Exploring Cooperation with Social Machines

Sally A. Applin / Michael D. Fischer
University of Kent, Canterbury SAC
Centre for Social Anthropology and Computing
Marlowe Building, Canterbury, Kent CT2 7NR
+44 1227 823144
sally@sally.com / m.d.fischer@kent.ac.uk

ABSTRACT

As humans become more and more immersed in a networked world of connected and mobile devices, cooperation and sociability to achieve valued outcomes within geographic locales appears to be waning in favour of extended personal networks and interaction using semi-automated agents to support communications, transportation and other services.

From a messaging structure that is complex, multiplexed and much of the time asynchronous, conditions emerge that disrupt symmetry of information exchange. People thus encounter circumstances that seem unpredictable given the information available to them, resulting in limited or failed cooperation and consequent quality of outcomes. We explore the role of Social Machines to support, change, and enhance human cooperation within a blended reality context.

CCS Concepts

• **Human-centered computing Computer supported cooperative work** • *Human-centered computing Collaborative and social computing devices* • **Applied computing Anthropology** • *Computing methodologies Mixed / augmented reality*

Keywords

Cooperation, Sociability, Community, Automation, Social Machines, Blended Reality. Geography, Anthropology.

1. INTRODUCTION

A critical challenge for Social Machines research is to design and develop systems that support and enhance human social interaction within a given Social Machine. The Social Machines environment we currently dwell within has emerged from adaptation by people to more and more computerisation and automation. Our social connections are increasingly found on the network, rather than in our geographic location (local locale).

One of the key outcomes of social interaction and consequent social relationships is cooperative interaction, where people collaborate directly or indirectly, to achieve jointly acceptable outcomes. Virtually everything we value in our day-to-day life is a result of such collaborations, including family relationships, access to food, energy, transportation, and the security of our person and possessions. In short, most of what we value and require in order to live is a result of successful cooperation. In modern urban society, these 'collaborations' can be very indirect. Few of us have direct relationships with most of those we depend upon. Over time, a complex system of interrelations between groups and locations has evolved that generally ensures we can live the lives we do. These circumstances are not unique and are always changing. However, in change, it is critical that the outcomes that we depend upon are not disrupted to the point these cannot be recovered. Thus, any changes to social interaction are worthy of attention.

Cooperation depends on successful communication. When social interactions are on the network and distributed across multiple geographic locales, the cooperation these foster may have limited benefit in a given local locale. When interaction was mostly limited to a local locale, people in that locale would frequently benefit indirectly from cooperation by others in the locale, without necessarily being aware of that cooperation.

Activities that depend on cooperative efforts have increasingly shifted to the communications network. The various social networks that comprise the communications network interact without a strong mechanism for connecting groups to each other, other than the coincidence of individuals bridging multiple social networks through joint membership.

The shift of cooperative efforts from local locales to Social Machines is only a concern if the shift fails to induce a means for people to reproduce their way of life. Social Machines may be a part of the response that must emerge to address such change. Such change promises to bring about many new possibilities. However, within that change it is also important to maintain some level of continuity.

Consequently, Social Machines have the potential to improve how organised cooperation is coordinated, and even semi-automated, without being creepy, privacy invading or rigid. We explore the role of Social Machines to support, change, and enhance human cooperation in physical, geographic local locales.

2. Cooperation Shifting to the Network

2.1 Managing Messaging

PolySocial Reality (PoSR) describes the dynamics of multiple, multiplexed, synchronous and asynchronous messages within a network of agents; messages we se

messages are not received or responded to within a required timeframe. Outcomes from PoSR dynamics can be merely inconvenient when people are mainly monitoring connections and messages, when the messages are social 'pings', or when the content of the messages can be anticipated due to familiarity with the task, or with the other parties. But when messages are critical, for example, acting as a token of control in an automated subsystem, missed message coordination can effectively assign automated systems unintended agency that conflicts with human agency. Successful receipt of messages matter because these foster cooperation. For cooperation to work well, first and foremost, critical messages must be successfully received and understood. As outcomes of PoSR dynamics, messages can be received and understood, not received, or received and not understood. In the latter two cases, the opportunity for cooperation is greatly diminished or dependent on enough familiarity between parties and skill in the tasks involved to anticipate a critical message.

Failed cooperation can be due to a combination of human and machine errors, or due to lack of opportunity. Real world examples of failed cooperation due to poor communications can be a simple as someone not receiving a message to meet a friend, or as grave as a cargo ship not receiving a message that a traffic bridge is down and unknowingly sailing through it leaving people drowning in its wake. Automated messages that are not well designed can decrease the effectiveness of cooperation. A parking ticket machine that can only receive commands in a certain order or the process breaks down, or the program that enables retail transactions in a certain order, but cannot be interrupted or changed once it is in motion, can cause frustration and problems for people as cooperation between the human and the machine is disrupted.

