8. BACK TO THE FUTURE WITH ICONS AND IMAGES: USING 'LOW-TECH' TO COMMUNICATE AND PROTECT PRIVACY AND DATA

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1. The quest for a universal language

Since the myth of the tower of Babel, humankind has been concerned with the impossibility of communicating across cultures, societies, and literacy levels. Although multilingualism can solve some of these challenges, pictograms and images carry even more potential of easily crossing cultural barriers. This is why traffic worldwide is governed by a set of symbols that uses minimal lettering to be culturally neutral and avoid misunderstandings on the road that could be fatal.[1] Similar wayfinding systems were created for the Olympic games in the Seventies and have then spread to be internationally adopted in airports and similar facilities where travellers of different origins need to move around effortlessly and rapidly.[2]

Convinced by the success of such initiatives in a growingly globalized society, policymakers have started to propose and regulate the use of pictograms in other domains, for instance to improve public safety. The European Union has elaborated and standardized several sets of symbols, seals, and labels meant to transparently inform consumers about the characteristics of similar products and support them in their comparison of the products to make better purchase decisions, for example in terms of energy consumption and food.[3]

1.1. Iconic language for data privacy

Basing their assumptions on similar premises, recently regulators[4] have

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1 Rayan Abdullah and Roger Hübner, *Pictograms, Icons & Signs: A Guide to Information Graphics* (WW Norton 2006).

2 Arianna Rossi and Gabriele Lenzini, 'Making the Case for Evidence-Based Standardization of Data Privacy and Data Protection Visual Indicators' (2020) 8 Journal of Open Access to Law 1.

3 ibid.

4 In Article 12(7), the General Data Protection Regulation explicitly provides for the use of standardised icons to give "in an easily visible, intelligible and clearly legible manner a meaningful overview of the intended processing". Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the

proposed the creation of a standardized iconic language capable to express data privacy concepts. Like pictograms employed to protect consumers, such a visual vocabulary would plainly inform individuals about how their personal data are collected and processed, including the entailed risks. It would thus supposedly empower them to make more informed decisions about whether to use one service over another.

In fact, icons are designed by humans with intent, thus their meaning must be interpreted by the viewer (unlike e.g., most photographs). If they intend to communicate efficiently and trespass language barriers, icons need to be easily recognizable. Lastly, they are a means to attract and retain the attention of viewers.[5] Pictograms can be designed for multiple goals: they may give directions, inform about a state, or signal the existence of an entity (i.e., indicative function); they may aim to induce or discourage a certain behaviour (i.e., imperative function); or they may try to influence the feeling of the receiver to trigger a certain reaction (i.e., suggestive function).[6]

The use of icons to increase information transparency has been conceived to solve some of the well-known problems of privacy notices that fail to effectively inform individuals about personal data practices, i.e., extreme length, language complexity, lack of visible textual structure.[7] For instance, existing evidence points to the role of icons to enhance navigability and noticeability of key notions in online legal notices,[8] even though much of the existing usable privacy research focuses on standardized formats and labels[9] rather than pictograms. Generally,

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Protection of Natural Persons with Regard to the Processing of Personal Data and on the Free Movement of Such Data, and Repealing Directive 95/46/EC [2016] OJ L119/1 (GDPR).

5 Rossi and Lenzini (n 2) 2-3.

6 ibid 3.

7 Arianna Rossi and others, 'When Design Met Law: Design Patterns for Information Transparency' (2019) Droit de la Consommation = Consumenterecht : DCCR 79.

8 The Behavioural Insights Team, 'Best Practice Guide. Improving Consumer Understanding of Contractual Terms and Privacy Policies: Evidence-Based Actions for Businesses' (Department of Business, Energy and Industrial Strategy of the UK 2019).

