

Technology and Behaviour Change, for Good and Evil

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Since the first basic stone and bone tools were used by Plio-Pleistocene hominids over three million years ago (McPherron et al., 2010), the ability of humans to fashion tools has not only extended our capacity to conduct tasks, but may also have had a transformative impact on our own selves. For instance, tool development may have been a key facilitator in the development of a large, energy hungry brain in humans (Gibbons, 1998). In more recent times, technologies and inventions - ranging from tally marks as a pre-cursor to numbers, the number zero, writing, the printing press, the stirrup, and the computer - have transformed not only individual human abilities through an extension of physical capabilities (McLuhan, 1964), but also society through both the intended and unintended consequences of widespread adoption and use.

In the present position paper we summarise the key ways in which technology influences behaviour, and propose ways in which the same technology can be utilized in order to achieve a social good. We then look at two technologies – smart technologies for self-monitoring and social media – and discuss potential ways in which our approach to understanding the use and impact of tools can help shape their application in changing behaviour.

Modern Technology and Behaviour

The notion that technological developments can transform not only society and individual behaviour, but also the very evolution of humankind, is well established within the field of technology studies. For instance, White (1964) describes how the development of the stirrup not only transformed medieval warfare, but also led to the development of feudal systems (although later historians have disputed the causality she

asserts). Similarly, while the digital camera may seem to be a simple upgrade of the film camera, the ubiquity of digital photography is now beginning to have far-reaching consequences (e.g. in the production and consumption of pornography). This is by no means limited to digital technology – the invention of the printing press in the 1450’s “destroyed the oral society ... and its effects were to be felt in every area of human activity” (Burke, 1991, p.71), According to Ong (1986), writing ‘restructures consciousness’; it separates the knower from the known and creates a distance between the author and the reader. Writing cannot answer questions, and is forever static (one of Plato’s concerns). Ong (1986) further argues that writing may have a neuropsychological effect - encouraging left hemisphere activity in readers of alphabetic scripts.

Just as trust in society frees us up to engage in specialist tasks (Fukuyama, 1995), so the development of technology and tools also frees us from mundane, everyday jobs. For instance, we don’t need to remember a shopping list because technological solutions, like smartphones, increase our capacity to remember a large number of items and transform the nature of the task itself into one of checking the list against our grocery shopping rather than a memory and shopping task.

At the same time, the impact of technology on social behaviour is not a simple relationship of cause and effect. Not all technology and tools are widely adopted (see, for instance, the video phone), and users often appropriate a technology to their own ends (e.g. using an ansaphone to screen calls). The way a technology impacts on society is an ‘assemblage’ of multiple factors, both social and technological (Shove & Southerton, 2000).

In the present paper, however, we are particularly interested in the ways in which technology can be used to change behaviour in order to achieve a social good. By ‘social good’ we mean an outcome that has positive benefits for society. First, however, we must examine the ways in which a technology or tool can change behaviour, and the processes by which this is achieved.

How technology influences behaviour

Sara Kiesler (1997) draws a distinction between technologies that amplify and those that transform:

Some technological change is primarily amplifying, making it possible for people to do what they have done before, but more accurately, quickly or cheaply. In other cases, technology is truly transformative: It leads to qualitative change in how people think about the world, in their social roles and institutions, in the ways they work, and in the political and economic challenges they face ...

Sometimes the amplifying effect is what we see first, never realising there is a later transformative effect to come, or that the amplifying technology is part of a larger social change (Kiesler, 1997; pp: xii-xiii).

In the present paper, we propose that the impact of technology on behaviour can be thought of as operating through three related processes: extension, amplification and shaping (see Figure 1 for a visual representation of this). Extension relates to the notion that tools can be used to extend human capabilities (e.g. to communicate, remember, express). Amplification is how technology use can amplify existing effects through this

increased capability. Third, shaping refers to the ways in which technology and tools can provide the choice architecture that independently influences behaviour.

