Humanising Data through 'Data Comics': An Introduction to Graphic Medicine and Graphic Social Science

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Abstract

In recent years data visualisation scholars and practitioners have drawn attention to the need for data to be humanised. In addition to making complex information more coherent, visualisations can work to incorporate empathy and help audiences connect to information. Addressing this call for humanising data visualisation, this chapter considers how the emergent area of 'data comics', looking at how the new fields of graphic medicine and graphic social science deal with numeric data. We examine recent data comics from graphic medicine and graphic social science that exemplify the complexities and potential of presenting data in more humanising ways. Our discussion is framed around what we call the EMA framework, considering the Epistemic (knowledge and perspective), Methodological (ways of working), and Aesthetic (practices of representation).

keywords: humanising data; feminist data visualisation; data comics; graphic medicine; graphic social science

The Call for Humanising Data Visualisation

In recent years data visualisation scholars and practitioners have drawn attention to the need for data to be humanised (D'Ignazio and Klein 2016, Gray et al 2016, Kennedy et al 2016, Lupton 2017). Looking at possibilities for haptic and visceral data manifestations, Lupton (2017) has called for the "generation of alternative or counter perspectives and greater opportunities for people to 'feel' their data in ways which make sense in the context of their own lives" (p15). In a piece that circulated around social media, data visualizer Giorgia Lupi provocatively asked, "Can a data visualization evoke empathy and activite us also at an emotional level, and not only at a cognitive one? Can looking at a data visualization make you feel part of a story of a human's life?" (2017). Resonating across these calls for humanising data is an acknowledgement that while data visualisations often do a good job of clearly presenting information visually, more emphasis can be placed on creating empathy and connecting data to audiences.

In this chapter we introduce the idea of 'data comics' looking at the emergent fields of graphic medicine and graphic social science in relation to humanising data visualisation. Recent work by Bach et al. (2018) on 'data comics' explains the potential of the medium in communicating 'data-driven' stories and provides practical information and theoretical research on how this might be done. Graphic medicine is an umbrella term used to bring together a growing number of comics that engage with illness, disability and the healthcare system (Green & Myers, 2010). Graphic social science refers to the use and potential uses of comics in public communication about social science (Carrigan 2017). By looking at

examples from graphic medicine and graphic social science, that explicitly engage emotive and empathetic narratives, focused on humanising findings, we work to expand Bach et al's (2018) call. We do so by considering the Epistemic (knowledge and perspective), Methodological (ways of working), and Aesthetic (practices of representation) dimensions of these exemplary data comics.

Both graphic medicine and graphic social science mobilise the graphic medium of comics to engage with data communication in ways that are approachable, accessible and relatable (McCloud 1993; Green and Myers 2010; Williams 2014; Czerwiec et al. 2015; McNicol 2016). By *approachable* we mean that the comics medium is familiar to people (McCloud 1993). They are *accessible* because the information is presented to the readers using iconography that is familiar to targeted cultural-audiences (Williams 2014; Czerwiec et al. 2015; Bach et al. 2018). Finally, data comics rely on elements of storytelling and visual narrative in order to make information *relatable,* using readers' personal experiences as a basis for the interpretation process (Bates 2012; Bowman 2017, McNicol 2016).

In addition to these benefits of engaging with the comics genre, research into graphic visualisation has shown that the effective use of text and image can enhance understanding of complex information, especially in low literacy and vulnerable audiences (Green and Myer 2010; Ahmed-Husain and Dunsmuir 2014; Al-Jawad and Frost 2014; Kassai et al. 2016). For example, beyond patient-doctor understanding, which was the original target relationship of graphic medicine (Czerwiec et al. 2015), comics have been examined as an effective communication medium to enhance social behaviours in young people with autism spectrum disorder (Ahmed-Husain and Dunsmuir 2014) and pre-surgery education for paediatric patients in order to improve post-surgery recovery (Kassai et al. 2016; current study by Thomas et al.[1]).

Introduction to the EMA Framework

To better understand how graphic medicine and graphic social science can help humanise data visualisation through their use of data comics, we created a framework which we call 'EMA'that is structured around three pillars. These pillars are intended to guide data visualisation evaluation and the future production of data comics. The pillars are: Epistemic (knowledge and perspective), Methodological (ways of working), and Aesthetic (practices of representation). These three pillars capture the varied formal conventions and underlying theoretical premises of graphic medicine and graphic social science. The EMA framework is a preliminary attempt to attend to the potential benefits that graphic medicine and graphic social science offer through their use of data comics.

The Epistemology pillar of our framework draws on trajectories of feminist knowledge production, specifically the work of Standpoint theorists Patricia Hill Collins (1990) and Nancy Harding (1986), in order to critically interrogate what counts as a data

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[1] See website for preliminary report: https://www.graphicmedicine.org/dont-be-afraid-of-surgery-comic-monkey-takes-pediatric-patients-by-the-hand/ . Current study theorised to be completed with final results by the end of 2018.

point, a data set, or a data visualisation. Is it only the scatter plot or pie chart that can effectively frame data? Or can comics, graphic novels, textiles, and other mediums also count as data visualisation? Further, our framework acknowledges the *partiality* of knowledge production and rejects the false binary between numbers and objectivity on the one hand, and stories and subjectivity on the other. Rather, we echo other recent scholars, artists, and practitioners, who employ both numbers and stories to provide a richer and more complex examination of their subject, such as Kate Mclean's (2017) sensory maps and the Data for Black Lives group ("Data for Black Lives," n.d.).