2.2 Humans and Algorithms are Co-Adapting

Smart and Shadbolt (2014) state that "social machines are best understood as systems in which human and machine components make complementary contributions with respect to the performance of some larger joint process" [2]. This could be interpreted as the foundation for a joint process of cooperation.

Applin and Fischer (2015) argue that we are entering a cycle where humans and algorithms are adapting to each other. Humans are filling in the gaps where algorithms cannot easily function, and algorithms are calculating and processing complex information at a speed that for most humans is not possible. Together, humans and computers are sorting out which is going to do what type of task. It is a slow and tedious process that emulates a kind of sociability between entities in order to form cooperative outcomes. Either one or both parties must yield a bit for cooperation to work, and if a program is developed in a rigid way, the yielding is usually done by the human to varying degrees of frustration as agency (our ability to make choices from a range of options) becomes constrained by the process of automation. Indeed, sociability and social relationships depend on the assumption of agency on the part of the other, human or machine [3]. Humans often attribute agency to machines in their assumptions underlying how the machine will satisfy their present need, or indeed inhibit them from satisfying a need.

People communicate and cooperate in varying degrees of success with machines on a daily basis via our mobile devices. Humans are cooperating with machines and through these, cooperating with other humans who may not be in their same geographic location. To achieve this type of cooperation, people must first negotiate with the specific device's hardware, then its software, then a communications layer, which may or may not be wireless or mobile technology, which they then use to connect to others via voice, text, or other types of software enabled messaging such as e-mail, social media messaging, or networked applications or chat programs. Soon this will include mediation with numerous other devices on the Internet of Things (IoT). If the entities attempting communication are successful in this negotiation of medial layers, they might make a stable connection to their intended target in synchronous time and messages can be exchanged to contribute to a cooperative effort. If they are successful in sending an asynchronous message, there may be no feedback that a received message is a "read" message, and senders may want to wait to receive a confirmation or reply to their message before taking action. As messages continue to be exchanged, each round is a potential vulnerability for both communication and cooperation until a cooperative outcome is negotiated. Thus, much of today's cooperation is an automation hybrid, whereby people are cooperating with autonomous or semi-autonomous systems in order to connect and cooperate with other people, and/or with machines and systems.

Communication, and thus cooperation, is not necessarily with those in our local locale as much of our communication passes through one sort of network or another. Especially where there is substantial geographical population mobility, such as in the US, where people have networks that include members far outside their local locale, and indeed, these can be quite distant. Even so, there is enough local cooperation to reproduce supplies, power, water, adherence to law, etc., in the local locales. In many ways, we are unable to cooperate locally as we once could. Some of this is due to the "urban" problem of high heterogeneity in a concentrated space and the outcomes of cultural differences co-existing in a given locale, typical of cities since their inception. More likely, with the advent of automation in many of the processes of locales, problems of local communication and cooperation are instead being addressed by ‘process, script, algorithmic’ or other loss-of-agency 'solutions' that require more yielding of humans to the automation, rather than the other way around [3].

Frustration with processes, scripts, and algorithms in a local locale translates into a more general frustration within a locality. When people are unable to get what they want (exercise agency) locally, they have network tools to enable them, though cooperating with automation, to shift tasks that they may have done in their communities (purchase goods and services) to online. Thus, the infrastructure of geographic localities becomes more utilitarian and less social as people, though various pressures and time constraints in their lives, use their mobile devices more often than not as they move through the local locale. As a result, opportunities for exchanges of information between people, such as pleasantries, gossip about the neighbourhood and community political concerns, are reduced, as local people with jobs that support local needs are replaced by algorithms and packages left on doorsteps. This social glue is replaced by function: people can order the supplies they need to survive in their locale, and can do so without socialising with others in the same locale. This contributes to a breakdown of cohesion, understanding, and ultimately cooperation in locales, and a concentration of shopping patterns and behaviour tracking, privately owned on the network by companies that may or may not be in business in the future.

2.3 Social Machines as Cooperative Agents

When people use mobile devices in the local locale more frequently than not, and are connecting socially and cooperating

with those on the network more than they are with members of their local community, then the way to connect them to their locality will be more effective when done through their mobile devices. This is what some civic and retail systems are currently doing by relating people to services based on local regions [4][5][6][7]. However, they are not necessarily connecting people to people, but rather to regions, often that stop as abstract representations within software. This type of blended reality has problems in that people may no longer have privacy in spaces where they are sharing a data history, now attached to their patterns in the local locale. Simultaneously, the future of cooperation may be hinged upon people's willingness to engage with blended reality (e.g. a combination of network and local locale functions) in their communities as automation takes hold.

