, a consultancy based on Sloane Street, London. Bridge submitted a report with recommendations for future administration, promotion and funding of the group. The document was extremely matter-of-fact and included a detailed vision for the group, which up to that point had been run by Schumacher, McRobie and Porter in a casual fashion. Bridge's vision for the ITDG featured a formal organization chart and dedicated a remarkable amount of attention to the issue of the name. The group did not change name immediately, even though internally the wording 'intermediate technology' indeed kept being considered confusing. It seemed to refer exclusively to developing countries, and thus restrict the organization's horizons. During the early 1970s, the expression 'appropriate technology' started to be used in its stead. It was perceived to be more universal in tone, and more inclusive.

In October 1974, George McRobie was invited to open a series of lectures on environmental issues held at Imperial College, London, under the auspices of the Institute of Cultural Research (1975). His paper was titled 'Toward a Non-violent Technology' and developed on a theme that Schumacher had already touched upon in his essay 'Technology with a Human Face', in which he argued that modern technology had become 'inhuman' because its benefits have not been distributed equally across society. Technological advance, in Schumacher's reading of the history of technology, is used by the elites as a means of capital extraction, rather than a way to achieve better living conditions for the masses (Schumacher [1973], 2011, pp. 120–34). In his talk, McRobie pointed out that technology is a field to be negotiated through individual choice (1975, p. 2). Instead of merely accepting technology as something imposed upon us, individuals can appropriate it as a means of personal development. McRobie mentioned a series of allied experiences, which signalled that AT and ITDG were not isolated realities. Among these examples were the dire forecasts of the 1972 book *Limits to Growth*, and the work of organizations such as Friends of the Earth, the Soil Association (also led by Schumacher) and the Conservation Society, and magazines like *The Ecologist*, *Undercurrents* and the *New Scientist* (McRobie 1975, p. 5). Participation within design and manufacturing was in fact a professed core aim of the AT movement throughout its history (Day and Croxton 1993, pp. 179–83). Technology, argued McRobie, did not proceed along a linear path. Individuals were not forced to follow a single line of technological determinism:

> If, as many of us now believe, the structures based on large-scale 'robber economy' technology are increasingly unacceptable on social and human grounds; threatening to our survival on ecological grounds; and increasingly insupportable on economic (energy) grounds; then the economy we must envisage must be less city-centred, with manufacturing … much more evenly spread throughout the country, and families, communities and society as a whole much more self-sufficient in food and the basic necessities of life. (McRobie 1975, pp. 6–7)

During the second half of the 1970s, McRobie kept writing about technology choice in 'rich countries' (McRobie 1981) and submitted at least one proposal for governmental funding on the establishment of an AT programme for the UK (McRobie s.d.). However, the only outcome of the

programme was a series of studies commissioned by ITDG to Loughborough Consultants Ltd. Among the papers the Loughborough University–owned consultancy firm produced for ITDG, one proposed to implement AT as a means to prolong cars' lifespan. A few pages into the report, the idea that design can contribute to overcome quick obsolescence is quickly abandoned by the authors. Car buyers, they argue, would not be prepared to purchase vehicles that are more durable and expensive than the current ones on the market. Neither would they accept settling for vehicles with a lower technological content. In its stead, they propose a marketing strategy. Cars would be leased to consumers with servicing included, in order to maintain economies of scale for the manufacturers and create jobs in the sector of repair and maintenance. In effect, less than on environmental sustainability, the focus of the proposal was more on reaching a compromise between the needs of industrial development and maintaining constant employment through technocratic planning (Loughborough Consultants s.d.). For all intents and purposes, this programme would have effectively been state-run car leasing.

Our machines shape us: Making and subjectivization

During the 1970s and 1980s, ITDG published a series of Project Bulletins (Intermediate Technology Development Group 1979–86). These profiled completed projects mainly for fund-raising purposes. They provide a number of details on the way the group operated in that period (ITDG 1979–86). At the time there were three offices in the UK: one in London, one in Rugby and a workshop hosted by the University of Reading. The group was staffed predominantly by designers and engineers who would look for problems to solve in the developing world and conceive solutions. The Reading and Rugby offices developed and tested prototypes. Many of these designs were, however, actually then commissioned to British manufacturers and then shipped to Africa, South Asia or Latin America.