9 Patrick Gage Kelley and others, 'Standardizing Privacy Notices: An Online Study of the Nutrition Label Approach' (SIGCHI Conference on Human factors in Computing Systems, ACM, 2010).

icons can improve legal documents understandability, help information finding,[10] and retain a reader's attention.[11] They can be easily recognized, processed, and memorized, serving as cognitive support.[12] Usable security research demonstrates that visual indicators are effective to attract and retain attention, improve understanding, and make online risks more tangible.[13] On the other hand, some studies revealed the potential danger of misleading individuals[14] due to lack of standardization,[32] low quality design,[15] bad implementation,[16] or misalignments between designers' and users' mental models,[17] which casts doubt about the reliability of visual indicators for privacy and security.

1.2. Necessary conditions for universality

To overcome such challenges, two solutions can be devised. The first is a standardization that can be achieved via two complementary means, namely the combination of established norms and uniform use.[18] The European Commission has imposed the standardization of the consumer

10 Stefania Passera, 'Beyond the Wall of Text: How Information Design Can Make Contracts User-Friendly' (International Conference of Design, User Experience, and Usability, 2015).

11 Matthew Kay and Michael Terry, 'Textured Agreements: Re-Envisioning Electronic Consent' (Sixth Symposium on Usable Privacy and Security, ACM, 2010).

12 Connie Malamed, *Visual Language for Designers: Principles for Creating Graphics That People Understand* (Rockport Publishers 2009).

13 Sadie Creese and Koen Lamberts, 'Can Cognitive Science Help Us Make Information Risk More Tangible Online?' 24(6) Intelligent Systems, IEEE 32.

14 Ana Ferreira and others, 'Do Graphical Cues Effectively Inform Users?' (International Conference on Human Aspects of Information Security, Privacy, and Trust, 2015).

15 Jason RC Nurse and others, 'Trustworthy and Effective Communication of Cybersecurity Risks: A Review' (1st Workshop on Socio-Technical Aspects in Security and Trust (STAST), IEEE, 2011).

16 Douglas Stebila, 'Reinforcing Bad Behaviour: The Misuse of Security Indicators on Popular Websites' (22nd Conference of the Computer-Human Interaction Special Interest Group of Australia on Computer-Human Interaction, ACM, 2010).

17 Borce Stojkovski, Gabriele Lenzini and Vincent Koenig, '"I Personally Relate It to the Traffic Light" - a User Study on Security & Privacy Indicators in a Secure Email System Committed to Privacy by Default' (36th Annual ACM Symposium on Applied Computing 2021).

18 Rossi and Lenzini (n 2).

protection symbols mentioned earlier and is expected to do the same for the privacy icons, by taking expert advice into account. Habib et al., for example, have demonstrated how an empirical evaluation of icons is essential to convey the presence of privacy choices without creating misconceptions and, as a consequence, to inform policymaking.[19] The second key factor for successful standardization is widespread and coherent use of the pictograms across domains and applications. Immediately recognizable icons like the geolocation pin and the security padlock are *de facto* standards because they have been used across graphical user interfaces, becoming familiar to millions and even billions of users.

The second solution is machine-readability, which would also incidentally support the understanding of a graphical language by visually impaired people. A formal, machine-readable representation, as also prescribed in the law, can assign a semantic meaning to the icons by means of metadata in a machine-readable format (e.g., RDFa or RDF). Thus the icons become self-explainable and can facilitate searches, comparisons, and transparency.

2. From icons to characters: Comics as visual communication tool to obtain ethical and legal informed consent in genome research

Contrary to popular assumptions, icons may not always facilitate the expected level of comprehension necessary to comply with legal or ethical requirements. To fully understand what is depicted by an icon, the viewer thereof needs a certain amount of existing knowledge to make the icon easily recognisable.[20] Although the meaning of arbitrarily presented icons may be learnt over time as the viewer's familiarity with the icon increases, instant comprehension at first sight is unlikely. Factors

19 Hana Habib and others, 'Toggles, Dollar Signs, and Triangles: How to (In)Effectively Convey Privacy Choices with Icons and Link Texts' (CHI Conference on Human Factors in Computing Systems, ACM, 2021) <https://dl.acm.org/doi/10.1145/3411764.3445387> accessed 10 June 2021.

