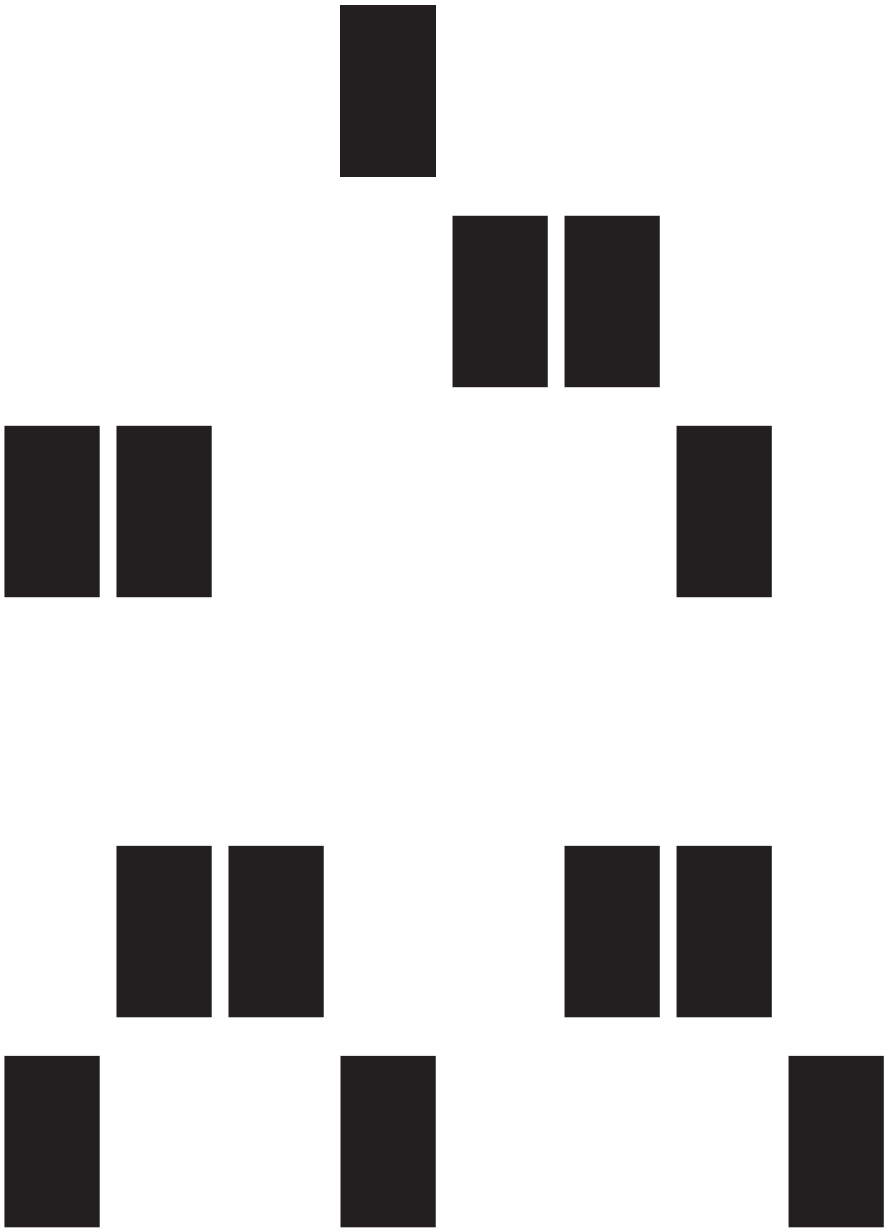
WHAT WILL WORK BE TOMOR-ROW?



Work and Wellbeing in Digital Public Space

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Work is changing rapidly as the dimension and scale of digital instruments continue to rise. A vast space of memory, processing power and connectedness changes the physical workspace, working practices and our relationship to employment and reward. We might think of 'digital space' as an additional or parallel dimension to the physical world. But as the digital dimension opens up scope for massive-scale information processing and storage whenever and wherever it is required, digital space and physical space have become intertwined. Previous technological leaps in worker roles have often been about changes in constraints of space and time – the coordination of clocks, connectivity of ships or railways, the efficiency of mills, office towers and even the physical size of silicon chips. So how is the nature of work changing with the ever-increasing resources and features of digital space?