The second pillar of our EMA framework, Methodology, attends to the material reality out of which graphic social science and graphic medicine arises, that is, the conditions of production from the point of data collection to the ethics of distribution and remediation. How is the data collected, scraped, and analysed? How are the research 'subjects' included in the design framework, if at all? In what format are the graphics made available to the public? We are especially interested in alternative research models that might attend to these questions. Participatory design models, for example, are a generative source for rethinking the relationship between researcher and participant.

The final pillar of our EMA framework considers aesthetics as not merely the formal norms of color theory, iconography, and graph choice, but the politics of the handmade, the concept of mark-making, and the history of comics design. Developing the principles put forward by D'Ignazio and Klein (2016), it argues that a feminist data visualisation requires a rethinking of the relationship between power, context and the labour of making. How does the shape our work takes in turn shape the way it articulates its content? That is, how does form inform?

The remainder of this chapter uses the EMA framework to consider how data comics deal with numeric data, offering a humanising approach to the visual communication of information. Before turning to specific examples drawn from graphic medicine and graphic social science, we offer a brief history of these two emergent fields in turn.

History of Graphic Medicine
In 2007, the term 'graphic medicine' was coined by Dr. Williams, a physician, writer, and comics artist (Green & Myers, 2010). As a broad, growing field, graphic medicine addresses healthcare, illness, disability, patient education, treatment and experiences and practitioner experiences. The phrase provides an umbrella term to bring together a growing number of comics that engage with these issues. Today, "graphic medicine" is also a critically acclaimed organization[2] of the same name. Works classified as graphic medicine cross a variety of comics genres, including webcomics, graphic pathographies (health and illness memoirs), informational comics, comics strips, single panels and video/audio installations. In 2015, graphic medicine scholars, artists and practitioners published the seminal text *Graphic Medicine Manifesto,* an interdisciplinary collection of comics and

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[2] See www.graphicmedicine.org

essays that laid out how the comic, as a medium, serves as a way of communicating knowledge and experience to medical practitioners and students. The manifesto looks at the shifting iconography of illness and the power of self-representation. Advocates of graphic medicine see the potential of enhancing effective communication through the direct, collaborative involvement of patients, practitioners and artists.

Including quantitative data in graphic medicine is a way of juxtaposing the clinical definition of what the artist (or narrator) is experiencing with the actual lived encounter with the illness or disability. Graphic medicine works often reclaim the human side of health experiences from the clinical lexicon upheld by healthcare systems (Charon 2006; Farthing and Priego 2016; Priego 2016; Czerwiec et al. 2015). In particular, graphic pathographies – person-centred illness narratives in the comics medium – bring out the participatory and humanising aspects involved in the process of making them. As graphic pathographies involve acts of personal storytelling, they are well suited to the task of humanising data around the lived experiences of illness or disability, often complicating notions of ill identity (Green and Myers 2010).

Christina Maria Koch (2016) describes how "the visual-verbal medium of comics is particularly apt in showing how intricately mental states are bound up with lived bodily experience and an embodied sense of self" (p. 29). In the comics medium, the somatic and psychological experience of one's changing health identity is found in hyper visualised graphic embodiment that allows for a holistic representation of human experience. The medium allows for a lived reality of the artist to be made visible to their readers through their mark-making. For the purpose of understanding how we might humanise data visualisations, the next section examines an example of graphic medicine through our EMA Framework.

Graphic Medicine and data visualisation in *Taking Turns*. *Taking Turns* (2017) is an account of MK Czerwiec's experience as a nurse in an HIV/AIDS care unit during the AIDS epidemic from 1994-1999. Czerwiec's hand-drawn line graph, which spans from 1981 - 2000, uses data produced by amfAR (The Foundation for AIDS Research; fig. 1, n.p.)[3]. The artist includes small drawings alongside the graphical line to mark important historical moments in the AIDS crisis. By doing so, Czerwiec creates an emotional narrative out of the data visualisation's timeline (X axis) and the known deaths of AIDS victims in the U.S. (Y axis). Czerwiec adds three illustrations and caption boxes to further contextualize the HIV/AIDS epidemic. However, it is in the images that Czerwiec links numerical data to emotive narratives for an emotional impact.

Epistemological. The hand-drawn style of this data visualisation, discussed in greater detail in Jill Simpson's chapter of this collection, serves as a reminder of the human that produced it. Czerwiec's made an epistemological decision to use data in conversation with her own life experience enhanced the emotive narrative behind the numerical information