20 Arianna Rossi and Gabriele Lenzini, 'Which Properties Has an Icon? A Critical Discussion on Evaluation Methods for Standardised Data Protection Iconography' (Socio-Technical Aspects in Security and Trust. 9th International Workshop (STAST), Luxembourg City, Luxembourg, September 2019) *Revised Selected Papers* (Groß, Thomas, Theo, Tryfonas (eds), Springer 2021).

such as the viewer's cultural background, age, literacy, levels of education, sophistication, or existing knowledge of the icon's technical domain have major influences on whether the viewer can quickly and correctly interpret the meaning of the icon.[21] This assumption of pre-knowledge as condition for understanding icons poses a huge challenge to international standardisation efforts in respect of icon evaluation.[22]

On this basis the mere introduction of data protection icons to solve transparency problems and enhance privacy related communication issues has been criticised.[23] In reiteration of these icon designs it was found that the introduction of colour to designs is not only important to make a design visually more attractive, legible, and viewer-friendly, but it also enhanced direction and navigation in respect of icons used in computer displays.[24] The combination of icon and colour proved to be an effective integration of pleasure and comprehension whilst paving the way for more innovative designs following a holistic methodology that combines several media and evaluation indexes – such as comics.

2.1. Iconic thinking – a western mistake?

The human mind has powerful "image memory and processing capabilities" and images are often perceived as being universal in its communication capabilities.[25] In many areas, including the digital world, graphic

21 Siné McDougall and others, 'Measuring Symbol and Icon Characteristics: Norms for Concreteness, Complexity, Meaningfulness, Familiarity, and Semantic Distance for Symbols' (1999) 31(3) Behavior Research Methods, Instruments, & Computers 487.

22 ISO, 'Graphical-symbols–Test methods–Part 1: Method for testing comprehensibility' <https://www.iso.org/standard/59226.html> accessed 7 July 2021.

23 Yves Punie and others, 'DigComp into action, get inspired make it happen: A user guide to the European Digital Competence framework' (Publications Office of the EU, 2018) <https://op.europa.eu/en/publication-detail/-/publication/2b2c2207-5ca2-11e8-ab41-01aa75ed71a1> accessed 7 July 2021.

24 Yan-Peng and Peter C Woods, 'Experimental Color in Computer Icons' in M.L. Huang and others (eds), *Visual Information Communication* (Springer 2010) 149.

25 Ronald Baecker, Ian Small, and Richard Mander, 'Bringing icons to life' (SIGCHI Conference on Human Factors in Computing Systems, 1991) <https://dl.acm.org/doi/10.1145/108844.108845> accessed 8 July 2021. Steve A Connor, 'World's most ancient race traced in DNA study' (*UK Independent*, 23 October 2011) <https://www.independent.co.uk/news/science/world-s-most-ancient-race-traced-dna-

icons serve as road signs to guide people towards important and useful information to enable them to make informed decisions.[26] This was subsequently the premise on which a visual communication tool was designed to help bridge the communication gaps between an indigenous population and genome researchers in 2015.

The ancestry lines of the San people in southern Africa dates back approximately 100,000 years ago causing today's San people to carry the oldest living, and most diversified, genes in the world.[27] This diversity makes their genes extremely sought after globally for purposes of genomic research, i.e., to examine genetic variants and traits that provide important insights into disease development, the spread of diseases and the epigenetic influences that cause such diseases, which can lead to accelerated drug and diagnostic developments.[28] However, these genetic resources were almost lost to the world as a result of seemingly insurmountable language and educational barriers. Western researchers failed to obtain adequate ethical informed consent from San elders because they found it impossible to communicate with them and published the gene sequences without consent.[29] Despite the Working Group of Indigenous Minorities in Southern Africa objecting to this, the western scientists persisted in their refusal to engage with the San in an effort to acknowledge the need to consult with the San leadership, instead they justified their actions by referring to the ethical approval they had received from no less than four separate Research Ethics Committees (RECs). However, apart from most members of the San community

study-1677113.html> accessed 8 July 2021.

26 William Horton, 'Designing icons and visual symbols' (Conference Companion on Human Factors in Computing Systems, 1996) <https://dl.acm.org/doi/10.1145/257089.257378> accessed 8 July 2021.