Digitally enabled processes and tools for work show a trend towards the breaking down of tasks into small, and therefore manageable, component parts. Roles traditionally completed by a single person can be shared in this way across a team. In this essay we propose that there is a quality to digital public space conducive to this fragmentation and that it has an implication for how we define work, how it is carried out and who does it. We set out how traditional worker roles are fragmenting through the influence of digital processes, and as fragmentation continues into smaller and smaller parts, how we are starting to see the possibility for cohesive forms to re-emerge as the resolution (number and density) of the fragments becomes great enough for new meanings of work to appear.

Digital space is changing different aspects of work at different paces, destabilising the balance between aspects of production, management and well-being. Fragmentation in business practice is not new and has historically been beneficial to those industries willing to embrace it through models such as supply chain integration, outsourcing of roles and tasks, and decentralisation. Examples

of successes in free and open-source projects have demonstrated that fragmented management models can match or outpace traditional centralisation.

In this essay we describe trends in the further fragmentation of production and management, largely found in a new breed of digital organisations, where entire categories of work have been dissolved into algorithmic testing and hidden user labour. Individual worker roles have been broken down into complex systems of activity and use, bound together with digital resources and computation. Traditional aspects of wellbeing appear to be slow to keep pace with these changes.

Digital Fragmentation

Digital technology is characterised by the storage, transformation and transfer of information in the form of 'bits', usually computed as 1s and 0s. Claude Shannon[1] outlined the theory that describes how signals, words and data can be held in this binary format and probabilistically communicated, while taking account of loss and noise on the channel. This loss-less processing of information sets out the principles of 'general computation'. A computer that can handle any digital information simply as a series of bits does not need to be built with a specific task in mind and does not need to be re-engineered for each individual task. This disconnection between infrastructure and use means that the science of computation can advance extremely rapidly, and unexpected uses for this technology can evolve. Work roles that were often defined by proximity to or skilled use of a tool or resource can be divided up into component parts.

Large-scale programming projects – native to digital space – are often characterised by a process of fragmentation. In free and open-source projects in particular, roles that would have traditionally been completed by one or two people are often broken down into much smaller parts and carried out by a distributed network of thousands.[2] Searchable storage, annotation, interface design and computational connectedness are used to compensate for the disorder of the fragments, allowing large numbers of people to contribute, but many at a low level of engagement in terms of skills and participation.

This process also makes system rules (algorithms) more important since many separate people carry out similar tasks in widely varying contexts. The process of solving a significant challenge then shifts from the act of a single worker completing a task to a swarm of activity gradually pushing forward on a problem following a set of cascading rules and priorities determined by the group. Splitting a task into multiple parts requires detailed (often automated) planning,

The dependability of a fragmented system of work relies on a redundancy of participants in the process

but can deliver efficiency (productivity, economies of scale, levels of completion). Dividing the tasks up further becomes unmanageable as tracking, inter-communication and documentation workloads increase with the number of parts in the system.[3] The dependability of a fragmented system of work relies on a redundancy of participants in the process. Fragmentation needs to continue far enough that the parts seem to represent a new whole. A traditional job can be substituted by a swarm of activity, which acts as a coherent form at a distance if the resolution is high enough.[4]

We can start to see examples of high-resolution fragmentation in successful open systems. The tone of voice within the articles of Wikipedia for example is relatively consistent despite the community size. The encyclopaedia is sustained by a deep digital space of social interaction, participation tools and historical edits stretching out 'behind' each current page of the website. Wikipedia also features a complex set of instruments to bring this quality into being; from how screen interactions are organised to the consistent information architecture across articles, to editing procedures and participation guidelines. The key aspect of this texture (or resolution) of digital activity is that it was not imposed or predetermined but has evolved over the lifetime of the project (and continues to do so) in response to participants' views, actions and contributions. It is a consensual system.