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[3] See website for more information: https://www.amfar.org/

presented in the visualisation through her aesthetic choices. She used existing data collected and refined by amfAR. By embedding this data into a personal narrative, readers get to know the larger data set in a smaller scale. Here the placement of Czerwiec's hand-drawn graph at the end of her emotive narrative shows readers the larger context of the HIV/AIDS epidemic.. Simultaneously, embedding the national statistics within her story contextualises the numerical data through a small number of people's life stories.
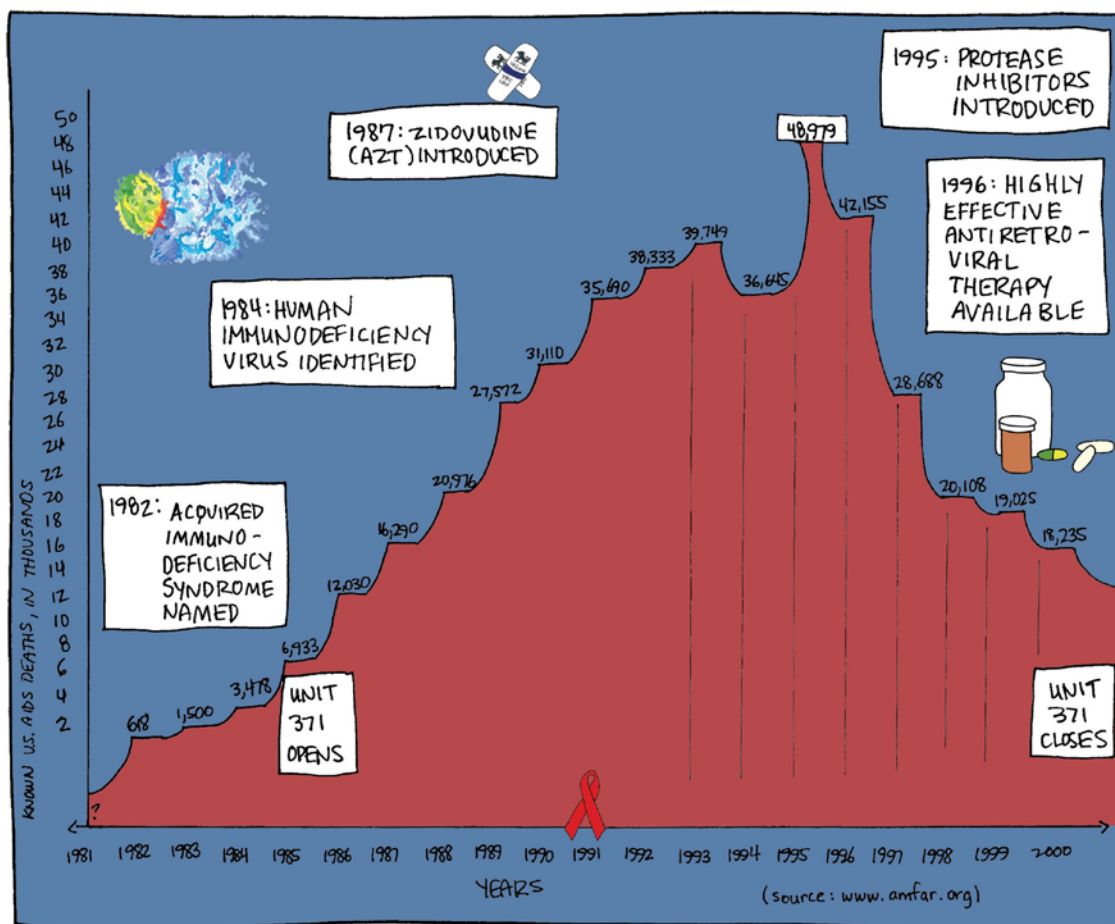

Figure 1. Hand-drawn amfAR line graph. Reprinted from *Taking Turns* (n.p.), by M.K. Czerwiec, 2017, University Park: The Pennsylvania State University Press. Copyright 2017 by M.K. Czerwiec. Reprinted with permission.

   Methodological.Through emotive narratives a line graph displaying deaths on a national scale is scaled down to the stories of patients in one HIV/AIDS care unit and nurse MK. The rise and fall of the deaths on the graph are similar to the structure of a basic narrative; the three images included are that of the introduced antagonist, one of nurse MK's conflicts, and the hope embedded in a dénouement. This change in medium is a shift in the ways of producing and method of distribution of the existing amfAR data. Readers of graphic pathographies have the potential to interact with the graph and larger illness narrative physically by turning back to the moments in the story the data refers to. This does not occur

in traditional interactions or encounters with data visualizations and is a methodological affordance of the medium.

Temporal and spatial scales create affordances in the comics medium that, combined with the hand-drawn characteristic of Czerwiec's line graph, creates experience with a data visualisation that is untraditional and explained by the principles of data storytelling. It creates longer and more intimate interactions with emotive narratives, whereas traditional interactions with graphs are brief. According to Bach et al. (2018), a key principle of "space-oriented" genres of narrative visualisation, which they list as infographics, charts, and posters, is that a reader can relatively quickly and effortlessly interpret the information (p. 2). In this encounter, the communicability of the data visualisation will have an impact on how long the reader will engage with the information, unlike "time-oriented" genres, like videos or animations, where the time is predetermined (Bach et al. 2018, p. 2). Bach et al. (2018) classify the data comics genre as being both spatially and temporally oriented, which allows readers to choose their own pace and also has a narrative structure that research has shown "is intrinsically easier to remember and facilitate readers engagement and persuasion" (p. 2). The time spent with the emotive narrative adds depth to the line graph even with the inclusion of three images discussed next for their aesthetic contribution to the amfAR data.