27 Erna van Wyk, 'Largest genomic study shows Khoe-San people are unique' (*Phys Org*, 20 September 2012) <https://phys.org/news/2012-09-largest-genomic-khoe-san-peoples-unique.html> accessed 8 July 2021.

28 Eddie Cano-Gamez and Tania Trynka, 'From GWAS to Function: Using Functional Genomics to Identify the Mechanisms Underlying Complex Diseases' (2020) Frontiers in Genetics <https://www.frontiersin.org/articles/10.3389/fgene.2020.00424/full> accessed 8 July 2021.

29 Roger Chennells and Adriens Steenkamp, 'International Genomics Research involving the San People' in Doris Schroeder and others (eds) 'Ethics Dumping – Paradigmatic Case Studies, a report for TRUST' (Trust Project 2016) <http://trust-project.eu/deliverables-and-tools/> accessed 16 August 2021.

being illiterate, having low levels of formal education, and linguistically limited to their own indigenous languages, such indigenous populations also do not view individuality and individual rights in the same way as is commonly understood in western civilisations. In this regard numerous research ethics guidelines have been published which clearly set out the requirements for conducting research on indigenous peoples.[30] Although solutions to this problem, as proffered by the San councils, included a Code of Conduct, a research contract, an elected council, and collective permission principles, none of these provided any solution to the main problem of the San being unable to understand any consent forms presented to them, hence the need to create a communication solution that suits the needs of the San, whilst staying true and respectful of their culture.

The San have a history of storytelling and rock art to transfer knowledge which tradition, infused with modern usage of icons, could serve as an ideal medium of communication between researchers and the San population.[31] Steenberg-Botes subsequently created the visual informed consent communication tool shown in Fig. 1 to overcome the aforementioned communication obstacles and to enable the San to make fully informed decisions about their involvement in research projects, whilst protecting the public research interest in the research.

30 Australia National Health and Medical Research Council, 'Ethical conduct in research with Aboriginal and Torres Strait Islander Peoples and communities: Guidelines for researchers and stakeholders' (2018) <http://nhmrc.gov.au/guidelines-publications/e52> accessed 16 August 2021; and Canadian Government National Health Council, 'Research involving First Nations, Inuit and Metis Peoples of Canada' (2018) <http://www.pre-ethic.gc.ca/eng/policy-politique/initiatives/tcps2> accessed 16 August 2021.

31 David M Witelson and David-Lewis Williams, 'An ancient San rock art mural in South Africa reveals new meaning' (*The Conversation*, 31 March 2021) <https://theconversation.com/an-ancient-san-rock-art-mural-in-south-africa-reveals-new-meaning-157177> accessed 8 July 2021.

