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Resources, Learning and Inclusion in Open Development

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SIRCA III – WHITE PAPER

Resources, Learning and Inclusion in Open Development

Marion Walton, Andy Dearden & Melissa Densmore

Abstract

Engaging with open development (OD) necessitates learning in which people appropriate and adopt new technologies and socio-technical practices. This typically involves informal learning (i.e. outside of formal education), and will differ between reading relationships (as a user of OD resources) and writing relationships (for full ownership or authorship of OD). If potential participants are unable to connect with existing learning networks, OD initiatives will have limited impact. Communities that aim to be 'open' may exclude people by virtue of race, language, literacies, gender, sexuality, phone/computer ownership, access to Internet or other aspects of identity. This project will explore the situated material conditions and informal learning practices that surround processes of inclusion in (and exclusion from) OD initiatives. The project will develop more detailed ethnographic and socio-material accounts of the informal learning processes and outcomes in such encounters. It will foreground the ways that global inequities of infrastructure, default identities and the cultural practices often associated with openness can “format” participation in subtle but significant ways.

Learning across open development

This project explores a range of theories which help explain the situated material conditions and social learning practices that surround processes of inclusion in (and exclusion from) open development initiatives.

Open source software, open content and open educational resources are developed through participation in online curation, conversation and connection across multiple contexts. Open government and open data initiatives also demand a complex ecosystem where learning and capacity building are critical for sustainability (Chattopadhyay, 2014; Beghin & Zigoni, 2014; Rahemulla et al., 2011). The online resources commonly provided by open development projects can thus all be seen in relation to informal learning. Whether intended for health, government, education, or other aspects of open development, such resources are created and put to use within a diverse range of distributed learning networks. If such online resources exist without activating suitable informal learning processes, open development is unlikely to succeed. At the same time, given the prevalence of modernizing teleologies and unthinking developmentalism, even the apparent successes of open development may come at the cost of reinforcing (post)colonial (North-South), gender, economic disparities and other inequitable power relations.

It is worth exploring how, if potential participants are not able to connect with or be accepted by existing learning networks, an open development project may

only engage or benefit a limited range of people. As happens in other nominally "open" projects, such as Wikipedia (Ford, 2011), open development may even actively exclude potential participants by virtue of their language, literacy, gender, race, access to technologies or other aspects of their identity, digital materiality and general circumstances. Furthermore, even apparently successful open development projects may involve processes of cultural assimilation, continuing the colonial processes of direct and indirect rule, as well as nationalisms that have historically oppressed and shaped the subjectivities of dominated people (Mamdani, 2012).

Whilst there has been considerable research examining the experiences of openness in the global North encountering and engaging with such networks, little is known about the experiences of people in the global South. On the other hand, as Singh & Gurumurthy (2013) point out, issues of who is able to engage, what facilities are provided, what supporting infrastructure is available, and what actions are taken to promote engagement are critical to understanding how open initiatives might relate to development outcomes.

This paper introduces a range of situated, socio-cultural and socio-technical approaches to learning which can help to develop an ethnographic and contextual understanding of processes of learning and people's experiences of encountering nominally open initiatives that have development objectives. We also point towards works of scholarship and philosophy which shed light on the complex processes of subjectification and identity formation at play in informal learning and open development. Our priority has been to put African sources in dialogue with Northern learning theorists, with the goal of sparking a conversation which we hope will resonate in many Southern contexts. We expect future research should also challenge the masculine bias in the sources to develop a deeper awareness of the role of various forms of intersectionality in open development relationships.

Hence we outline a "toolbox" of theories that can be applied in enquiries and used to characterize the learning practices and genres of participation (Ito et al., 2010) in open development projects. These will help us understand how these learning practices themselves are embedded in wider networks of power relations (Contu & Wilmott, 2003), are shaped by distinctive digital materialities (Walton, 2014), and how they might be configured to promote (or deny) values of inclusion.

Theories of situated learning (e.g. Lave & Wenger, 1991) make visible complex social relationships at the heart of learning in open development. These social relationships include both what we have termed *reading relationships* and *writing relationships*.

Thinking about relationships in this way includes both people and the materialities which allow them to relate to one another. We believe the idea of a reading relationship is preferable to popular notions of "skills", "computer literacy", or even some uses of "capability" (when viewed narrowly as an

attribute of an individual person). Reading relationships inspire, nudge, shame or force learning by potential users of open development resources. Here, by focusing on relationships, we wish to draw attention to issues of culture, identity, language, ethnicity and material context in the various kinds of informal learning crucial to open development.

The focus on writing as well as reading is a reminder of the importance of authorship as well as use in open development projects. Writing relationships allow (or prohibit) participants, including users, to play a role in creating and setting the goals for open development projects. Such writing relationships are required if participants are to gradually establish their position in a community of practice and (in some cases) access and gain command of all the 'writing rights' (Kress, 1997) theoretically available within open communities of practice.

Materialities and digital materialities are implicated in both reading and writing relationships. Characteristically, writing relationships require a far more extensive and expensive set of material resources. We are particularly interested in bringing to light the power relationships, hierarchies, inclusions and exclusions that emerge as a result. To develop a workable theoretical toolset, it will be necessary to establish an iterative encounter between the emerging conceptual machinery, bodies of relevant evidence, and people hoping to apply the tools.

Equality and openness - or just equal opportunity

Open development promises to "shift the balance of relations between haves and have-nots" (Reilly & Smith, 2014: 23). Reilly and Smith (2014) argue that, unlike other flavours of ICT4D, the term "open" signifies more than access to technology. For these authors, openness involves major changes to patterns of developing and distributing information, cultural production, and knowledge in the direction of networked social morphologies. According to the rules for such "openness", traditional hierarchically controlled models need to make way for towards spaces or architectures which support networked transparency and contingency. This shift is seen as enhancing the development of human capabilities (Sen, 1999; Nussbaum, 2000), in that openness can help to enhance freedom, for example by fulfilling individual rights to education and expanding capabilities (Reilly & Smith, 2014:32) Nonetheless, given the scale and import of contemporary development dilemmas, a strategy focused on "spaces for achieving openness" may well suffer from the weakness of other "equal opportunity" philosophies. As Lummis (1991) argues "equality of opportunity only makes sense in a society organized as a competitive game, in which there are winners and losers". Here equal means a form of equality before before the rules of the game, or equality before the law. In other words, the rules of openness are applied equally, while the people themselves are distinctly unequal.