Aesthetics. The line graph is included at the end of the text, so we can imply that readers are encountering it after they have read the longer emotive narrative and are able to link the images back to their seminal place in the story. Readers are assumed to recognise the HIV virus cell (the green-yellow and blue abstract image) from the beginning of the story when Czerwiec describes and illustrates HIV and AIDS for her readers (fig. 2, p. 6). This image appears when the virus is referred to in the story. The comics medium allows the creator to visualise the virus, thus transforming it into the antagonist of the story, rather than a sick body for one individual. During the HIV/AIDS epidemic victims of this disease were stereotyped and led to social stigmas of homosexuals. HIV/AIDS became synonymous with the gay male body. By separating the virus from its carrier, Czerwiec challenges her readers to examine their bias and the way that social stigma affects marginalized populations.
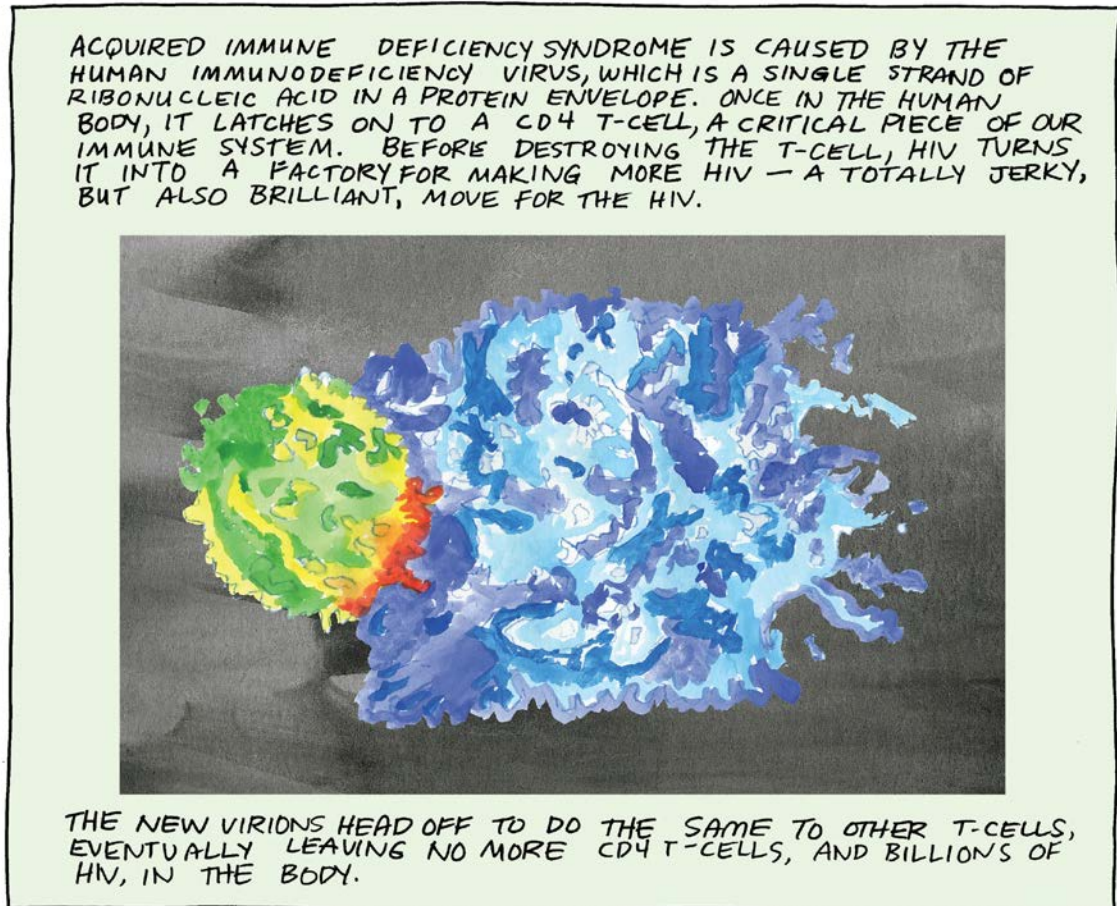
Figure 2. HIV virus cell. Reprinted from *Taking Turns* (6), by M.K. Czerwiec, 2017, University Park: The Pennsylvania State University Press. Copyright 2017 by M.K. Czerwiec. Reprinted with permission.