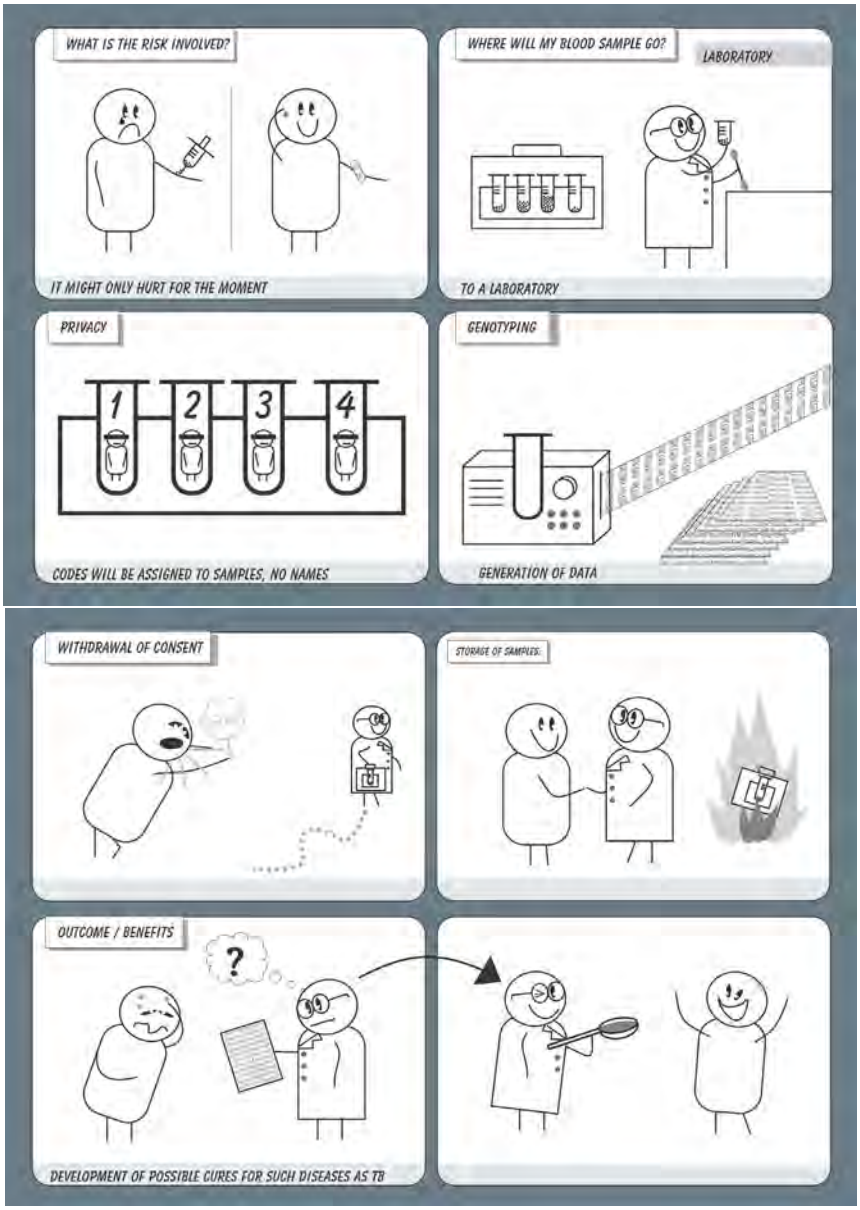


Fig. 1. Pages from the original San Genome Research comic that was tested during the study discussed

The design of this comic was conceptualised to depict the characters as a combination of icons and fully developed characters, which design was cost-effective to produce, reproduce, and scale. However, the San population did not identify with these characters. To the contrary, when viewed against the historical discrimination they suffered, it became clear that participants had a desire to be accepted by and incorporated into modern society and expressed the need to be portrayed as fully developed characters, in colour, and fully clothed in modern westernised clothing.[32]

2.2. Empirical testing and research results

The above genome consent comic was undertaken in two of the biggest South African San communities consisting of approximately 3,500 !Xhun and 1,100 Khwe speakers residing at Platfontein, 15 km from Kimberley in the northern Cape Province. A total of 150 members of these communities were identified to participate in the study, making sure that participants roughly represented the age groups of 18-30, 31-60 and 61-80+ years, and to ensure that all the age generations, levels of educational development, foreign language ability, and gender were fairly represented in the study.[33] Steenberg-Botes primarily followed a qualitative research method to explore the issues of comprehension improvement and identification with the characters, seeking insight rather than a statistical analysis of data.

Almost all the participants requested that the characters in the comics be clothed, indicating that the representation via the use of iconography did not resonate with them. This aversion seems to be related to historical discrimination and humiliation the San had to endure, hence their current strong need to fit into modern society and to be accepted by local communities, which must also be depicted in any visual material pertaining to them.[34]

32 Wilhelmina Marietjie Steenberg-Botes, 'Visual communication as legal-ethical tool for obtaining informed consent in genome research involving the San community of South Africa' (DPhil thesis, University of South Africa 2018).

33 ibid.

34 ibid.