First, we would like to highlight the three dimensions of the rules which generate social systems characterised by openness – first, openness of content, second,

openness to people and third, a transparency or contingency of the process (Reilly & Smith, 2014:30). Those rules regarding openness to people, or social openness, provides the provocation for this project. While the nature of open communities are our focus, this does not preclude the question of whether openness levels or amplifies inequalities, or the need to understand the relationship between openness and the vast number of people who are oblivious to, ignore, and consciously transgress rules such as copyright (Haupt, 2008).

If social openness, based on sharing, participation, and collaboration, is foundational to open models, then why, in practice, are many such projects so closed to participation? As a form of "equality of opportunity" (Benkler, 2006), openness is believed to provide opportunities for local innovation, spaces for newcomers to establish themselves, and chances to shift the balance of power in various ways. Yet access and use are strongly delimited by global inequities of infrastructure (Graham & Haarstad, 2013). Furthermore those default identities and the cultural practices often associated with openness can "format" participation in subtler but equally important ways.

Furthermore, when aligned with an anti-institutional normativity, open development comes perilously close to prioritising individual at the expense of public, social goals (Singh & Gurumurthy, 2013). Singh & Gurumurthy highlight the political economy of openness, showing how the outward appearance of openness of access, participation and collaboration on platforms such as Twitter and Facebook, masks commercial arrangements supporting private enclosures. Challenging this neoliberal contour of open development, Singh & Gurumurthy (ibid.) defend values of public-ness, which they define as public ownership *in addition to* public access. This important provocation raises the question of how such open publics might be defined. If "open" spaces are publically owned (along the lines of, for example, public broadcasting), how is that ownership managed and shared? This is a particularly important question in relation to those perceived as "outsiders" by citizenship, region, language, and so on. How will they accommodate the counterpublics (Fraser, 1990) that arise in response to racial, gendered and other forms of exclusion within dominant publics? (Chib, Malik, Aricat, & Kadir, 2013)). Finally, how are open development projects themselves implicated in constituting various identities (regional, national, and so on)? How the publics created through such projects might define themselves, in relation to various scales and purposes of global, national, and other forms of association and identification suggests several crucial research questions.

Development has many continuities with the colonial project (Esteva, 2013). Social advancement and even simple social survival has long been associated with winning admission to, or getting onself "into step with the white world"(Fanon, 2008:42). For this reason, learning to participate in the networks which form around open development projects may trigger powerful identity conflicts or activate the power relations associated with colonial and class processes of assimilation through education (Soudien, 2004).The complex processes of initiation and learning associated with openness will gain significance in relation to prior relationships, and existing embodied identities

and relationships. Understanding who takes up the invitation to participate in open development projects and why they do so will require careful attention to the global inequalities which shape relationships, as well as the expectations created by citizenship of coercive and predatory states (Mbembe).

First, this paper provides an overview of some of the approaches to identity which can help to develop more nuanced and fine-grained accounts of how people assert and perform their identities, to listen to their experiences such as exclusion, self-consciousness, anger and fury against oppression, and to act in response to the dominance of broadly Western knowledge systems, rationalities, and ways of being (Fanon, [1968] 2008).

Second, we need to explore the dynamics of the social relationships which are established in unequal global learning networks.

One dimension of this is to explore, given the Northern origins of the movement towards openness, whether and how people learn that open development networks are in fact open to people from the South. When using and participating in open development projects, to what extent do people want to define and own open development projects? Given that many existing networks are “invited” networks, how do people learn to “invent” goals for their own open development project, and to shift ownership of such networks (Naidu, 2012). This requires us to provoke, document and analyse the processes of informal learning in open development, listen for resonances with various forms of identity, and trace whose identities may be expressed in the broader publics that are being create. To engage with these relationships our conception of learning must extend beyond cognitivist notions (“ideas”) into the realm of social relationships, discursive practices, and embodied perceptions and activities (Kirshner & Whitson, 1997). In addition we must account for human and non-human actors, and particularly the role that infrastructure plays in mediating access.

Given these contexts, we can document to what extent broadly cultural activities of building networks may be evolving and appropriating new rituals and diverse identities and practices, or whether they continue to exclude such subaltern histories.

We will introduce several key notions associated with the social turn in learning theory, informal learning, peer learning, learning from media, affinity spaces and genres of participation, and literacy events and practices (as theorised by the New Literacy Studies).

The ‘social turn’ and situated learning

Learning was traditionally understood as an individual activity involving cognition and knowledge acquisition – something in the mind. This paradigm has shifted and scholars in areas such as literacy studies, cultural studies and learning theory alike emphasize the urgency of understanding the socio-cultural

dimensions of learning. These theories include situated cognition (Brown, Collins, and Duguid 1989; Greeno 2011; Lave 1988), distributed cognition (Hutchins 1995), and New Literacy Studies (Gee 1990; Street 1993).

Situated learning

For our purposes it is important that theories of situated learning (e.g. Lave & Wenger, 1991) were sparked by the challenge of understanding of learning cross-culturally. In particular, Jean Lave's ethnographic studies of apprenticeship among the Vai and Gola tailors in Liberia called into question ethnocentric views of "informal education" as something inferior to formal, schooled varieties (Lave, 1997:17). The activities of the tailors showed that cognition is an activity distributed across mind, body, and culturally organised social settings (Lave, 1988). These settings include other actors, external representations, collaborative interactions and the materiality (including digital materiality) of the infrastructure shaping access to collaborators and use of external representations (Star & Bowker, 2006;Horst, 2013). Specific accounts of distributed cognition in human computer interaction (Fields et al., 1997; Wright et al., 2000) can thus be updated to theorise openness in mobile interaction design (Robinson et al., 2015). The discussion can further be extended to acknowledge open development and participation in public culture (Appadurai and Breckenridge 1988; 1995).

Particularly important for open development are accounts of more complex social arrangements for informal learning, such as apprenticeships. Apprentices learn by doing, undergoing a trajectory of participation within a community of practice:

> Apprentices learn to think, argue, act, and interact in increasingly knowledgeable ways, with people who do something well by doing it with them as legitimate, peripheral participants (Jean Lave, 1997:19).

Like other theorisations of practices, situated learning emphasizes the importance of relationships between people and their actions in the social world and challenges researchers to understand what motivates people to solve problems and learn as they go about their lives (Lave, 1997:23).