The second image in the line graph is an image of AZT pills. This is a reminder of when MK accidently stabbed herself with a needle after treating a patient in her unit (fig. 3, p. 83). AZT is prescribed to her in order to attempt to fight any transmission that may have occurred. The inclusion of the pill in the graph reminds readers of the fear, anxiety and unknowns surrounding the HIV/AIDS epidemic as seen through nurse MK's personal experience. The reader's experience of reading this section of the narrative would have mirrored to some degree these emotions: does nurse MK now carry the virus? Seeing this image in the graph allows the reader to reflect upon their own experience reading the story.
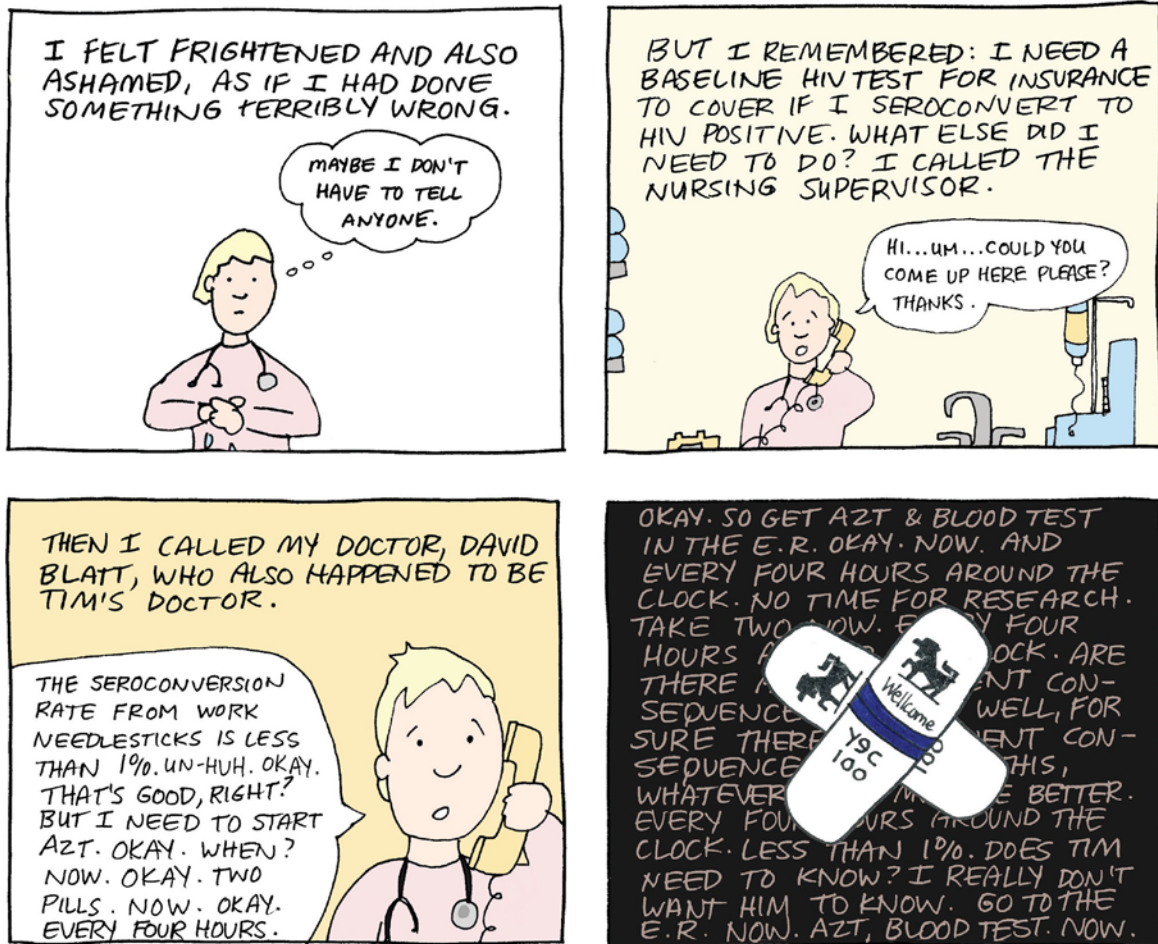
Figure 3. ATZ pills perscription. Reprinted from *Taking Turns* (83), by M.K. Czerwiec, 2017, University Park: The Pennsylvania State University Press. Copyright 2017 by M.K. Czerwiec. Reprinted with permission.

The third image that Czerwiec includes in the graph is the medication bottles and pills. This image, as its accompanying caption states, is the H.A.A.R.T. (Highly Active Anti-Retroviral Therapy) medications that became available in 1996. The bottles and pills come from a single full page panel with the caption, 'And then hope arrived.' (fig. 4, p. 146). Returning to the line graph, we see that the the ATZ pills are placed above the highest reported deaths in 1995-1996, thereby aligning fear and death; whereas the location of the H.A.A.R.T. medications, with the decreasing reported deaths,provides a feeling of hope to the visualisation.