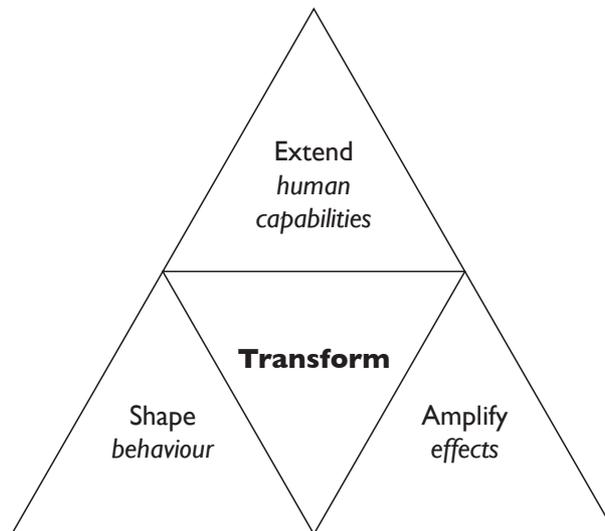


Figure 1: Extend-Amplify-Shape-Transform (EAST) framework for technology and behaviour change

Technology as an extender

The notion that technology can simply extend our current capabilities is well established. Indeed, McLuhan defined ‘media’ as “any technology that ... creates extensions of the human body and senses” (McLuhan 1964, p. 239). Similarly, Fogg (2003) argues that technology can be persuasive by increasing people’s capabilities in a number of ways – for instance, by making a specific behaviour *easier* to enact, by *leading* a user through a process or by performing calculations or measurements that *motivates* the user. Fogg’s notion of tools increasing the ease of action is closest in definition to the idea of a tool as an extension of human capability or an amplifier of existing social interactions. For instance, the inclusion of ‘share on *Facebook*’ menu options within a smart phone

operating system makes it *easier* to share content with user's contacts by removing steps to completing the action. Similarly, *Amazon's* 'one-click' technology makes purchasing (including impulse purchasing) easier compared to the situation when user needs to enter or verify credit card and delivery details with each purchase.

However, it is too simplistic to argue that simply because a tool extends or augments existing capabilities then it is not transformative. Take for example the development and implementation of life-style self-monitoring tools (current examples include *FitBit*, *Nike +*, *BodyMedia*). Most of the facilities provided by these tools are available in a non-digital form – for instance, you could count all the steps you take in one day, record your heart beat using your pulse and a watch, or measure your blood pressure using an aneroid sphygmomanometer with a dial, bulb, and air valve. However, new tools such as the *FitBit* not only make it easier to collect and collate this information, but critically they also support *self-monitoring*. Self-monitoring is a key behaviour change technique (Abraham & Michie, 2008) that has been implicated in supporting behaviour change endeavors in a range of domains, including energy consumption (Brandon and Lewis, 1999), dietary management (Rosser et al., 2009), and physical activity (Hurling et al., 2007).

Technology as an amplifier

While the examples given above illustrate the potential ways in which technology extends human capabilities, a second possibility is that new technology amplifies existing social processes and behavioural responses. For instance, computer-mediated communication (CMC) extends our ability to communicate via text across time and distance, while simultaneously amplifying social processes that have a behavioural component (Walther,

1992, 1996). For instance, Tidwell and Walther (1992) studied CMC through the lens of uncertainty reduction theory (Berger, 1979), and report that participants in their CMC condition engaged in questioning behaviour quantitatively different than that of their face-to-face participants. Similarly, hyperpersonal interaction (Walther, 1996) in CMC – feelings of exaggerated liking and connectedness – rely on the amplification of offline social processes via the extensions caused by mediation (for instance, disclosure via increased levels of self-awareness (Joinson, 2001) or uncertainty reduction strategies (Tidwell and Walther, 2002)).

Technology as an amplifier can also operate alongside its use as an extension through increased ease of use, visibility or utility. For instance, smart monitoring technologies - discussed in more detail below - act by extending our capability to collate and analyse self-related information, while simultaneously amplifying the effect of, say, self-monitoring on motivation and self-regulation of behaviour. In the discussion of social media below, we also look at how the increased visibility of users to varied audiences can be used to amplify existing effects, leading to identifiable behavioural consequences.

Finally, when considering the impact of new technology on human behaviour it is also important to recognize that we tend to respond to technology itself as if it were a social actor (Reeves and Nass, 1996). For instance, people apply existing social norms such as reciprocity, politeness and empathy to computers as well as to other people (Fogg and Nass, 1997; Nass and Moon, 2000). In terms of behaviour change this effect is important – for instance, while a technology can have a profound effect on behavior by extending capabilities and amplifying effects, it may simultaneously introduce entirely new outcomes by triggering responses to computers and tools as social actors. This possibility leads to a third way technology can influence behaviour – through shaping.