Given our focus on who is able to enter the communities of practice which emerge around open development it is also important to explore what people understand by participation, what it means to them to be peripheral in a community, and what might motivates them to seek a more central status or to challenge a hierarchy. Here, for example, the distinctive status associated with core members of open source developer and deployer communities is understood to arise from meritorious contributions, rather than from other aspects of identity, and these relationships are disrupted when projects are captured through backroom deals motivated by commercial sponsors (Phipps, 2012).

Despite the claims of meritocracy, the experience, significance and exact mechanics of exclusion need attention if we are to understand how trajectories of participation can be truncated: “some communities have ways of denying women and members of other oppressed groups full membership no matter what their level of participation” (Lemke, 1997). For this reason, as Lemke, (1997:43) points out, it is particularly important to know when communities of practice explicitly or implicitly require particular identities, prior education, initiation rites, or other kinds of qualifications before peripheral participants are accorded full membership.

Learning from media and affinity spaces

Learning is also situated by a person’s prior history, and a range of prior experiences are likely to influence participation in open development projects. The nature of these experiences mean that middle classes with access to consumer electronics are particularly advantaged.

For these middle classes around the world, growing near-ubiquitous access to ICTs, and the growth of newly ‘conversational’ forms of media have given rise to the evolution of a 'participatory culture' (Jenkins, *et al* 2006:3). For some members of open communities, then, such early experiences, particularly of media and other fan cultures are likely to constitute a distinctive aspect of their prior socialization which may prepare them to play specific roles in open communities (and advantage them over others without those experiences). They will thus be well-versed in new opportunities for the creation and dissemination of messages, for public participation in online communities, and for informal processes of learning (Jenkins, *et al*, 2006:3), which are all becoming an integral part of 21st century consumer culture and marketing practice.

For young people in particular, such forms of learning within fan culture increasingly competes with and supplements formal schooling, creating educational ‘ecologies’ distinct from classroom modes (Gee, 2003; Sefton-Green, 2004). These ecologies are strongly interconnected with children’s and youth culture, media use and consumption of media commodities (Buckingham, 2007). A ‘production renaissance’ driven by such media practices (Sefton-Green, 2006:296-7) involves young people participating in social media (e.g. Jenkins et al, 2006) and benefitting from non-hierarchical interest-driven opportunities for learning (Gee, 2004,2005).

Where these interactions centre around a common interest in media or youth culture, where fans read, write, use and produce media they are termed ‘affinity spaces’ (Gee, 2003). These are online spaces where like-minded people share a common set of endeavours and practices, socialize one another and develop new resources and identities together (Gee, 2003:183). Gee identifies how, in these online spaces, learning is social, distributed, and composed of ‘people, tools, technologies and companies all interconnected’ and gives examples showing how, for some players, such interest-based online participation is used

to support the development of complex forms of knowledge and sought-after abilities (Gee, 2003:176).

(Gee, 2004) develops the notion of 'affinity space' to circumvent the limitations of notions of 'communities of practice' (Lave and Wenger 1991) by showing how online spaces allow participation based on shared activities, interests and goals, without necessarily requiring shared class, race, or gender identities or the slow enculturation associated with traditional apprenticeships and other forms of informal learning communities.

Genres of participation

The notion of "affinity space" has been critiqued as attributing too much agency to the media (such as a game) which attracts fans to interact online (Pelletier, 2009).

An alternative approach identifies distinctive 'genres of participation' or the different modes of participation defined by young people using digital media (Ito et al., 2010:11). These youth-defined conventions of interaction emerge in social network sites or are associated with the production and sharing of user-generated content, and are also likely to be an important precursor experience for users of open development resources.

Ito et al. (2010:16-7) distinguish between 'friendship-driven' and 'interest-driven' genres of participation. These two genres of participation are characterised by distinctive social network structures, modes of learning, and associations with youth culture. 'Interest-driven' participation resembles Gee's notion of 'affinity spaces' in that this form of interaction supports more specialized, niche or marginal activities and identities. These forms of participation are enabled by online sites, where youth can make contact with others who share their specialised interests, making contacts with people who do not participate in their everyday peer networks. In contrast, for Ito *et al.*, 'friendship-driven' participation supports and develops everyday interactions and relationships with friends and peers and constitutes the key source of connectedness in relation to friendship and romance (Ito et al. 2010: 15-16).

Given these distinctive modes of participation, Ito *et al.* argue against the notions of learning 'transfer' as individual internalization of content, suggesting instead that learning takes place as youth shift genres of participation, gradually coming to participate in new social networks and identifying with different cultural referents (2010:17). We would argue that a similar trajectories between different genres of participation online are likely to be taking place in open learning. Here the key question is which participants are able to shift between everyday friendship-driven genres of social networking to the new modes of interaction which open development will need to define and support.

New literacy studies

New Literacy Studies is another approach to informal learning. This ethnographic approach to literacy arose from a cross-cultural investigation

(Street, 1993a) of how literacy is used across different societies. From this perspective, literacy involves more than just knowing how to read and write, but also involves social practices that are given meanings within specific contexts, and which are used to establish power relations and identities in those contexts (Barton & Hamilton, 2005; Hull & Schultz, 2001; Prinsloo & Breier, 1996; Street, 1993b).

For example, terms such as 'open source', 'comment', 'login', 'friend' and 'profile' have all developed specific meanings. People do not learn these meanings by checking a dictionary, but by participating in open source communities, and social networks, and by engaging in the literacy events and practices of the communities to which they connect.

As literacy is a form of social interaction, New Literacy Studies focuses on '*literacy events*', or the particular social events in which writing is used. Literacy events which involve mobile literacies might include (for example) 'unfriending' someone on a social network site such as Facebook.

Specific social approaches to writing, or '*literacy practices'* undergird literacy events and give them meaning and ideological values in society. Thus, while middle class parents approve of bedtime stories for young children and may encourage their children to use word-processing to write their school assignments, they may be horrified by their graffiti or textisms. In the context of mobile communication, literacy practices might encompass the situationally specific meanings associated with responsiveness – what does it mean if someone is slow to respond to a flirtatious text message? Is it appropriate to ask for a job via SMS? Thus the definition of 'literacy' is an ideological move, which imposes 'particular norms of social behaviour and particular relationships of power' (Buckingham, 2007:149).