Using our EMA framework we are able to examine how Czerwiec's use of data visualisations and the comics medium in a graphic pathography not only brings clinical evidence to these stories , but in turn contextualises data by embedding it in an emotive narratives.
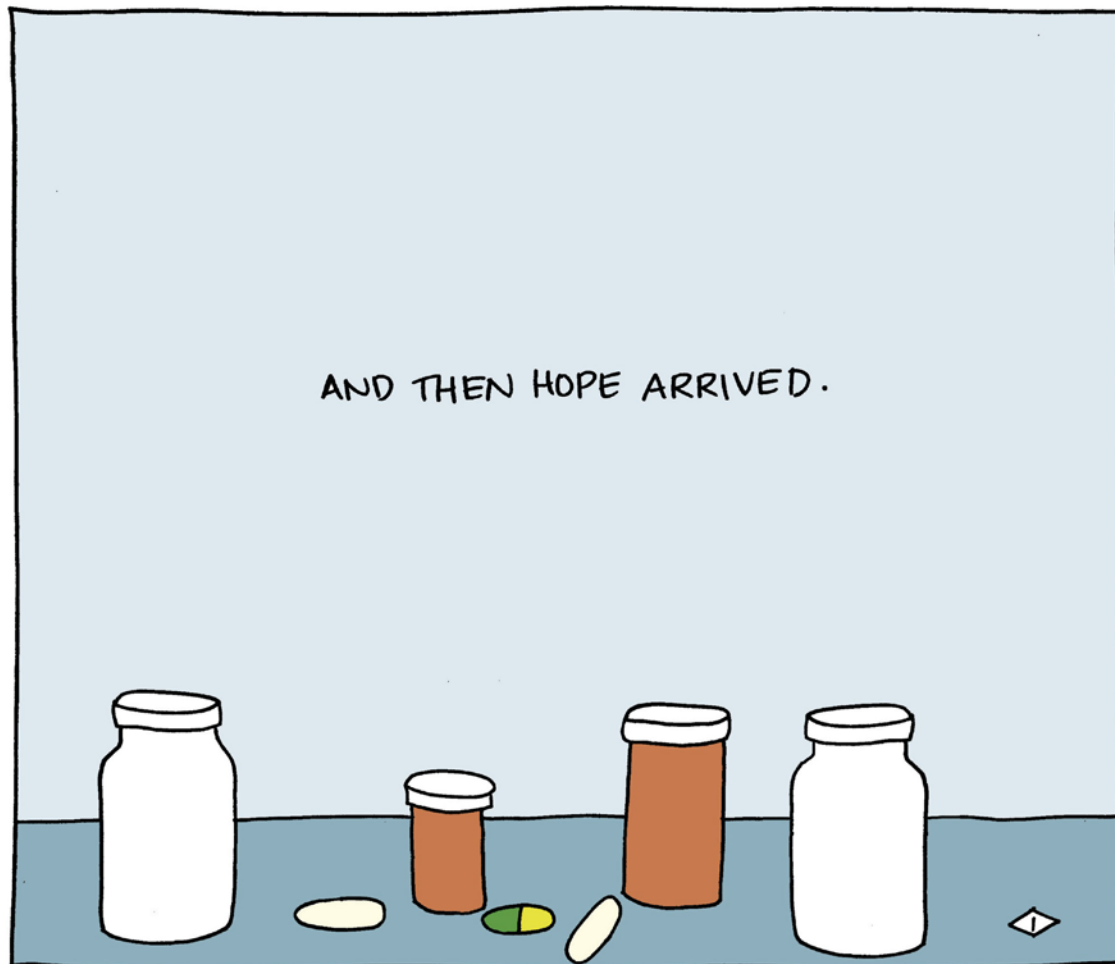
Figure 4. H.A.A.R.T. medication introduction. Reprinted from *Taking Turns* (146), by M.K. Czerwiec, 2017, University Park: The Pennsylvania State University Press. Copyright 2017 by M.K. Czerwiec. Reprinted with permission.

Graphic Social Sciences

Just as graphic medicine has offered a new way of thinking about and relating to medical research, the burgeoning field of graphic social science hopes to establish itself within the social sciences (Alamahodaei et al. 2017). In June 2017, the Graphic Social Science Research Network was established to provide a forum for scholars, artists, and publishers to more formally consider the practical and theoretical implications for the integration of graphics into social science. While some efforts have been made to adapt research articles and theses into the comics medium (Priego 2016), many affiliated with the network are interested in embedding data visualisations to more impactfully communicate research findings to stakeholders, through graphic, emotive narratives. Just as graphic medicine highlights the socially embedded and psychologically contextualized nature of illness, the work explored in this section uses personal experience to extrapolate larger claims about social and political realities, and the ways that these realities in turn shape everyday life.

***Funny Weather* and graphic social science.** British comics artist, graphic novelist, and zinester Kate Evans produces work that significantly parallels graphic medicine and offers a social sciences example of data comics. Like MK Czerwiec, Evans' comics stretch the comics medium to include sweeping biographies (*Red Rosa* 2015), comics journalism (*Threads: From the Refugee Experience* 2017), and educational guides on breastfeeding. Although Evans is not an academically trained social scientist, her works can be classified as 'graphic social science' for the ways that they draw on social science research to graphically represent complex numerical data in the comics form.

Epistemological. *Funny Weather We're Having at the Moment: Everything you Didn't Want to Know About Climate Change but Probably Should Find Out* (2006), or simply *Funny Weather*, is Evans' take on the topic of climate change. The comic covers an impressive amount of data, visualising complex meteorological processes that account for rising sea levels and average global temperatures. She constructs two characters that lead the viewer through the narrative. One of the characters is a young boy, and he reflects the viewer: we learn alongside him about the realities of the carbon supermarket, and his youthfulness is used to represent naïveté or, alternatively, youthful idealism and the will to change society for the better. The other main character is a nameless man in a suit, a cigar poking out of his paunchy mouth – a "fat cat" that represents the elite class that helps to manufacture dangerous emissions. Throughout the comic, he's constantly pushing back against the young boys questions and explanations. In one panel, he's depicted towering over the young boy, his face contoured in rage. The text beside his image reads, "Who says climate change is even happening anyway? I'm not convinced! We need more proof!" In this sense, he represents the more broadly antagonistic social attitudes towards human-driven climate change.

While these characters may seem over-the-top, they are hyperbolical manifestations of two opposing subject positions vis-a-vis the larger issue of human-driven climate change. It is the standpoint of the characters, rather than objectivity, that most concerns Evans. In an interview with the author she states, "In your so-called objectivity you're missing out a layer of political information that people need to make sense of the world. I don't attempt to be objective in the representations I make. What I do is I make a representation of events that's consistent with the facts, but I make it as emotionally engaging as possible to the reader." For Evans, epistemic knowledge is always situated and made legible by one's embeddedness in social and political systems.