The Public in Digital Space

How might industries traditionally dominated by paid work draw on wider audiences of participation that open communities regularly benefit from and that appear a necessary component to achieve high-resolution fragmentation?

Free and open-source projects combine contributions from paid and unpaid workers by building on a context of equal, 'public' ownership. Other industries that are traditionally based on private, corporate ownership of creations and products are currently faced with a difficult transition when trying to draw on fragmented worker contributions that include their 'users' or 'consumers'. The problems they face relate to how they are perceived by their customers, how ownership is centrally organised and how they understand the nature of participation and control.

In many instances the corporations and government departments driving digital developments are organisationally indistinguishable from their twentieth-century counterparts. They depend on management hierarchies, careful deployment of resources, attraction of outside investment and shepherding of a globally listed share price.

One model is to hide the nature of the work while using the worker to perform 'human computation'.[5] The financial value of creativity, filtering and documentation in environments like Facebook is hidden from its workers ('users'). They are rewarded instead in kind with some free storage, a highly structured social instrument and software stability. Human computation can be a productive way of solving socially oriented problems since the number of opinions needed to classify a category convincingly varies between tasks; often fewer responses (or computations) are needed to reach full resolution.

The financial value of filtering creativity and documentation is hidden from its workers

Researcher Luis Von Ahn is best known for demonstrating alternative forms of reward for human computation. These include 'fun' as a reward in the image tagging ESP Game,[7] 'fulfilment' in the language-learning transcription site Duolingo and 'function' in the case of ReCaptcha log-in tests that verify a user as human while also digitising scanned documents.[8] Examples like the map editing interface on Google Maps borrow directly from the successes of the Open Street Map project. But the value of the work done in updating a map is downplayed, with the contributions to Google's map being locked into their license agreement, which prevents contributors from adapting their maps for anything but personal use.

The repercussions of lost ownership of the contributions made in all of these systems has yet to be fully examined. Indeed much user participation currently seems to succeed by hiding traditional transfers of ownership deep within the click-through small print of the online terms and conditions. The terms of participation are then heavily weighted on the side of the corporations involved.

Companies are also finding that they can go further without asking their customers to be workers at all. For example, Google's location services for Android phones harvest data from people using the devices. Their maps are faster to pinpoint a location than standard GPS because they draw on a database of known Wi-Fi hotspots. However, this database is updated unknowingly by the users of the system when they agree to Google's terms of service. In summary, access to and supply of work in digital public space is dependent on a series of infrastructural disruptions and features a complex arrangement of technical and social elements whose effects we are only beginning to observe.

Fragmenting Worker Wellbeing

Worker wellbeing is founded on traditions that have changed little in comparison with the fragmentation of production and management. The engineering production paradigm favours efficiency, throughput and clearly definable outcomes. Despite sharply reducing the cost of connectivity, digital technology can also enable disconnection. Personal user interfaces and algorithmic time management can act to reduce human contact. Policies that lack humanity can be enforced more easily if there are no humans to directly witness the impact.

Systems of support for wellbeing, safety and social security have adjusted weakly to fragmented working practices and tend to prioritise aspects of production and resource allocation. Free and open-source projects have not had to consider much of the traditional architecture of social security because there is generally no payment for work. While mechanisms have developed in some digital spaces to manage abuse and marginal voices, other concepts such as minimum wage, maximum working hours or sickness support are largely sidestepped because these are traditionally regulated through pay and union representation, and most contributors to such projects are giving their time for free.

Even in many traditional industries we can see the effects of digital space on wellbeing. Email has allowed employers and managers to shift the risk of time management and accountability to their employees, and shift tasks into unpaid time. Rapid automation has left cohesive working communities suddenly without skills or systems of support. Cheap communication networking allows outsourcing of the service industry to areas of the world with this month's cheapest wages or lowest worker rights, in a race to the bottom. There has been a corresponding attempt to imbue digital systems with human-like characteristics, often related to tone of voice, speed of response and the tropes of physical world affordances such as transparency, lighting effects and angles of view.