The literacy practices associated with Western schooling are one form of literacy among many, but these are often given priority in open projects, such as for example academic citation conventions in Wikipedia. Anthropologists have found that these 'schooled' versions of literacy may have higher social status, but they are not always as helpful to people as the literacies that are acquired and used outside school settings. For this reason New Literacy Studies focuses on people's competencies, rather than their deficiencies -- even people viewed as 'illiterate' in school terms are often able to use literacy outside school to achieve their purposes (Prinsloo and Breier, 1996).

Nonetheless, ethnographies of low-literacy societies (e.g. Bidwell, 2014) reveal the many ways in which technological interfaces and systems themselves have inbuilt biases towards specific literacy practices and the 'social operating systems' with which they are associated, such as networked individualism (Rainie & Wellman, 2012; Wellman et al., 2003). As Bidwell explains, such systems translate culturally specific meanings of personhood and what being a person means: even when deployed with the intention of extending access to multimedia communication in rural communities, they remain tightly implicated in

reproducing the dominance of writing cultures, which tend to 'reify knowledge, disembody voices and neglect the rhythms of life' (Bidwell, 2014:51, 52). Open development projects might involve people in claiming such 'writing rights' by appropriating similar technologies. Bidwell highlights how important it is to document the costs and exclusions of such translations, both to the person involved, and to those who remain marginalized in its wake.

Digitally-enabled open networks all have resources and practices which aim, to varying degrees, to support access to an affinity space, while some go considerably further in their efforts to integrate new participants. These practices have been theorized in various ways to explain the development of open communities in Northern contexts.

Forte & Lampe (2013) argue that any open collaboration system requires specific attention to process of socialising new users. The support provided varies substantially, and the key skills needed are not always easy to discern. Ducheneaut (2005) has shown that contributing successfully to Open Source depends as much upon "a complex socialization process" and forms of "legitimate peripheral pariticipation" as on technical expertise. Steinmacher et al. (2015) identify multiple barriers to participation in open source software projects including technical hurdles, experiences of social interaction in the community, and challenges of finding suitable mentors. Halfaker (2013) considers the strengths and weaknesses of the social norms within the Wikipedia community that aim to encourage volunteer activity as well as policing anti-social behaviours, whilst Hill (2013) considers similar issues for the Scratch programming community. Imbalances and inequalities in such communities are also important. Ludwig (2014) shows that command of particular symbolic and stylistic vocabularies is a predictor of engagement in on-line communities, the converse being that those who are already marginalised by language and culture may face further marginalisation within nominally open spaces. Stahl (2014) provides similar results in relation to computer supported co-operative learning. Graham & Haarstad's (2014) observations on the global inequalities in representation within Wikipedia are an example of the consequences of these realities.

As suggested by the above review of obstacles to participation in supposedly "open" projects, the communicative infrastructure and 'writing rights' (Kress, 1994) needed to navigate, reshape and rally such learning networks are not universal. Beyond physical access, Blommaert (2008) has documented a long history of African writers struggling to establish 'voice' in the face of the stigma attached to grassroots literacies. Our review above suggests that these struggles are also present for contemporary voices attempting to access 'open' networks from the margins. In this sense then, open development requires mobility, or the ability to act across contexts, and to transfer identities, repertoires of interaction, voices and knowledge from one context to another (Blommaert, 2008; Kress & Pachler, 2007).

We ask to what extent distinctive digital materialities and networking practices hamper or support the development of voice and full access to “writing rights” in open development projects.

Technicities and diffusion of innovations

From a cultural studies perspective, contemporary technology plays a powerful role in the development of identity. Dovey and Kennedy (2006) explain this using the concept ‘technicity’, by which they mean the ‘interconnectedness of identity and technological competence’:

> People’s tastes, aptitudes, and propensities towards technology become part of a particular ‘identity’. This identity then becomes a basis for affiliations and connections with like-minded others. Our particular habits with, for instance, mobile phones, iPods, computer games or DVD collections can become expressions of our ‘technicity’ (2006, p. 64).

For example, Dovey and Kennedy assert that the dominant meanings associated with computer games produce an ideal subject that is naturalised as white, male and heterosexual, as well as resistant identities such as all-female gaming guilds. In other contexts, a range of resistant technicities have been documented, such as for example, the role of remix and media sharing in ‘conscious’ hip hop identities in South Africa (Haupt, 2008, Schoon, forthcoming), or children’s responses to adult hegemony in their gaming practices (Pallitt, 2013).

These broadly cultural identities and embodied interactions, then, play a key role in defining why, where, in what context, and to what extent individuals are exposed to particular technologies, and also whether they appropriate technological practices as integral to their identity. Thus informal learning networks will be shaped by people’s pre-existent social networks, which demonstrate strong patterns of homophily in relation to people’s closest relationships. Here the more distant relationships, or ‘weak ties’ (Granovetter, 1973) have been shown to play a particularly important role in connecting different communities, and thus in people learning about and adopting new innovations (Rogers, 1976). Online affinity spaces or communities of practice are of particular importance in that they also allow people to develop additional relationships which may not be as tightly mediated by their physical location and embodied identities.

Identity and learning

Individuals relate to their various communities in complex ways, mediated by their own embodiment and agency. People develop identities through participation in and exclusion from community practices, where they must negotiate a range of entitlements, expectations, and obligations (Hull and Greeno, 2005:78). The social meanings of particular bodies in relation to systems of gendered, racialised, age, caste and class signifiers are particularly

important. People's bodies and their general dispositions both communicate and reflect their social identities (Bourdieu, 1984). Exploring why people perceived class distinction, Bourdieu theorised the way in which habitual practice and dispositions became part of people's embodied identity, or habitus. These meanings can also infuse online interactions, where digital representations and associations are inflected by somatic significations, and where repeated practice gives rise to a digital habitus or hexis.

Positional identity (Holland et al., 1998) describes the way that individuals are entitled, expected and indeed obligated to participate in community practices in different ways, depending on their social positions. Thus identity consists of repertoires that guide people's participation in community practices, and their relationships with others. Presenting and representing the self to others in these relationship has been described as "voice". Voice allows individuals to take agency, authoring their identities as they participate in social worlds.
Furthermore identity is positional in that it can be understood in relation to three broad dimensions, namely interpersonal (relationships to other people), epistemic (relationships to knowledge) and discursive (relationship to language)(Hull and Greeno, 2005:83).