Methodological. Evans' methodology reflects her interest in creating empowering educational tools to guide social change. In preparing a new comic, she spends substantial time reviewing the source data in order to translate it into an easy-to-understand format for the lay reader. From the perspective of an activist and comics artist, it is the scientific report or the data table that obscures, rather than highlights, the truth. The reality of climate change that *Funny Weather* addresses, as reflected in meteorological and geological information, is made illegible by 'science-speak.' Instead, the comic becomes a vehicle to both demystify and translate this complex data, ultimately with the goal of spurring her reader to pressing action.

Figure 5. Explanation of methane gas. Reprinted from *Funny Weather We're Having at the Moment: Everything you Didn't Want to Know About Climate Change but Probably Should Find Out* (n.p.), by K. Evans, 2006, Oxford: Myriad Editions. Copyright 2006 by Kate Evans. Reprinted with permission.

Aesthetics. Like other works from graphic medicine, *Funny Weather* employs a hand-drawn, unsophisticated aesthetic that mirrors the epistemological positioning of its central protagonist. This simple style also echoes Evans' participation in feminist and queer zine subcultures of the 1980s and 1990s, where handdrawn aesthetics and a DIY ethos prevailed. Within this subculture, there was an emphasis on the ethics of practice; that is, that one's methodology can help orient one's work towards or away from social justice. It was also common for zines to be Xeroxed for distribution, giving many of them their signature black-and-white, shadowed, and irregular appearance. We see many of these same properties in *Funny Weather*.

We encounter the graphs alongside the characters, looking with and through them. Encountering the data in this way collectivises the process of understanding, as the characters dialogue with each other to clarify graphical meaning. As a social activist, Evans has always been interested in questions of accessibility. In an interview with *Scientific America*, when asked why comics are a good teaching tool for difficult science, Evans relates the power of humour to demystify complex statistics. "People are having fun," she says. "When you create that, it's very easy to get the message across." By using laughter, silliness, and absurdity, Evans is able to tackle the topic of climate change in a disarming format. Aesthetically, the comic strip is obviously hand-drawn, which adds a lighthearted and playful impression. Like

graphic medicine, Evans elevates the comics medium to a legitimate and innovative epistemological frame for the visualising of data.

Lessons from Data Comics

Comics and related graphic forms allowed for more inclusion of the affective and personalise(Czerwiec et al. 2015; Williams 2014). In each of the case studies we explored, comics practices of graphic storytelling are used to expand the realms of possibility for the visual depiction of numerical data. These artists' work repurposes contemporary data sets to offer a fundamentally richer encounter with the lived realities from which these data are gleaned. By applying our EMA Framework we can see how data comics engage an approachable, accessible and relatable aesthetic form that allows for new ways of knowing and understanding data, strengthening the connections between lived experience and numeric information.

Reading data comics from the emergent fields of graphic medicine and graphic social science in relation to data visualisation enables us to see how comic forms can be engaged to visualise human reactions and encounters with data, how data comes to be known or experienced , and what data does in terms of shaping our lives and the lives of others. We argue that by using the EMA framework, we can explore the epistemic, methodological and aesthetic possibilities for expanding what data visualisation can do. Graphic medicine and graphic social science have a powerful role to play in humanising data visualisation. These graphic works allow us to expand representations of personhood beyond traditional statistical ways of symbolising people in data visualisations. Engaging with data comics to visualise information can help humanise the personal narratives behind the numbers.

Reference List

Ahmed-Husain, S. & Dunsmuir, S. (2014). An evaluation of the effectiveness of Comic Strip Conversations in promoting the inclusion of young people with autism spectrum disorder in secondary schools. *International Journal of Developmental Disabilities*, 60(2): 89-108. doi: 10.1179/2047387713Y.0000000025.

Al-Jawad, M. & Frost, L. (2014). Creating and analysing practitioner comics to develop a meaningful ward manifesto for a new dementia care unit. *International Practice and Development Journal*, 4(2). url: https://www.fons.org/Resources/Documents/Journal/Vol4No2/IPDJ_0402_06.pdf.

Alamahodaei, A., Alberda, A. & Feigenbaum, A. (2016, November). *Giving Graphic Narratives to Numbers.* Paper presented at An Agenda for Graphic Social Science, London, UK.

Appadurai, A. (1988). *The Social Life of Things: Commodities in Cultural Perspectives.* Cambridge: Cambridge University Press.

Bach, B., Wang, Z., Farinella, M., Murray-Rust, D., & Riche, N.H. (2018). 'Design Patterns for Data Comics. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI 18.* doi: 10.1145/3173574.3173612.

Bates, V. (2012). 'Misery loves company': sexual trauma, psychoanalysis and the market for misery. *The Journal of Medical Humanities,* 33(2): 61-81. doi: 10.1007/s10912-012-9172-x

Bordo, S. (1987). *The Flight to Objectivity: Essays on Cartesianism and Culture.* Albany: State University of New York Press.

Bowman, D. (2017). The Moral of the Tale: Stories, Trust, and Public Engagement with Clinical Ethics via Radio and Theatre. *Journal of Bioethical Inquiry,* 14(1): 43-52. doi: 10.1007/s11673-016-9766-5

Boy, J., Pandey, A. V., Emerson, J., Satterthwaite, M., Nov, O., & Bertini, E. (2017). Showing People Behind Data. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems - CHI 17.* doi:10.1145/3025453.3025512

Carrigan, M. (2017, June 21). What is Graphic Social Science? [Blog post]. Retreived from https://markcarrigan.net/2017/06/21/what-is-graphic-social-science/.