Social Machines might meet the hybrid need in several ways: 1) Social Machines can bridge the blended reality issue of network and local locale presence; 2) Social Machines provide useful data to each individual user on the network whilst simultaneously connecting to many multiple users on the network—in the users' preferred asynchronous time schedule [8]; and 3) Social Machines have a unique capacity to replicate some human behaviour in a way that takes up the slack of humans' emotional and/or physical limitations when engaged with the network. In short, Social Machines have the potential to provide some of the cooperative (and perhaps even emotive) social glue that humans have forfeited in our local locales as we have become consumed by nearly constant connection to the network [2].

For example, Waze, Google's "community-based traffic and navigation app" [9], has been used as an example of a Social Machine [10] that collects data from individual nodes, aggregates and processes it, and returns it to individual nodes as "smarter" data that gives more contextually relevant information that aids in navigation. With Waze, users forfeit some privacy and location information, but what they receive is a deeper and more useful dataset (to them), which has the potential to save them time and stress during a commute. In addition, Waze gives some identity and presence to "fellow travellers" on the road, thus humanising and creating a virtual community that exists as a blended reality, where real cars that participate in the network, have node representation as well.

The dataset is dynamic and useful for the time the user is driving, but the idea of the community on the road and fellow travellers may be persistent and could potentially provide a sense of community long after the commute has finished. Drivers (users) are characterised as cartoon cars in the app and thus, may seem more human than the dissociation drivers often have when isolated in their vehicles. Waze may be successful because it provides crowd-sourced navigation information. However, it may also be successful because it is evidence of a cooperative community and illustrates that community to users in real time—even if the drivers as individual nodes may not be so cooperative to other drivers. Thus, an area of research could be to explore if the community aspect of Waze produces feelings of group membership that are sustained after the commute has finished. Do Waze users feel more camaraderie on the road? Is Waze as a Social Machine, providing a community cooperative glue that is not available on the roads when drivers are by themselves in their cars?

2.4 Social Machines as Community Proxies

Social Machines show properties of being an emergent system as "the fabric itself of its constituting parts mutates under their mutual influence, as do the interactions between them' [11]. As such, Social Machines interoperate with other Social Machines and systems, merging and transforming. We too, move through groups in a similar fashion. Potentially, Social Machines could create a cooperative experience that offers a cohesive sense of community that promotes successful cooperation, without compromising to various automation and algorithms that keep digital personal experiences separate from each other, and as such, leave them open to PoSR dynamics related social vulnerabilities.

What is currently missing in much of mobile application design is the shared locale and shared information that operates at a community level (a community comprised of a number of interacting social networks) that gives information back to that community, which is useful to both individuals and the groups. Part of this is due to trust and privacy issues in that people are become more wary to share personal information, including location, to larger entities they either do not understand and/or do not offer much of a reciprocal cooperative relationship. Programs such as Foursquare, Yelp and other apps, enable individual contribution and usage, but do not necessarily have a means to connect people to each other in a local locale. Part of this is due to privacy, and part of this is due to technology, specifically the problems with interoperability and devices. There are two major smartphone platforms, iPhone and Android [12], and within them, users have highly heterogeneous computing environments.

The Waze example of a Social Machine supports cooperation by providing high-level communication between different isolates to enable more collaborative activities while simultaneously not cluttering the individual networks, emulating the pre-digital, or in other terms, the constraints of "local" geography.

Social Machines have to be adaptable because they are dependent on, and service, systems that change. The companies that are responsible for the infrastructure that Social Machines utilize may reorganise, stop shipping products, make new products and render others obsolete, or may be victims of power failures that disable Internet services altogether. The heterogeneity, even of the five major players [12] can create potential for disruption of Social Machines. Thus, Social Machines are required to be nimble, and transcendent of the systems they use at any given time. In contrast, the physical communities whose cooperation and other social features Social Machines could and likely will take on board, change more slowly and although they absorb new changes, they maintain their physical structures due to the physical constraints of geography and materials. This presents a challenge for transferring cooperation to a digital platform that is useable in the local locale because of the temporal nature of technology contrasting with the slower change of communities and community participation.

However, social situations are changing, particularly in urban areas where real estate is expensive and people are transient. In these cases, Social Machines, and the network in general, may perform a type of anchor function and promote community coherence absent in daily life. It is in these environments and amongst these users that Social Machines could first flourish as a cooperation proxy.