This need confirms the theory by cartoonist McCloud, that people who prefer a more realistic depiction of visuals tend to have a more concrete perception of their environment, as opposed to the abstraction of symbols used in the written word.[35] Many of the San people also requested the use of only pictures and no words, which underscore their general concrete perception or awareness of their environment and tendency to move away from the abstraction of the written word to gravitate more towards concrete depictions, consistent with what is expected from people with lower levels of education or literacy. The participants with a higher level of education favoured the use of words in the comic more, whilst participants with lower or no levels of education favoured the exclusive use of pictures in the comic.[36]

The introduction of the genome comic increased participants comprehension of what genome research entails by 8,33%.[37] What was interesting is that there was a decrease of comprehension in two of the study questions that dealt with biological terminology and concepts of genome research, namely the methods used for obtaining genetic material (decrease of 6, 15%) and the fact that genes are located inside the human body's cells (decrease of 2, 89%).[38] It appears that research participants, when entering the study, had preconceived ideas about genes, their location, and how scientists obtain these for research purposes. Although some of the research participants previously encountered terminology relating to genomes or genome research, it was clear that they held incorrect preconceived ideas about these concepts and its actual meaning. The introduction of the comic appeared to have added to the San's initial confusion or diminished comprehension as a result of being forced to revisit such pre-conceived and incorrect ideas of these concepts when confronted with the correct meaning of genome terminology.

As opposed to the scientifically oriented questions, discussed above, the only legally oriented question that revealed a decrease in comprehension after the introduction of the comic was related to the issue of

35 Scott McCloud, 'Understanding Comics: The Invisible Art' (1993) <https://www.academia.edu/39224115/Understanding_Comics_The_Invisible_Art_Scott_McCloud> accessed 8 July 2021.

36 Steenberg-Botes (n 32).

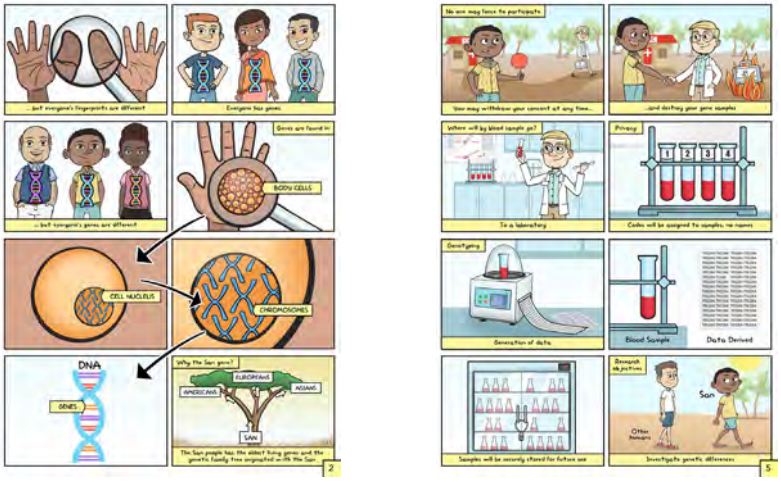
37 ibid.

38 ibid.

privacy. Research participants were especially concerned about the scientific handling of their genetic samples, as well as about the information that scientists could obtain from their biomedical samples. Almost all the participants refused to have their genome information published and were especially concerned about how the San will be depicted and received by the international (scientific) community. These concerns arguably stem from the historical exploitation that the San community in general experienced at the hands of scientists, as discussed above, as well as modern day discrimination and humiliation that they continue to suffer at the hands of local (non-San) communities.

2.3. Designing for experiental learning – colour, characters, comics

In consideration of the above research outcomes, the redesigned comic shown in Fig. 2 boasts full colour panels with much more background detail as requested by the participants during the study. Characters have also been developed into detailed characters and depict the San and scientists as fully clothed in modern day fashions and with smiling faces, as explicitly requested by the San. Text in this comic has been kept to the minimum but was still included to support the meaning of the images and provide a holistic message.