Technology and the shaping of behaviour

An additional way we can think about technology and social behaviour is through the ‘nudges’ technology can provide for specific types of action through its design¹. The cognitive psychologist Gibson (1979) introduced the idea of affordances to explain his notion of direct perception. According to Gibson (1979), objects or environments have certain properties that lead to different types of behaviour. For instance, a solid, flat surface affords walking, while a vertical or boggy surface does not. This idea of objects affording certain types of behaviour was adopted enthusiastically by human-computer interaction researchers, most notably Don Norman (1988). In applying the notion of affordances to everyday objects, Norman argues that affordances are the “perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used” (Norman, 1988, p. 9).

So, just as a flat smooth surface affords walking, so the telephone’s affords (‘is for’) talking, but not walking on. What is important about the idea of affordances is that they imply a direct, in some cases **designed**, link between the properties of an object, material or tool, and the uses to which it is put.

Take for instance social network sites such as *Facebook* or *LinkedIn*. While these sites extend and amplify, they also shape behavior through the use of defaults (e.g. in terms of privacy settings). The power of a default option to change people’s behaviour has been well established in a number of fields, including healthcare (Halpern, Ubel and Asch,

¹ Thaler and Sustein (2008; p. 6) define ‘nudge’ as: “any aspect of the choice architecture that alters people’s behaviour in a predictable way without forbidding any option or significantly changing their economic interests.”

2007), pension uptake (Madrian and Shea, 2001) and organ donation (Johnson and Goldstein, 2003). In terms of the development and design of technology or tool, the designer has considerable leverage over not only the default selections, but also over the ways in which options are presented. Again, there is considerable evidence from the field of behavioural economics to suggest that the method of presentation of options has a significant impact on how people make decisions and subsequently behave (Ariely, 2010). For instance, people tend to weigh losses more heavily than gains (Kahneman and Tversky, 1979), give too much weight to small probabilities (e.g. 5% moving to 10% compared to 60% moving to 65%) and evaluate events differently when they are further in the future ('hyperbolic discounting').

If we understand the goals and motives that people seek from a tool or technology, we can also design specific behaviours and actions into the use of the technology. In his study of uses and gratifications of *Facebook*, Joinson (2008) found that relatively open privacy settings were related to wanting to use the site to meet new people. So, if a gratification of *Facebook* is to make new contacts, then a specific behavior, such as allowing *Google's* search engine to index the profile name and page, is required in order to maximize the likelihood of gaining that gratification (Joinson, 2008). Similarly, routes through a site (or educational resource) can be specifically designed to elicit or require actions in order to move to the next stage (something Fogg (2003) calls 'tunneling').

Technology as transformative

The degree to which a technology is also transformative is difficult to identify without the benefit of hindsight. Simply because a tool or technology extends our capabilities, and perhaps amplifies existing relations, does not exclude the possibility that it will have

a transformative effect further down the line. For instance, the growth in availability of pornography, and relative ease of access to it by young people, can be seen as both extending (in terms of access) and amplifying (in terms of the potential impact on attitudes towards sexual behaviour and sexual violence). However, it is possible that in the long term the combination of extension and amplification effects will have a transformative impact of teen's later relationships - something that has been already been the focus of considerable concern (Freitas, 2013; Hald et al., in press).

In a similar vein, the recent widespread adoption and use of social media such as *Twitter* and *Facebook* can be seen in terms of both extension (of previous ways of connecting and sharing) and amplification (via CMC process, self-affirmation and so on), as well as shaping behaviour within the site itself. For example, when a new user signs into *Facebook* they are encouraged to 'find friends' to other users by allowing access to their email contacts list, and (as of April 2013), the default privacy setting for new users is 'Public' for postings, with search engines also being able, by default, to link to the new users' timeline.

When the outcomes of extension, amplification and shaping combine – as in the example above – then we can start to think about technology as *transformative* in that it no longer becomes an extension of human behaviour and capabilities, but that it in turn begins to exert a widely felt effect on societal values and more general human behaviours. The longevity of these transformative effects are difficult to predict – technology is shaped by society, and the ways in which a (potentially) transformative technology is adopted and adapted will in a large part determine its wider impact.