The 'small farm transport vehicle' provides an example of the limitations this UK-centric approach suffered. The vehicle, a sturdy hybrid between a wheelbarrow and a forklift, was designed and built by ITDG before 1985. After the early prototypes were sent to the southern Indian state of Tamil Nadu, the local ITDG staff realized that the ergonomics of the vehicle did not suit the most common body proportions among the intended users. The bulletin dryly reports the episode in these terms: '[The] prototype demonstrated that minor changes were required to the handle geometry to suit local people. These changes were incorporated on later prototypes.'

Thomas Kuby was a German designer who, after studying at the HfG Ulm, the Institute of Design in Chicago and Royal College of Art in London, worked for ITDG until 1973. In April 1976 he presented a paper at a symposium held at the RCA on 'Design for Need: The Social Contribution of Design' (Kuby 1977, pp. 33–8). In his presentation, Kuby gave an account of a particular piece of equipment designed by ITDG, the egg-tray machine. This was a project that Schumacher himself had initiated and that was routinely quoted as a successful example of AT (Marsh 1978, p. 851; Matlock 1981, pp. 129–41). The problem the machine sought to solve was the lack of suitable forms to transport the eggs to market in Zambia. Paperboard trays like those in use in Europe or North America would have improved transportability and enlarged the potential market for the goods. However, the smallest machine on the market in the early 1970s had a capacity of 1.3 million

trays per year and cost roughly GBP 120,000. The machine was fully automatic and required only one operator. Pace and volume of production were beyond the needs of the users the machine was meant for. ITDG, writes Kuby, 'set out to develop an intermediate alternative and in technical terms it succeeded'. The first prototype exceeded all expectations and cost merely GBP 6,000, one twentieth of the original price (Kuby 1977, p. 37).

The issue with the machine, however, was that ITDG was using the existing social, economic and political structures to develop and deliver its machine, and in so doing, they were only confirming them. Design and technology are shaped by social forces, they reflect the aspirations of a community. But the intervention of ITDG in Zambia was actually providing more of an obstacle to the process than facilitating it. The machine was manufactured in the British Midlands and then shipped to Africa. A short informational video was also released by Thomas Kuby himself to show how the machine worked. In the five-minute film, allegedly shot in Limuru, Kenya, an ITDG engineer is shown demonstrating how the device works to a surprised local. The machine is fed water and old newspapers, which are rendered into a pulp and then pressed into shape by a moulded hand press. At the end of the film, the learner is made to stand on a pile of egg trays to show their resilience. The film closes on the smiling, surprised face of the supposedly future operator of the labour-intensive machine. Once in Africa, the governmental authorities and the entrepreneurs who had ordered it started requesting amendments and modifications to its design. Distribution channels departed from main urban areas, and so a small volume of production was less than desirable. The fact that ITDG designed labour-intensive machinery suddenly became an opportunity for the machine owners to increase profit margins:

> Step by step … the 'alternative' character of the new technology has been eroded. Today a Mark III version of the egg-tray machine is being built which is said to produce more than two million trays per year and to cost £100,000. Scale, output and price being about the same, the intermediate technology concept shrinks to a cynical proposition to offer the poor countries of the world a primitive, labour-intensive technology which has most of the disadvantages of large scale while lacking all the positive sides of modern technology and automation. The story seems to have gone full circle but it isn't even back where it started. (Kuby 1977, p. 37)

In fact, as early as 1975, the Swedish economist Claes Croner had expressed scepticism at the World Bank's decision to fund a number of intermediate technology projects in an article in which he reviewed the conceptual premises of intermediate technology. Croner warned in particular against the dangers associated with the naive reasoning that low wages were a good ground for adopting labour-intensive production. Labour seemed cheap only when thought about in Western standards. But in fact what is low is not the price of labour, but the workers' wages; as Robert Solo argued in a 1969 review of labour-intensive technology in developing countries:

> The low level of wages of labor in developing countries has been put forward naively as the reason for adopting labor-intensive technologies … . certainly wages in these countries are extremely low – but this does not mean that labor is cheap. The laborer may be cheap, but his labor, understood as an input in production, can be very expensive compared to the labor inputs purchased for a much higher wage rate in advanced countries. (Solo 1969, p. 98)

When technologies like those provided by ITDG were delivered to a developing country without changing any of the existing political, economic and social structures, the effect was paradoxical:

> Only in a development strategy that aims at transforming the basic structure of underdeveloped countries, i.e. the foreign dependency, ownership and power relations and income distribution, will the development of massive labour-intensive methods in certain sectors become a meaningful and viable means for creating productive employment. The application of large-scale labour intensive methods … presupposes that the low rate of wages – which is one of the most dramatic manifestations of underdevelopment–will be maintained, reduced further or, alternatively, that wages grow at a significantly lower rate than labour productivity. While this may be a realistic assumption in fascist-type military dictatorships like Chile or Brazil (which, incidentally, are also supported by the World Bank), it is not likely to be acceptable to Indian construction workers. (Croner 1975, p. 1777)

AT machines and tools were purportedly designed as a means to bridge the technological gap between industrialized and industrializing societies. Their proponents recruited support on the basis of an apparently reasonable argument: that labour is more abundant in developing countries and that it is reasonable to tap into this resource instead of relying on mechanization, or building the necessary infrastructure to reach remote areas. This assumption is technically plausible, but it is also the limit of AT. The tools and the machines might be ingenious and functional, but they mostly fall short of representing the aspirations of supporting individual or social development. The labour that powers their gears is imagined to be inexpensive, and it winds up being forced to stay in that state of inexpensiveness: 'The problem with employing object-centred methodologies to work that is based in the social is that the latter remains an immaterial space; it consists of intangibles, such as Michel Foucault's "always-ready" pervasive power structures' (Janzer and Weinstein 2014, p. 330). Machines function as moulds that shape their subjects, but, at the same time, one also continuously struggles to change that mould and readapt it. The passive subject wants to be an active subject.

Conclusion

The decolonization process provided an occasion for AT to receive attention, attract resources and actually be implemented in South Asia, Africa and Latin America. Its proponents were then quick and keen to emphasize its universal scope. Small-scale, miniaturized, fragmented social and industrial structures were celebrated for being more advanced than the mammoth-like structures of the past. AT received governmental funding in Britain to test and experiment viable approaches to industrial design and production even at the national level. This all happened within less than a decade after Schumacher's original manifesto had first been launched from the pages of a British newspaper (Schumacher 1965). Opportunity, vision and translation were initially crucial in establishing its credibility. AT remains popular with design education and development aid (Mulberg 1993; Nieusma 2004). As a programme, however, over the decades it lost ground in the developing regions of the world it had originally been conceived for because of its inability to generate economies of scale, and function in a competitive environment.

Its principles have in fact found a more fertile ground in Europe and North America (McRum 2011). Recently, the repair and the maker movements have also situated themselves along similar lines, being small scale, slow approaches that ultimately rely on the (self)enrolment of the users as source of labour. Labour-intensive, small-scale fabrication and a vague notion of 'enoughness' also imbued Radical Technology and other DIY movements of the 1970s. If the infusion of labour in the life cycle of an artefact is stretched beyond the phase of manufacturing, it can be ultimately assimilated into the moment of use or consumption. During the past decade, several authors and researchers have studied the implications of this overlapping of roles (Mugge et al. 2009), or the effects this form of participation has on product lifetimes through emotional attachment (Chapman 2005). When the distance between makers and users is reduced, they often end up being the same person (Knott 2013; Ritzer and Jurgenson 2010).

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