3. Conclusions

The Social Machines construct encourages exploration of distributed cooperative computing as a new means for connecting people and making possible new processes and outcomes not previously achievable. There is a real shift of people's behaviour from managing cooperation through relations and sociability within geographic localities, to managing cooperation through

social relations over a network, using tethered or mobile devices connected to the Internet. The results of this shift in cooperative behavior add a layer to the dynamism of Social Machines: these can become critical custodians to support necessary cooperative human social behavior, while assuming an active cooperative role themselves. This is particularly challenging when the systems that Social Machines (and people) rely upon do not endure to the same extent as the physical locales and persistent stories that have hosted human cooperation and knowledge throughout history. While persistence is an enduring issue with data, behaviour is only recently something that has become "datafied", and Social Machines are now challenged to be social in ways that can provide (or support) behavioural persistence. A future direction to explore is whether or not the community experience created by Social Machines, such as that found with Waze, can sustain and demonstrate a residual cooperative effect, after engagement with any particular Social Machines has ended, thus creating a sense of cooperation, continuity and community even when detached from both the network and others within a geographic locality.

There are a number of other issues that require further consideration. Most pressing is the role of Social Machines as people are not shifting to network-based locales at the same time or with the same degree of enthusiasm.

Social Machines will be deployed into a complex social environment, where some people may not have, or want, access to the technology that enables Social Machines in order for them to shift to network-based locales from their local locales. With different rates of adoption, degrees of enthusiasm, and personal preferences, adoption of Social Machines will be a process.

In any process of broad and radical change, younger people incorporate the adaptations of older people, adding many peer-sourced adaptations. These may be largely inaccessible to older people due to cultural and social restrictions on 'acceptable adult behaviour' that will change in acceptance as the new generations age. Economic and social inequality can have dramatic impacts on the capacity for participation, aggravating inequality further. In addition, people in nations with weaker infrastructure may be excluded from shifting. It is important that, to the extent possible, Social Machines promote benefits for all and minimise differences in capability in a mixed-rate period of change, lest a truly divided society emerge.

The result of present processes, with or without Social Machines, will result in dramatic changes in society worldwide. Social Machines can help by making these changes a more positive experience for most, and greatly impact the quality of life as change advances. Indeed, given the pace of change, and consequent outcomes, Social Machines have the capacity to greatly improve societal cooperation during the transitional shift of community to network locales.

4. REFERENCES

[1] Applin, S. and Fischer, M. 2011. A Cultural Perspective on Mixed, Dual and Blended Reality. *IUI LAMDa '11* (Palo Alto, CA, 2011).

[2] Smart, Paul R and Shadbolt, Nigel R (2014) Social Machines. In, Khosrow-Pour, Mehdi (ed.) *Encyclopedia of Information Science and Technology.* Hershey, Pennsylvania, USA, IGI Global, 6855-6862.

[3] Applin, S. and Fischer, M. 2015. New Technologies and Mixed-Use Convergence: How Humans and Algorithms are Adapting to Each Other. *IEEE International Symposium on Technology and Society (ISTAS 2015)* (Dublin, Ireland, 2015).

[4] 311 City Services: 2016. http://www.sanantonio.gov/Commpa/cityservices.aspx. Accessed: 2016-01-23.

[5] City of Chicago: 311 City Services: 2015. *http://www.cityofchicago.org/city/en/depts/311.html*. Accessed: 2016-01-23.

[6] San Francisco 311: SF311: 2016. *http://www.sf311.org/*. Accessed: 2016-01-23.

[7] Introduction to local inventory ads - Google Merchant Center Help: 2016. *https://support.google.com/merchants/answer/3057972?hl=en*. Accessed: 2016- 01- 23.

[8] Applin, S. and Fischer, M. 2013. Asynchronous Adaptations to Complex Social Interactions. *IEEE Technology and Society Magazine*.

[9] Free Community-based Mapping, Traffic & Navigation App: 2016. *https://www.waze.com/*. Accessed: 2016- 01- 24.

[10] Van Kleek, M., Smith, D., Tinati, R., O'Hara, K., Hall, W. and Shadbolt, N. 2014. 7 billion home telescopes: observing social machines through personal data stores. *Proceedings of the companion publication of the 23rd International Conference on World Wide Web Companion (IW3C2)* (Seoul, Korea, 2014), 915–920.

[11] De Roure, D., Hooper, C., Meridith-Lobay, M., Tarte, S., Cruickshank, D. and De Roure, C. 2013. Observing Social Machines Part 1: What to Observe?. *International World Wide Web Conference Committee (IW3C2)* (Rio de Janeiro, Brazil, 2013), 901–904.Ding, W. and Marchionini, G. 1997. *A Study on Video Browsing Strategies*. Technical Report. University of Maryland at College Park.

[12] Manjoo, F. 2016. Tech's 'Frightful 5' Will Dominate Digital Life for Foreseeable Future. *The New York Times.*