Charon, R. (2006). *Narrative medicine: Honoring the stories of illness*. New York: Oxford University Press.

Czerwiec, M., Williams, I., Squier, S. M., Green, M. J., Myers, K. R., & Smith, S. T. (2015). *Graphic medicine manifesto*. University Park, PA: The Pennsylvania State University Press.

Czerwiec, MK. (2017). *Taking Turns: Stories from HIV/AIDS Care Unit 371*. University Park: The Pennsylvania State University Press.

Data for Black Lives. (n.d). Retrieved November 9, 2018, from the D4BL website: http://d4bl.org/

D'Ignazio, C. (2015, December 1.) What would feminist data visualization look like [Blog post]. Retrieved from https://civic.mit.edu/2015/12/01/feminist-data-visualization/.

D'Ignazio, C. & Klein, L. (2016, October). *Feminist Data Visualization*. Paper presented at and published in the workshop proceedings from the Workshop on Visualization for the Digital Humanities at IEEE VIS Conference, Baltimore, Maryland.

Evans, K. (2006). *Funny Weather We're Having at the Moment: Everything you Didn't Want to Know About Climate Change but Probably Should Find Out.* Oxford: Myriad Editions.

Farthing, A., & Priego, E. (2016). Data from 'Graphic Medicine' as a Mental Health Information Resource: Insights from Comics Producers. *Open Health Data*, *4*(1), e3. DOI: http://doi.org/10.5334/ohd.25

Farthing, A., & Priego, E. (2016). 'Graphic Medicine' as a Mental Health Information Resource: Insights from Comics Producers. *The Comics Grid: Journal of Comics Scholarship*, *6*, 3. DOI: http://doi.org/10.16995/cg.74

Fyfe, G., & Law, J. (Eds.). (1988). *Picturing Power: Visual Depiction and Social Relations.* London and New York: Routledge.

Gordon, A.F. (2008). *Ghostly Matters: Haunting and the Sociological Imagination.* Minneapolis: University of Minnesota Press.

Gray, J., Bounegru, L., Milan, S., & Ciuccarelli, P. (2016). Ways of Seeing Data: Toward a Critical Literacy for Data Visualizations as Research Objects and Research Devices. *Innovative Methods in Media and Communication Research,* 227-251. doi:10.1007/978-3-319-40700-5_12

Green, M.J., & Myers, K.R. (2010). Graphic medicine: use of comics in medical education and patient care. *BMJ* 340(c863). doi: https://doi.org/10.1136/bmj.c863.

Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. *Feminist Studies,* 14(3), 575-599. doi: 10.2307/3178066.

Harding, S. (1986). *The Science Question in Feminism*. Cornell: Cornell University Press.

Hill Collins, P. (1990). *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment.* Boston: Unwin Hyman.

Kassai, B., et al. (2016). Introduction of a paediatric anaesthesia comic information leaflet reduced preoperative anxiety in children. *British Journal of Anaesthesia,* 117(1): 95-102. doi: 10.1093/bja/aew154.

Kennedy, H., Hill, R., Aiello, G. & Allen, W. (2016). The work that Visualisation Conventions Do. *Information, Communication and Society*, 19(6), 715-735. doi: https://doi.org/10.1080/1369118X.2016.1153126.

Koch, C.M. (2016). "When you have no voice, you don't exist"?: Envisioning Disability in David Small's Stitches. In C. Foss, J.W. Gray, & Z. Whalen (Eds.), *Disability in Comic Books and Graphic Narratives* (pp. 29-43). Palgrave Macmillan, London. doi: https://doi.org/10.1057/9781137501110_3.

Lupi, G. (2017, January 30). Data Humanism: The Revolutionary Future of Data Visualization. *Print Magazine.* Retrieved from http://www.printmag.com/information-design/data-humanism-future-of-data-visualization.

Lupton, D. (2017). Feeling Your Data: Touch and Making Sense of Personal Digital Data. *New Media & Society*, 19(10), 1599-1614. doi: https://doi.org/10.1177%2F1461444817717515.

McCloud, S. (1993). *Understanding Comics: The Invisible Art*. New York: HarperCollins Publishers.

McLean, K. (2017). Mapping the Invisible and the Ephemeral. In A. Kent and P. Vujakovic (Eds.), *Routledge Handbook of Mapping and Cartography* (pp. 500-515). New York: Routledge.

McNicol, S. (2016). The potential of educational comics as a health information medium. *Health Information & Libraries Journal,* 34: 20-31. doi: 10.1111/hir.12145.

Priego, E. (2016). Comics as Research, Comics for Impact: The Case of *Higher Fees, Higher Debts*. *The Comics Grid: Journal of Comics Scholarship* 6, 16. doi: http://doi.org/10.16995/cg.101.

Refaie, E. (2012). Chapter 2. In *Autobiographical Comics: Life Writing in Pictures. University Press of Mississippi* (pp. 49-92). Jackson: University Press of Mississippi. http://www.jstor.org/stable/j.ctt24htk9.

Williams, I. (2014). Graphic medicine: The portrayal of illness in underground and autobiographical comics. In V. Bates, A. Bleakley, & S. Goodman (Eds.), *Medicine, Health and the Arts: Approaches to the Medical Humanities* (pp. 64-84). London: Routledge.

Wood, D. (2015). Mapping deeply. *Humanities* 4(3), 304-318. doi: https://doi.org/10.3390/h4030304.