Online communication relies to a great extent on entering socially recognised discourses by means of various literacies. Thus it is important that assuming a particular identity requires access to and use of a discourse, or a socially recognised way of using language and other signifiers (Hull & Greeno, 2005): "we are constantly creating our identities from moment to moment through language and other forms of signification". (Hull and Greeno, 2005:84). For this reason, the process of learning a new discourse can involve changes to one's identity (Gee, 1996), and all the conflicts of becoming a different person (Hull and Greeno, 2005:78). Where these conflicts include postcolonial and decolonial clashes, we can expect further tensions in the process - "a linguistic, ideological struggle to make others' words at least somewhat one's own" (Hull and Greeno, 2005:85). The result can be multiple voices and complex and sometimes dissonant orchestrations.

The development of new literacies and the capability to make sense of writing in particular contexts (online and others) is likely to be crucial to open development. For this reason, a key theoretical lens for studying open development will be the New Literacy Studies, which is closely related to situated learning and is discussed below.

Going beyond these Northern theories, we explore Southern perspectives on identity which will help us explain how various invitations to "openness" are likely to be interpreted in the context of people's existing relationships and histories.
For example, colonial experiences of state power and subjection (Mamdani Mbembe [2001] 2015) diverge markedly from the ideals of citizenship and experiences of "public" in other contexts. While openness may be promoted by civil society such as NGOs and social movements, open practices may be interpreted from the lens of altogether more precarious "political society" which

refracts popular expressions of exclusion, often in non-democratic ways (Chatterjee, 2004, Mbembe [2001] 2015). Furthermore, in many contexts rejection and exclusion by the global economy has accompanied an embrace of open technologies but in relation to underground criminal networks (de Souza e Silva, Sutko, Salis, & de Souza e Silva, 2011). We need to understand local notions of sharing, which may be situated in histories of patrimony and clientelism (Mbembe ([2001] 2015). These along with collectivism engage radically different relationships and rules than those associated with libertarianism, the "Californian ideology". Where open goods are offered free of charge and perhaps devalued as a result, it may be necessary to consider the resonances of conspicuous consumption in many contexts where poverty carries an intense (and racialised) stigma (Posel, 2010).

The Materiality of Learning

The discourses reviewed above highlight the complexity of the social context in which learning and engagement with technology is situated. Additionally, interactions with technology and with 'open development' initiatives are also situated in and influenced by their concrete material contexts. For example, participating in an open initiative such as Wikipedia will be a different experience for a person using a desktop computer with a large screen, a physical keyboard, a space on a physical desk for making notes or referring to books, perhaps seated in a quiet library, and having a high bandwidth connection with no data limits, versus a person accessing the site using a mobile smart phone with a software keyboard, using bandwidth on a 'pay as you use' basis, and working in a South African township.

The particular technical design of gateways to open development initiatives will therefore have an effect on the degree of inclusion they are able to achieve. Consider for example the difference between attempting to update your status on Facebook from a smart phone using only the smartphone's browser to log in to https://www.facebook.com, versus using the browser to access https://m.facebook.com versus accessing the site using the Facebook app that is designed for your specific mobile device. In this case, the Facebook corporation has devoted considerable design resources to creating interfaces to their site that are specialised for these different modes of access. It is therefore important to understand how these material conditions interact with social context to influence engagement with open development.

Thus interface and communication architectures will effectively limit writing rights and digital literacies in developing contexts. Mobile architectures place severe constraints on the creation of more durable literacy artefacts, and the configuration of audiences, thus limiting authorship, publication and network-building on mobile platforms. In particular any designs intended for mass uptake must be highly economical in order to make minimal demands on users' limited processing power, cash resources, prepaid airtime and bandwidth. While mobile can certainly expand access to open development initiatives in theory, in practice the interaction between specific infrastructures and the practices of

learning networks will determine uptake. In particular the asymmetric affordances of mobile devices may shift uptake towards consumption rather than production of open development resources.

The mixed successes and failures of open development projects highlight the distance between designs for informal learning through peer networks and conventional approaches to designing digital resources.

A variety of theoretical frameworks exist to assist researchers and designers in considering the interplay of: the material context of a situation; the technical design of artefacts; and socio-cultural factors, together shape the evolution of interactions and systems. These frameworks can be broadly categorised as addressing these issues at either a macroscopic level, in the sense of exploring how longer term processes and choices may shape the evolution of technical and social arrangements of organisations over an extended time period (perhaps months or years); or at a microscopic level of analysing interactions between individuals, groups and technologies occurring over short time periods (seconds, minutes or perhaps days and months) to explore how the material design of the technologies (and of other artefacts in the system) influence momentary behaviours and choices, and how changes to those material designs might support different outcomes. Broadly, the macro level perspective is most commonly adopted in the sub-discipline of 'information systems', whilst the micro level perspective is commonly used in 'Human-Computer Interaction (HCI)'. Below, we discuss two of the major macro level perspectives from Information systems, and two of the major micro level perspectives from HCI.

Macro level frameworks

Structuration in Information Systems
Authors such as Barley (1986) and Orlikowski (2000) have used ideas from Giddens' (1984) structuration theory to consider the role that digital artefacts that are applied in organisations may be shaped in ways that reflect social structures, and in turn are implicated in the reproduction of social structures through their use. Thus there is a mutual shaping of the technology by the social relations of the organisation, and of social relations by the technology.

A structuration theory perspective on open development initiatives might thus look at social norms within such projects, management of technical facilities, and how the specific technical configuration of the system might enact, or be inscribed with particular assumptions about social relations. For example, although Wikipedia can be edited by any web user, there is a clear distinction between an anonymous user of the site and a registered user of the site. Registered users of Wikipedia (Wikipedians) have access to a number of additional facilities, in particular they can participate in discussions associated with a particular page, they can set automated 'watches' on a page so that they are notified whenever any user edits that entry, and they can award 'barnstars' to other Wikipedians to reward them and encourage them in their voluntary efforts on behalf of the community. Thus the website formally enacts a structural

distinction between anonymized and registered users, providing different facilities to each. There is also evidence of particular processes of socialisation for new entrants who join the community of editors which could be understood in terms of structuration of social norms which might be observed in debates and discussions, such as when a particular Wikipedia entry is highly contested (Bryant et al., 2005; Choi et al., 2010) Halfaker et al. (2014) propose a novel interface design specifically as an intervention into these socialisation processes.