Case studies

In the following section, we look more closely at two ways in which technology and tools can be used to change behaviour – smart tracking technologies and social media. In each case, we examine the current technology on offer, analyse it using the EAST framework developed above, and look at how it could be used to create socially positive behaviours.

Smart technology and behavioural self-monitoring

We are entering a new era of smart, personalized, and effortless self-monitoring. It is now possible to record temperature, perspiration and heart rate using a single, wearable device (e.g. *MyBasis* watch). Most smart phones are spiced with GPS, accelerometers, altimeters, compasses, and some even have pressure, humidity, and temperature sensors (e.g. *Samsung Galaxy S4*).

Devices are not only **extending** our capabilities of communication and information access, but also our ability to gather information about the environment and ourselves that was never possible before without clinical grade equipment and testing labs.

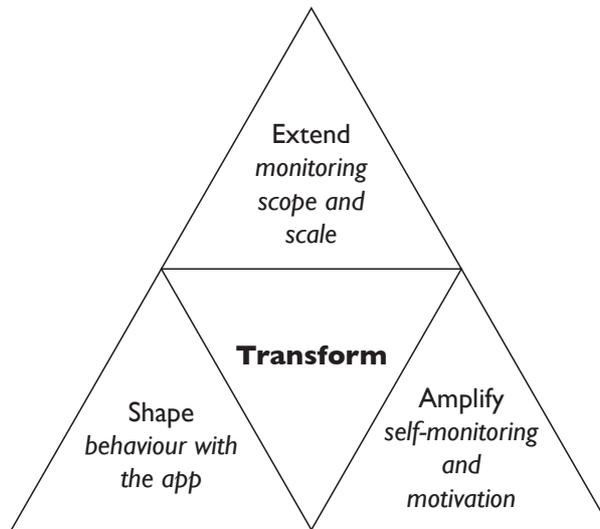


Fig 2: Extend-Amplify-Shape-Transform (EAST) framework for smart technology

In the context of behaviour change, the impact of smart technology on behaviour can be connected to three main factors: tracking with feedback, personalization, and simplicity.

Feedback intervention is one of the oldest processes investigated in psychological research, and its beneficial effect on performance has been dated to studies back in 1905 (Kluger & DeNisi, 1996). A great example of successful smart technology that harness the potential of feedback is *Nike +*. *Nike +* eliminates the tedium of tracking performance by using data from accelerometer to give an immediate personal feedback on distance and speed when jogging. On one hand this enables a sense of control and reinforcement to improve performance. Feedback on performance increases likelihood of continuing to produce behaviour (Bandura, 1977). On the other hand, *Nike +* shows feedback on other people's results and allows them to publicly share their own performance. This observation by others increases the likelihood of continuing a desired behaviour (McCarney et al., 2007; McClusky, 2009). Feedback on other people's performance also triggers a broad spectrum of social influence mechanisms like social proof, competition and comparison (Cialdini, 2001), and therefore contributes to the

amplification potential of the technology to change behavior.

Aside from feedback, personalization is another important technique of behaviour change boosted by smart technology. Thanks to tracking sensors, processing power and online connectivity of smart devices, the analysis of performance and feedback can be delivered on the personalized platform in real time or rather at the 'right' time for the user. Correct tailoring and timing of information provision in behaviour change is very important factor in delivering non-invasive user experience (Fogg, 2003). Research in health interventions for behaviour change shows that providing personalized information is more effective than generic information for behavioural change (Noar et al., 2007). This way personalization is tightly linked with tracking and feedback, in the sense that it benefits from more data collected about the user. For example, *Google Maps* uses GPS-based location and traffic analysis to predict how long it will take for the user to get to the specific location. If the user has an important meeting recorded in the online calendar, *Google* sends the notification in the right time to remind the user they need to leave soon to get for their meeting on time. This is a smooth and effortless process with tracking sensors working in the background, and personalized reminders serving a simple purpose of efficient time management for the user.