While it is true that new communities have emerged in response to distributed working practices (the open-source movement is a good example) around

a shared set of principles, they are often missing some of the essential signifiers of human-scale communities such as limited numbers, face-to-face meetings and informal communications. Shared values are often codified in frequently asked questions and terms and conditions documents rather than negotiated in shifting social contexts. The way digital work interactions are described often conceals their fundamental differences to real-world social dynamics and their essentially metaphorical relationship to real-world interactions.

Digital public space is largely denatured of the rights that people have treasured about work for five generations

We can see the effects of the unequal pace of fragmentation for production in comparison to worker wellbeing in instances where these principles have been applied to paid work. Amazon's Mechanical Turk allows people to sign up to a listing interface and select small tasks to complete for micro-remuneration. A job on Mechanical Turk might involve looking at an image and clicking to indicate if it is pornographic or not. Each task requires only moments of attention and effort, and pays only a few cents or tens of cents. The start-up Task Rabbit goes a step further and requires potential workers or 'rabbits' to bid on proposed neighbourhood tasks listed on the site. The number of participants means that there are likely to be enough workers 'on-call' whenever a task is offered.

What we see is not outsourcing of a company division to another country, but rather outsourcing to each individual worker the responsibility for work space, time management and employment risk. This is exemplified by oDesk, e-lance and Guru, just three among many sites (much like TaskRabbit) that offer opportunities for freelance workers to earn professional income. By 2013, oDesk alone claimed to have brokered $1 billion in online work. The revolution these companies represent is infrastructural and dematerialising. There is no need for employers to consider actual desks, lighting, insurance, healthcare, heating, stationery or legal advice. They are either virtualised or irrelevant to the oDesk workplace.

Employers post job specifications with a budget attached and freelancers all over the world undercut each other to win the work. oDesk provides a measure of security in the form of a legally binding contract. Union representation, income protection, a stake in company decision-making or pension provision are entirely

sidestepped. The hard-won rights of people in the workplace at every level have been rendered obsolete. Digital public space in this context is largely denatured of the rights that people have treasured about work for five generations. The online freelance environment does of course still demand the responsibilities of timely supply of work, completed to budget, featuring a high standard of finish.

The mechanisms of collective wellbeing seem slower to expand into digital space than the practices of work itself. Historically, we have seen new forms of collective bargaining evolve as technological invention gives rise to new forms of work. Can we expect that the same affordances of digital space that have made production and management more efficient through fragmentation may also enable new forms of insurance and protection for workers?

Might we imagine, for example, a geographically distributed team of workers, having developed an efficient working practice through collaborative online gaming, who 'job-share' a single well-paid job that requires someone to be on-call at unexpected hours? Or could it be possible for a group of zero-hour contract workers to collaborate on reallocating their unreliable shifts between the group depending on their own childcare responsibilities? The same methods for splitting work into smaller, more fragmented tasks could act to more evenly distribute the kinds of work that have historically been divided along gender and class lines.