Actor-network theory

Actor-network theory or ANT (Callon, 1990, 1994; Latour, 1987) allows us to identify the complexity of open development projects, which attempt to use technologies to develop learning networks, often with no institutional support (or coercion). Projects resemble marketing campaigns in that they must win the attention of participants. They are similar to social marketing strategies in that, if they are to go beyond publication or 'delivery' of content, they need to find ways to engage their audience, foster participation, and provide the tools which allow the transformation of audience into a network of publishers. In the terminology of ANT, this is 'translation' (Callon, 1986), a process whereby actors align the capacities and advantage of other actors to accomplish a goal.

Writing rights, literacy artefacts and learning

ANT also allows useful ways of understanding the relationship between first, technological designs for mobile communication (the socially shaped material affordances of mobile networks), and, second, the 'mobile literacies' that develop as people are enrolled in mobile networks and learn to act with them, deploying mobile technologies for their own purposes. From this perspective, objects are 'enacted', with properties that emerge as a result of the interpretive work and social strategies of their users and technology is thus seen as 'a set of multiple possibilities rather than a singular causal determinant' (Pelletier, 2009: 88).

Discussing book production and distribution technologies, Law describes the intricate socio-technical networks that are necessary in establishing relationships between authors and readers (Law, 1992:3). This is illustrated by Blommaert's (2008) research into grassroots literacies in Africa. He shows how, in parts of Africa, although most people learn 'how to write', they have limited access to the infrastructure of a book-oriented, vehicular and postal- distributed system of print communication, and when these obstacles are overcome, writers who try to write histories and biographies are stymied by the distance from the generic conventions needed to gain the interest or attention and recognition of elite audiences (Blommaert, 2008). Kress refers to a similar phenomenon when he discusses the uneven distribution of 'writing rights' within society, with most citizens limited to 'reproductive' modes of writing, rather than 'productive' writing and the status of authorship (Kress, 1994). Thus, while many people learn the alphabet and are able to write, they are not able to command the kind of socio-technical networks with which society rewards authorship.

A range of other voices have called for a socio-technical perspective on learning and literacy (Pelletier, 2009; Ito et al, 2010; Fox, 2000; Barton & Hamilton, 2005). Barton and Hamilton (2005:29) highlight the role of literacy artefacts ('stable mobiles' in Latour's terms) in shaping social relations, and exporting and maintaining them in new contexts. Such stable and portable artefacts are powerful in that they help to 'script' the performance of multiple agents in a network (Fox, 2000:863) and thus assist in coordinating action from 'centres of power' and maintain a network's influence over space and time.

Fox (2000) uses ANT to identify and account for power relations in communities of practice, and challenges us think less individualistically, and to reimagine 'the learner', who, from the ANT perspective "could be an actor-network comprised of human and non-human actants". Pelletier (2009) critiques simplistic notions of games generating particular kinds of learning practices and uses ANT to identify the interpretive work which takes place when ICTs such as games are adopted, appropriated and used. She argues that, rather than games generating learning practices, digital games exist within a network of relations (or contexts) and players perform meanings for ICTs and other technological artifacts as they act within these relational networks.

Thus the ANT perspective challenges researchers to take a new perspective on technological artefacts, systems and interfaces. Some artefacts act in ways similar to physical barriers, limiting or perhaps configuring access to fit a particular mould. Other artefacts, like literacy tests or insurance databases, act as 'stable mobiles' which not only represent the world, and spell out social relations and procedures, but also enact the procedures encoded in their source code.

Socio-technical perspectives are particularly helpful in understanding open development projects where technologies are to be recruited outside (usually Northern) networks or contexts of origin in order to be used 'for development' or "for literacy" in the South.

From the perspective of actor-network theory (ANT), objects exist within a network of relations. When people in Africa adopt technologies, the artefact arrives with its own implicit and enacted 'power architecture' - its design for use includes a set of built-in power relationships, in the form of choices and assumptions about how it will be used. Thus phones arrive in Africa already 'enrolled' in particular projects, and they themselves are actors:

> the technology's particular architecture embodies specific power relationships, between equipment makers and service providers, as well as between both of these and users. (Bar et al 2007:3).

These designs are not neutral. Thus adoption of mobile telephony can also be seen as 'enrollment' of consumers in networks of consumption designed to benefit mobile networks or handset manufacturers. Similarly, given the global

flows of technological innovation, the assumptions which inform technological designs are more likely to match the available resources and general living circumstances of middle class consumers in the North. Appropriation takes place when people in other contexts make such technologies their own and reinterpret them, developing new practices which accommodate their economic realities and are rooted within local cultural, social, and political networks (see e.g. Sokari, 2010; de Bruijn, Nyamnjoh and Brinkman,2009). Appropriation is closer to evolution and adaptation than mere adoption - people interpret the technology, selecting features that are useful, designing new practices, and disregarding or hacking features which do not serve their purposes, thus reinventing both the technology and their own practices. In a discussion of mobile phone use in Latin America, Bar et al. (2007) argue that appropriation is fundamentally political, a deeply creative confrontation, a struggle for power over how a technological system is configured:

> the definition of who can use [the mobile phone], at what cost, under what conditions, for what purpose, and with what consequences (2007:2).

The double dance of agency

A recognised problem with both ANT and Structuration theory in information systems is the challenge of articulating the agency of individuals, collectives (or social structures) and machines in social processes. Whilst both ANT and Structuration adopt a perspective in which technologies and artefacts affect social processes, the question then arises as to how this form of influence is related to the conception of people as agents in these processes. The ANT perspective involves a distinctive turn in analysis by specifically refusing to distinguish between the ways that a human might influence the evolution of social arrangements and interactions, from the ways that non-human objects might influence arrangements. Thus both humans and non-humans are treated in a uniform way as 'actants' enmeshed in 'actor-networks' that are composed of both human and non-humans, and ANT then attends to the evolution of these networks. This perspective can be related to the idea of treating both as Monads (Latour et al., 2012). This particular analytic choice may seem distasteful in a field such as development where fundamental principles and definitions are framed in human terms. For example concepts of human development, capabilities or human rights rest upon distinctions between humans and non-humans.