This brings us to simplicity - another technique of behaviour change that benefits from smart technologies. Simplicity enables users to increase the benefit/cost ratio, and therefore stimulates motivation to engage (Bandura, 1997) and reduces cognitive effort to do so (Mayer & Moreno, 2003), and we frame it as a **shaping** factor. Simplicity can be greatly achieved with smart technologies using principles of user interface design. For instance, it has been widely reported that capacitive touchscreen smartphones and tablets (e.g. *Apple's iPad*) enable smooth computing experience for older generations of users (e.g. Umemuro, 2004; Kobayashi et al., 2011). Older users typically had more difficulties

in adapting to mouse-and-keyboard interfaces. With touchscreen devices they found it much more intuitive and engaging, and the learning curve for those devices has proved to be much smoother than mouse-and-keyboard based devices (e.g. Jaimes & Sebe, 2007; Saljo, 2009). With the simplicity of a single-touch of an icon, users can check their e-mails, make a call, or snap a photo. Simplicity should eventually lead to smooth, effortless use of technology so that users don't really notice the transition.

Using smart technologies to change behaviour

With the technological potential available for behaviour change, it is somehow surprising that we are not yet immersed in the reality of personal, integrated smart technologies and intelligent environments that help us to make better choices regarding our health, financial savings, or travel. Indeed, companies like *Nike*, *Apple* or *Google* take full advantage of the rising trend in the use of smart devices, but rarely with the stated aim of creating a socially beneficial outcome. From the perspective of practical application in behaviour change domain, the current landscape for smart technology and behaviour change looks surprisingly barren. The use of technology in many behaviour change interventions seems almost forced, unintuitive, and ecologically invalid for practical application. An example where (so far) research has failed to effectively use smart technology for behaviour change is technology-assisted interventions designed to support weight loss (Neville et al., 2009). A common experimental design used in this domain is to provide participants with a pedometer measuring levels of physical activity, ask them to set up the weekly dietary goals using interactive Web form and send them tailored e-mail advice. Such an approach has been shown to produce results no different from just asking participants to exercise more (Booth et al., 2008). What is lacking in the majority of such interventions is a simple and personalized design of user interface with robust feedback model that takes advantage of social influence and is wrapped up in

smart technology.

One of the most promising smart technologies that could be flexibly adapted to behaviour change interventions is a modern smartphone. Smartphones are extremely popular - it is estimated that the number of mobile broadband users (who typically use smartphones) will reach 1.8 billion in 2014, which is more than double comparing to 2011 (Portio Research, 2011). Typical smartphones combine features such as portability, fast processing power and large memory, advanced operating system, broad spectrum of onboard sensors, high-definition camera and touch screen. Those features enable smartphones to replace and converge a huge range of other devices such as landline phones, digital cameras, radios, voice recorders, GPS navigators, handheld game consoles, alarm clocks, calendars and calculators (Miller, 2012).

Behaviour change interventions using smartphones have so far been limited in the scope and practical applicability, and there are significant concerns regarding privacy. However, it is clear that smartphones have a potential to be a disruptive technology for behaviour change intervention. Smartphones have already been used in research projects for large-scale behaviour data gathering (e.g. Killingsworth & Gilbert, 2010, Lathia et al., 2013, MacKerron & Mourato, 2013). For example, the Mappiness project (MacKerron & Mourato, 2013) collected over 3 million mood reports with GPS locations and ambient noise levels from 45,000 users through an iPhone app. MacKerron & Mourato (2013) used this data to show that participants were significantly happier outdoors in all green or natural habitat types than they were in urban environments. While still in early stages, such projects show that in the near future smartphones will enable researchers and practitioners to study and deliver simple, personalized, large-scale behaviour change interventions with instant self-monitoring and feedback system for the users.

We suggest that adopting the **extend-amplify-shape-transform (EAST)** framework

allows us to conceptualize more clearly how a technology such as smartphone-based interventions is being used to change behaviour, and what potential is being utilized or missed.

Social Media and Behaviour

The EAST framework for understanding the role of technology in behaviour can also be applied to our understanding of social media. At its core, social media such as *Facebook* **extends** our ability to connect to others and to share and consume content (Joinson, 2008), while that use also **amplifies** existing social processes and effects such as self-affirmation (Toma and Hancock, 2013), self-control (Wilcox and Stephen, 2013), awareness of the audience (Marder, Joinson & Shankar, 2012), and social impact (and anxiety) associated with multiple audiences (Binder et al., 2009, Joinson et al., 2011). This **amplification** can be especially useful for encouraging behaviour change through the power of ‘pledging’ and multiple audiences. There is considerable evidence that people are motivated to maintain consistency between their attitudes and behaviour, an effect that is particularly strong when there is an audience (Cialdini, 2001). For instance, Williams et al., (2005) report that an experimental group who signed a contract to increase their daily exercise did so significantly more than a group who were given just an exercise plan, but no contract. Failure to maintain a commitment made in public not only risks internal inconsistency, but also reputational damage (Bicchieri, 2006).