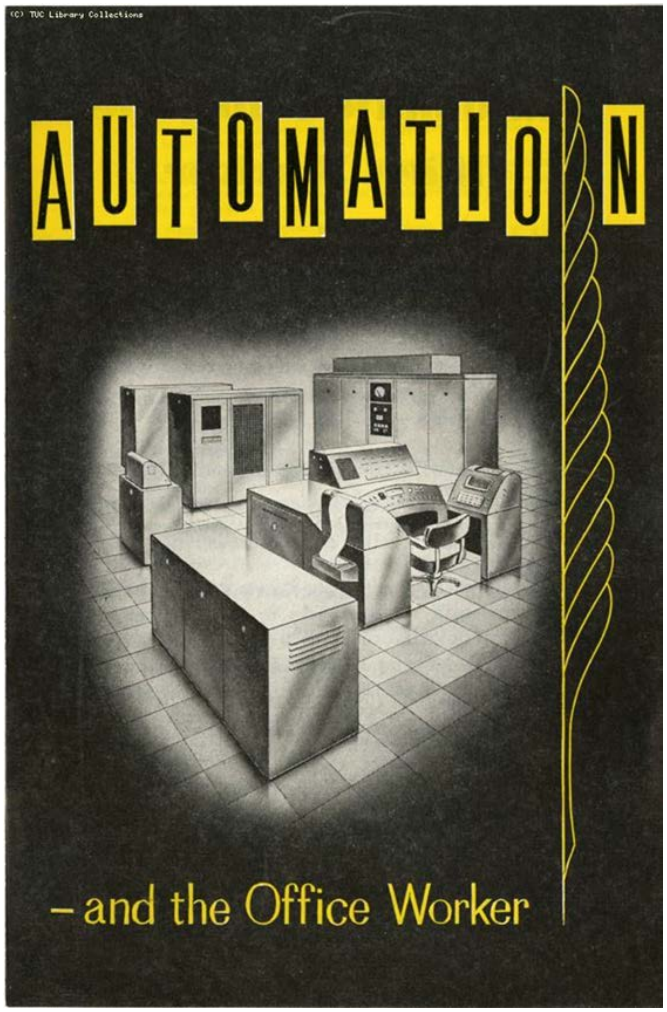
Fragmented worker wellbeing may also draw on the support and recognition systems of unpaid work. As worker roles become split into small low-paid tasks or unpaid user labour, communities of support, patterns of lower consumption and non-financial trade may become more important. These forms have substantial precedent in work such as care or craft that is historically unpaid or undervalued in terms of remuneration.

In summary, existing digital affordances have important implications for the rights and responsibilities of the future workplace. We recognise that a pre-existing set of social and technical instruments for collaboration, collective bargaining and wellbeing can be adapted and configured to offset some of the negative effects of these affordances. Global networking enabled the outsourcing of business activity far beyond spatial constraints and national borders. Rapid-access storage allowed for documentation of tacit knowledge and progress tracking, enabling tasks to be divided into even smaller parts still. Search and algorithmic ranking has further helped management to control and coordinate the fragmentation of task completion. User labour has allowed businesses to draw on similar growing scales of contribution without having to acknowledge the people solving the tasks as workers.

Through all of this, mechanisms of wellbeing have struggled to keep pace. A rhetoric of flexibility and freedom-to-participate hides the production efficiency needs of business practice. Digital tools of mass customisation have further helped to foster an, often shallow, sense of personalisation and individual importance – change your profile picture and live in the Google filter bubble.

However, outside of the co-ownership models in free and open-source projects, traditional concepts of worker rights, representation and negotiation have largely failed to keep up with digital tools. The eight-hour working day was achieved on the back of collective representation and negotiation of workers' rights built on professional and industry-based structures. What might digital post-fragmentation unions be like? Could there be task-level unionisation, micro-whistleblowing and radically networked worker councils? We call for new integrative forms to emerge from the fragmented nature of online 'employment' and new digital protocols for wellbeing in a person-centred digital workspace.

1 Shannon's work in the late 1940s turned out to have profound implications not only for computer science, cryptography and communications research but also in psychology and sociology and across the humanities. See C.E. Shannon, 'A Mathematical Theory of Communication', *Bell System Technical Journal* (July/October 1948).
2 For example, rather than one programmer trying their software on hundreds of different purchased test computers, they might use a system to elicit feedback from thousands of volunteer users each already using a unique computer setup, and hundreds of fellow programmers interested enough to rank or tidy some of the resulting information.
3 This is the argument of the 'mythical man-month', that adding more people to a project often increases the workload because of the burden of communicating changes in the larger network.
4 For example, a well-fragmented business support system may contact a customer via web chat, and then email, and then phone call with the consistency of a single personal conversation despite being serviced by a series of temporary support staff and additional customer tracking systems.
5 Cognitive work which humans are better at than computers.
6 'Players' in pairs try to guess words to describe images, which also provides effective labels for those images – now licensed as Google Image Labeler.
7 'Learners' practice a foreign language by translating short texts, and simultaneously help to translate the web in to their home language.
8 'Users' are shown two words they must type to submit a form, thus deterring spam and also helping to digitise poorly scanned words from books.



Automation and the office worker, 1961. Courtesy of TUC Library Collections, London Metropolitan University