Rose and colleagues (Rose, Jones & Truex, 2005; Rose & Jones 2005) provide a critique of both these perspectives, and develop a framework for disentangling the differences between human and technological agency in these accounts. Rose et al.'s perspective acknowledges that human actions that are taken in a material and technological context will be influenced by that material context, such that activities and choices in any particular setting can be understood as being shaped by the existing material conditions. Just as the route that a person chooses for a particular journey is influenced by the availability of high speed transport connections, the choices that a human actor makes about who to communicate with and using what media (e.g. phone, email, letter, face to face,

online social media, video conference etc.) will depend on the ease with which different media can be used, as well as on established social norms in the context. Thus, the presence of particular media, and the characteristics of these media can be viewed as having an influence on the emerging social processes, whilst positioning the human actor as a primary agent with the freedom to make other choices. However, if the behaviour of human actors are recognised to also be shaped by social conditions and experiences, the shaping of current emerging behaviour can be seen to be subject to the influence of both prior human social interaction and the material form of technologies. In the social processes of designing, developing and deploying technologies within and across organisations, current emergent behaviours serve to shape the form that these technologies will take for future social interactions in that context. Thus there is a 'double dance' of agency with human and machine agency being intertwined to frame the currently emergent behaviour, shaping future technologies and social relations which in turn will influence the evolution of the social setting. This framing allows for a distinction between the forms of agency exhibited by humans and non-humans, whilst recognising distinctions between the forms of this agency.

A complicating factor in understanding the agency of non-humans is that some non-human technologies do not simply constrain human behaviour (for example a digital system that allows different users to use different features depending on their authority as modelled in the system), but can also generate messages and actions in an environment, for example a fire alarm system. In this case, although the machine has been installed on the basis of human agency (constrained by the availability of fire alarms, expertise of fitters and funds to pay for installation), analysis of the situation where the machine detects a fire and sounds the alarm is most easily described by attributing agency to the machine to trigger the social process of evacuation. As digital and automated systems become more complex and widespread, the frequency with which we encounter this type of automated agency is rapidly increasing. Thus, in addition to the distinction between human agency, material agency in the form of constraints or influence, we might consider a further category of automated non-human agency.

Micro level accounts

Complementing the above perspectives on the long term evolution of social arrangements and their interactions with Information Systems, a variety of perspectives have been developed for understanding the interplay between the form of technical systems and the momentary interactions between people and systems. Historically, the field of Human Computer Interaction emerged from interdisciplinary dialogues between computer science and psychology in the 1970s and 80s, but has subsequently evolved its concerns to address all aspects of human interactions with any form of digital technology and its material embodiments. Much of the early work in the field adopted a cognitive psychological perspective with efforts to conceive of human behaviours with technologies in terms of a 'human information processor' (Kuutti, 1996), concerned with goals and devising strategies to perform tasks and decomposing

tasks into subtasks and finally actions on the user interface of the technology. In the mid 80s this viewpoint was challenged by a recognition of the situated nature of interactions, notably by Suchman (1987). Suchman demonstrates the inadequacy of the cognitivist account of interaction and drew HCI scholars' attention to the broader material context in which interaction was taking place. Whilst the cognitive models provided an account of how humans might translate their intentions into actions on the interface, a perceptual account of how humans might recognise possibilities was developed around the idea of the 'affordances' of a material object or an interface to a technology. Thus handles afford grasping and pulling, where buttons afford pushing. Careful design of symbols and interface components to suggest their potential use could then serve to reduce the cognitive demands on human users.

Taking the situated view into account, in the 1990s a variety of frameworks and methods were developed to understand these processes of interaction, and to assist technology designers in their decisions. Two key frameworks developed were developed around the idea of Distributed Cognition and Activity Theory.

Distributed Cognition

A key tenet of Distributed Cognition is the idea that the practices involved in using tools to solve problems and perform tasks were poorly accounted for by a framework that located all cognition and interpretation in the human actor, and presented the tools as neutral, given artefacts. Considering the practices of maritime navigation, Hutchins (1995) demonstrates how the material artefacts of maps, compasses, sextants and digital devices actually frame and constrain the practice and transformation of representations to enable the performance of the task. On the other hand, Hutchins highlights the fact that a map is actually a designed instrument that does not actually correspond to any pre-existing point of view. Thus the accomplishment of the task must be recognised as an achievement of a distributed network of humans and non-human artefacts interacting together. Drawing on this insight, Hutchins and related work (Hutchins, 1995; Hollan et al., 2000) explore how complex processes are achieved in practice in particular settings, and how people use physical artefacts to support complex and skilful performance.

Ethnographic analysis of complex work settings such as Air Traffic Control Rooms (Fields et al., 1998), Ambulance Communication Centres (McCarthy et al., 1997), and Surgical Theatres (Hazlehurst et al., 2007) provide insights into how the physical structure of material artefacts serves to support the work process and enable communication between participants. Design methods such as Contextual Design (Beyer & Holtzblatt, 1997) suggest that studies of work situations to inform design should investigate artefacts used in the work to develop an Artefact Model which would complement associated models of work flow, social influence, physical layout of space, and the detailed structure of tasks and processes.

Wright and colleagues (Fields et al., 1997; Wright et al., 2000) propose a framework in which the 'next step' in an interaction between a user and a digital

system is governed by the combination of a range of resources, including: the user's objectives or goals; abstract strategies or more detailed plans that the user has developed; the current state of the world (as perceived by the user); the interaction history; the user's theory or model of the relation between actions and effects; and the user's perception of available possible actions (or affordances). As we have argued above, many of these elements will be influenced by prior experiences, including social experiences, of 'the user', but Fields' et al.'s focus is on the moments of interaction rather than the background shaping of these beliefs, theories or preferences. This reflects Fields et al.'s concern with designing interfaces to technology by considering how a user interface can be designed so as to make some of these resources more explicit and thus less reliant on the cognitive capacities and experience of the user. For example, Fields et al. consider how the 'chart wizard' in Microsoft Excel provides an explicit representation of an interaction strategy (a particular sequence of operations), and at each stage constrains the range of possible actions to reconfigure the chart. Whilst charts can be created in Excel without use of the Wizard, the Wizard provides a supportive structure to achieve the task. In a different example, Fields et al explore three different ways that the airspeed of an aircraft might be presented when a pilot is determining when to deploy the flaps for landing. They consider three different interface designs (a rotary dial with an attached 'speed bug' to indicate the target speed; a numerical display of airspeed, and a three number display presenting current airspeed, target and the difference). For each of these representations, the cognitive task of the user is quite different. In the rotary dial, the problem is one of perceptual recognition that the airspeed indicator is pointing at the speed bug, in the single numerical display, the pilot must hold the target speed in short term memory and calculate the difference between current speed and target, in the third case, the calculation is conducted by the software, and the pilot must interpret the numerical difference display to decide whether it is time to deploy the flaps. In this example, there is no external representation of any 'plan' or 'strategy', the plan to deploy flaps at the right moment is part of the pilot's skillset, but the user interface can be structured to support recognition that a key goal state has been reached. Similarly, interaction design choices can make other abstract interaction resources such as histories, available actions, current state and action-effect mappings more explicit.