Facebook also has designed persuasive elements in order to **shape** behaviour (Fogg & Eckles, 2007). According to Fogg & Eckles (2007), social media designers attempt to move users through three key phases of involvement with the site: discovery, superficial involvement and true commitment (see Figure 3). The goal for a designer of a social

media site is to encourage behaviours that form the ‘true commitment’ actions: involving others, staying active and loyal, and creating value and content. In a related study, Vasalou, Joinson and Courvoisier (2010) examined how various elements of the *Facebook* site were used by participants from five countries (UK, US, Italy, Greece and France) at different phases of involvement with the site. The authors of the study found that the use of features of *Facebook* tended to change as users move through stages in time: photos and status updates increased in importance (i.e. ‘creating value and content’) while games and applications (more ‘superficial’ involvement) become less significant. Additionally, cultural background was an important factor in determining how users engaged in each of the target behaviours in the true commitment phase.

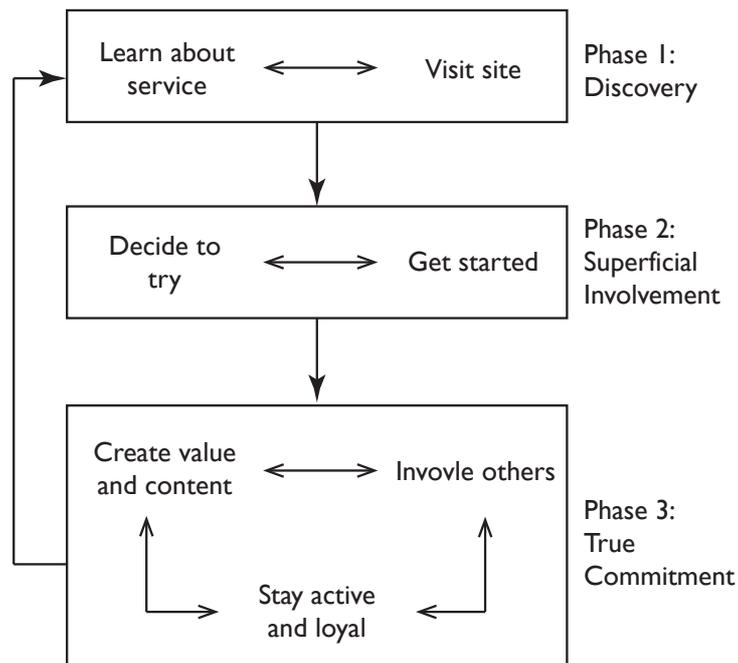


Figure 3: Behaviour Chain Model (adapted from Fogg and Iizawa, 2008, pp. 36)

Fogg and Iizawa (2008) drew a similar conclusion - that behavior is shaped by the site in culturally specific ways - when they compared how *Facebook* and *Mixi* (a Japanese social network) shaped users’ behaviour. For instance, at the time of their study, the main way

in which *Facebook* users could signify social presence was through the ‘poke’ mechanism, while *Mixi* users left ‘footprints’ when they visited a contacts’ profile page.