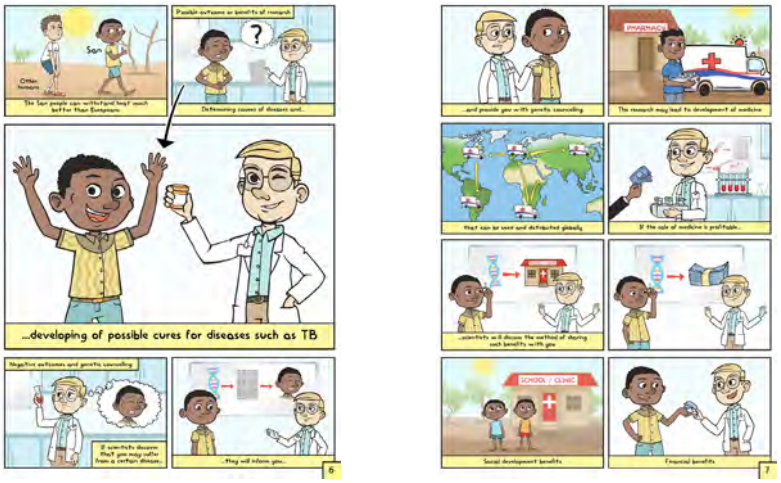


Fig. 2. Pages from the redesigned San Genome Research comic

Comics may overcome language and educational barriers and are a very effective medium to communicate complex concepts to a large diversity of people.[39] Characterising science or law brings alive otherwise abstract concepts from a lay person's perspective. The images make these concepts real and interactive, increase enjoyment and elicit an active engagement and a better information exchange between parties.[40] They provide an active learning experience as opposed to a passive one which changes the engagement dynamic and allows for deeper, more meaningful learning to take place. Traditional pedagogical approaches predominantly focus on content and are evaluative in nature, whilst experiential pedagogy focuses on the process and is developmental in nature.[41] With icons we have seen that a certain amount of existing knowledge is often necessary to make the icon easily recognisable.[42] This knowledge gap can also be overcome by the use of comics to convey

39 Elisa Schoenberger, 'Communication Science through Illustration' (2021) <https://bookriot.com/science-illustration/> accessed 8 July 2021.

40 Vincenzo De Masi and Yan Han, 'Animation: A New Method of Educational Communication in China' in Matteo Stocchetti (ed) *Media and Education in the Digital Age: Concepts, Assessments, Subversions* (Peter Lang 2014).

41 Colin Beard and Toby Rhodes, 'Experiential Learning: Using comic strips as 'reflective tools' in adult learning' (2002) 6 Journal of Outdoor and Environmental Education 58.

42 Rossi and Lenzini (n 20).

scientific or legal content to participants, thereby assisting with the development and empowerment of people.

Using graphic characters acknowledged the cultural values of the San in a respectful way and thereby allowed them the freedom to exercise autonomous decision making, more so than was the case with mere verbal information or written consent forms. This active involvement is what sets the use of comics as experiential teaching and learning mediums apart from other information or communication tools.

Comics promote comprehension which is experienced when a person understands a matter and is able to conceptualise it to help define his or her future activity, as opposed to apprehension, which is when a person is only aware of a matter in the here-and-now. The understanding of any matter is based on the formation of a proper concept thereof. Comics can facilitate the conceptualisation of otherwise abstract theories to attain a more holistic knowledge of it by achieving an adequate level of comprehension that complies with ethical and legal informed consent requirements.

Conclusions

Icons may become a universal language for data privacy only if they are standardized (both through norms and widespread, uniform use) and machine-readable to aid visually impaired people and maintain semantic meaning over time. However, they are not always the most appropriate solution to effectively communicate with different audiences. For instance, the socio-economic background and cultural rights (human rights), such as the right to receive information in a language or form that will enable full comprehension, which complies with the ethical requirement of respect and the legal requirement of dignity, must be taken into account. Therefore, any visual communication about data privacy must be sensitive to cultural interpretation. Only by incorporating human rights in the design of icons, comics, and other images will the messages be legal, ethical, and effective. Future work intends to analyze whether comics can communicate complex scientific and legal concepts to a more educated audience in a European context. It would also be meaningful to experiment whether a comic redesign may be more culturally correct and enable readers to better identify with the characters.

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EU legislation

Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC [2016] OJ L119/1