A key insight in Fields' et al.'s work is that designers can deliberately (re-)distribute the necessary interaction resources between the interface to the digital technology, the surrounding material context of the interaction, and the surrounding social context of the interaction thereby changing the demands on the human participant.

Activity Theory

Distributed cognitive accounts of interaction highlight the localised situation of an interaction and the interaction resources that are present at each stage, drawing attention to the details of the user interface, and eliding details about the person using the technology. Activity theory offers an alternative framework for studying user interaction that seeks to balance attention to the details of

interaction design and the micro level perspective with attention to broader social, cultural and historical factors that influence the evolution of interactions.

The activity theory perspective, drawing on traditions from soviet psychology begins by seeking to understand human actions, human-human interactions and human-machine interactions as always situated within 'activities', and it is only in relation to these activities that actions and interactions can be understood. Activities may be shared and may evolve and change over time. Activities are focused by some shared object, which may be a tangible thing, or could be an intangible idea, that is being transformed towards some outcome. A person may be involved in multiple overlapping activities at the same time. Thus, when editing a Wikipedia entry, a person can be involved in the large scale activity focused on the object of the encyclopaedia as a whole, as well as a more local activity focused around the subject of that one particular entry. Collaborating with others in writing a research article may be part of an activity that is focused on the evolving paper, but may be part of larger activities such as progressing a research career and building a research group. Kuutti suggests a distinction between a lower level of actions, which might be characterised as having 'goals' with Activities that are aligned with larger 'motives'.

Activities are conducted in the context of a community who share the same object, although other members of the community may be engaging in different activities with that same shared object. It is important that the activity is meaningful for the subject who is engaged in that activity. Thus, according to the model proposed by Engeström (1987) and articulated by Kuutti (1996) analysis of each activity must consider these three central components: Subject, Object and Community, and the interplay between them.

In conducting an activity, the subject may employ many different tools, both physical tools and conceptual tools to transform the object. The tools used are shaped by historical and cultural factors, and mediate the way that the activity progresses and is conducted. As with the Distributed Cognition account given above, tools both enable and constrain the evolution of the activity because the transformations that are made are those that are perceivable from the perspective of the particular tool, whilst other possibilities remain invisible. Thus tools mediate the interactions between subject and object. Attention must also be given to the interplay between Community and Subject in an activity, which is governed by social norms and rules; and between Community and Object, which are shaped by the division of labour. This structure then provides a basic analytic framework that can be used to explore activities in any specific context.
Karanasios (2014) discusses how broader concepts from Activity Theory that deal with the interactions and evolutions of related activity systems and potential contradictions and alignments of different activities can contribute to ICT4D theory. As an example Karanasios and Allen (2013) discuss the diverse network of activity systems that initially framed an activity to establish a local broadband Town Information Network (TIN) in Slavutych (a new town created to meet the needs of people who previously lived in the exclusion zone around the Chernobyl Nuclear Power Plant in Ukraine) and the emergent activity systems

that subsequently developed using the TIN as a tool. Karanasios and Allen focus on the range of tensions and contradictions between the different activity systems that can be identified by recognising alternate focal subjects, objects and communities.

Mlitwa (2007) uses Activity Theory as a framework to investigate the role of computers in Higher Education in South Africa, and Hardman (2015) has applied the the framework to school mathematics teaching in disadvantaged South African schools. Cox (2013) uses Activity Theory to investigate resistance of academics at the University of Cape Town to developing Open Educational Resources.

Ekundayo (2013) uses Activity Theory as a framework to investigate the use of ICT in overcrowded Nigerian university classrooms. Ekundayo draws attention to the way that students and lecturers integrate and co-ordinate their activities across multiple tools including their mobile phones, cybercafés, flash drives, free internet services such as blogspot, Wikipedia and YouTube, books, email, papers, pens and highlighters. He contrasts his learning experiences in Nigerian universities with his experience in Singapore where a 'busy' computer lab still meant he had an office chair, a computer to himself and space on the desk for notetaking etc. His accounts draw attention to important details of the different material arrangements that shape the quality of the educational encounter. Ekundayo's work also examines how students and staff collaborate and draw on their community within the activity system to progress their educational object.

Activity Theory thus provides another structured framework that can be used to investigate the interplay of social and material factors in investigating a particular encounter between people, technologies and open development initiatives.

Research challenges

Approaching open development by attending to the informal learning that takes place as people encounter and engage with open initiatives will provide important insights to guide future efforts at open development. In this paper we have outlined a range of theoretical tools and frameworks that can usefully be applied to unpack the social, cultural-historical, and material dimensions of these encounters. These include: notions of peer learning, affinity spaces, genres of participation, new literacy studies, theories of identity, structuration, actor network theory, distributed cognition and Activity Theory. These diverse lenses can be combined to build rich insights across these social, cultural and material dimensions of open development.

We propose that empirical and ethnographic investigations should be directed towards encounters with open development as informal learning experiences.
Thus the overall goal is to provide an overview of theories exploring the socio-material conditions and actual practices of learning and engagement as people encounter open development projects. Potential projects could investigate:

- What are the experiences and trajectories of people at margins as they encounter and interact with open (development) initiatives?
- What are the implicit demands in terms of physical resources, social & technical skills, prior learning and networks of support to participate in differently open (development) initiatives?
- How are particular identities included or excluded through these socio-material processes in informal learning networks?
- What roles can and do intermediaries play in promoting learning and thus inclusion, and to what extent is it possible to overcome the socio-material barriers? What learning support strategies should be recommended?

We intend this paper as a provocation for future empirical research in the following broad areas:

- Trajectories and experiences of engagement in open (and pseudo-open) networks in development;
- constraints faced by users of mobile devices in activities that involve media authorship as opposed to media consumption;
- the role of social and cultural capital in online networks, and how this relates to various aspects of identity;
- explicit initiatives to visualise networks, support learning and address inclusiveness in open development projects.

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