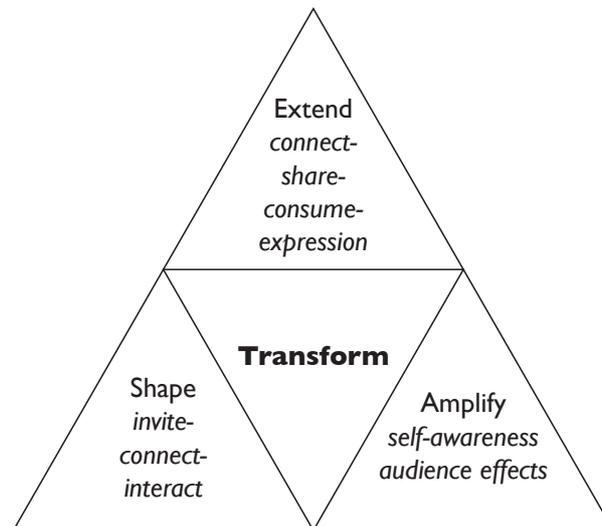


Fig 4: extend-amplify-shape-transform (EAST) framework for social media

Just as social media can shape behaviour by making it easier to engage in behaviours (e.g. inviting all email contacts), so it can also shape behavior by making undesired actions more difficult to complete. For example, arguably it is in the interests of *Facebook* that users’ do not fully utilize the privacy settings available to users (Bonneau & Preibusch, 2010). To this end, the default settings of *Facebook* have become increasingly permissive since it was founded, with an increasing amount of information available across the network, and the Internet itself (Stutzman, Gross & Acquisti, 2013). Privacy campaigners have long argued for the use of ‘opt-in’ rather than ‘opt-out’ default settings in recognition of the power of inactivity in shaping behaviour. Finally, social media also shapes the ways in which we interact with others. To use the example of *Facebook*, we have only one category of contact – friend – and by default share the same information across all members of that group. This may cause anxiety amongst users trying to manage an impression to competing audiences (Joinson et al., 2001), and lead to their own self-

ensorship of their behaviour. However, alternative approaches (e.g. *Google +*) are available that allow for a more nuanced approach to sharing by grouping contacts. Similarly, on Facebook there are two responses available to content – ‘Like’ or ignore. On Twitter the character limit is an obvious shaper of behaviour – but subtler shaping also occurs. For example, if a user wishes their content to be distributed on *Twitter* (‘retweeted’), they must leave enough spare characters for the retweet tag and their username to be included in the forwarded text.

Despite the focus on negative impacts (e.g. via privacy infringement and multiple audiences) of social media (e.g. Joinson et al., 2011), there are a number of ways in which social media can be used in order to influence behaviour for positive outcomes. As noted earlier, the power of commitment is increasing the likelihood of behaviour is well established. We would predict therefore that making statements in semi-public spaces such as *Facebook* increases the likelihood of an intention to enact behaviour change being completed. This is potentially important since anecdotally, a relatively popular use of social networks is what we term ‘intention-pledge’ status updates – ranging from intentions to change behaviour to exercise intentions and new year resolutions. Alongside the power of pledging, social media also provides an opportunity for influencing others’ behaviour through the communication of social norms. Different social media provide a variety of ways to communicate social norms – from the ‘sharing’ of content on *Facebook* to retweets on *Twitter* and recommends / favouriting on many other platforms. This communication of social norms not only relates to the content of postings – it can also incorporate peer disapproval – something that has been shown to reduce negative behaviour in a range of contexts including cheating (McCabe and Trevino, 1997), health-risk behaviours such as smoking, sexual activity and drug use amongst teens (Beal et al., 2001) and drink driving (Brown, 1998). According to routine

activity theory, for a crime to occur three factors need to be present – a motivated offender, a potential victim, and an absence of capable guardians (Clarke and Felson, 1993). The visibility of action and intentions in social media, and likelihood of capable guardians being present due to multiple audiences may therefore decrease the likelihood of socially negative behaviour occurring. Outside of individual behaviour, social media has the potential through extension and amplification to have far-reaching societal consequences, as seen in the ‘Arab Spring’ (Wulf et al., 2013). Wulf and colleagues report from ‘on the ground’ in Sidi Bouzid (in Tunisia) on the ways in which social media was used to not only spread information, but to organize and connect disparate groups across the country. Social media can connect protestors with those providing wider social solidarity (Starbird & Palen, 2012), while also providing information (and co-ordination) from the site of the protest itself – something also seen in the use of social media in mass emergencies.

Conclusion

In this paper we have argued that technology and tools can be used to extend, amplify and shape behaviours, and that in doing so they may have a transformative effect. As social scientists we usually assume that a behaviour is preceded by a decision or preference of some kind (e.g. theory of planned behaviour – Ajzen, 1991). However, there is also evidence that behaviour *creates* a preference, rather than simply being the product of a preference (Ariely & Norton, 2007). So, if technology and tools are changing behaviour, they may, in turn, also be changing people’s attitudes towards those same actions. We conclude therefore that it is critically important that we not only understand how new media technologies and tools are changing behaviour, but also how those processes can be harnessed in order to create a social good.

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