Encounters with Errors: How the error shapes relationships with digital media practice

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Abstract

This paper considers how the 'error' shapes our relationship with computation and creative practice. It also considers how rethinking the 'error' can aid undergraduate students when learning about digital media practice. Comparing conceptions of the 'error' with those of other key concepts from digital and creative practice such as 'glitch', reveals the defining character of the 'error' and the way it shapes creative processes.

As well as surveying the role of the 'error' in digital arts practice, this paper also discusses the author's experiences of teaching undergraduates on a digital and interdisciplinary arts programme. It reflects on the impact that challenging conceptions of the 'error' can have on students' understanding of computation and creativity.

Introduction

We encounter errors daily when interacting with the many computer systems that we have incorporated into our lives. They take the form of corrupt files, buffering video feeds or the esoteric HTTP status errors, the most famous of which is the '404 page not found'. Given its ubiquity, the 'error' might be one of the defining characteristics of the digital or as some would term it the 'post-digital' age [1, 2]. If the digital revolution is over as the term 'post-digital' suggests, then the error is surely here to stay rather than an initial problem to be eventually overcome.

The error describes the moments when things simply do not work, revealing the limits of our mastery of computers. This is in contrast to the way that new technologies are typically advertised, with promises of increased ease of use and seamless integration into our lives. It has been suggested that we struggle to accept our lack of complete control over computational systems, and that when things break down they create a rupture in our experiences and the flow of media [3]. Yet perhaps we have now reached the point where we are resigned to and have come to accept the error. We clearly respond to the slick advertising that promises to replace our existing hardware and software with improved versions, but we also accept that they will ultimately be flawed. We agree to the

regular 'automatic updates' that will be needed to ensure that they keep functioning at all. Meanwhile there is an acceptance of an inbuilt obsolesce that means that new products are designed to fail [4].

Mark Weiser of Xerox PARC wrote that "a good tool is an invisible tool" [5]. This resonates with the notion of 'transparent immediacy' that has come to dominate so much of our interactions with computers, and which sees the interface aim to disappear [6]. Errors break this transparency and yet, it could be argued, their ubiquity means that they have their own form of invisibility. Not all errors are equal and will range from minor inconveniences that pass almost unnoticed to total system and user meltdowns.

This paper considers how the more mundane and everyday errors may frame our relationship with computing. It will also consider how the way we perceive and understand the role of errors might inform undergraduates' approaches to media practice. Reflecting on experiences of teaching on an interdisciplinary arts course, the benefits of a research-oriented approach are discussed, including how this helped to give a structure within which students can 'fail' successfully.

Corrective Errors

The term 'error' is used widely and has a number of meanings across disciplines and contexts. It is a catch-all term but is also one associated particularly with computing. The first recorded use of the term error in relation to computing comes from none other than Ada Lovelace, often described as the first computer programmer, who used it in relation to programming the Analytical Engine. As well as having a computational flavour, there are many detailed taxonomies providing definitions of the error as it relates to programming. Such taxonomies employ categories that include 'error' alongside other terms such as 'bug', 'defect', 'failure' and 'fault' [7]. These tend to define the error as a mistake made in code that prevents it from functioning. This does not quite match the more everyday experiences and usages of the term error. Error messages, for example represent the correct functioning of code in so far as it has successfully identified a 'potential error' before it has actually occurred [8]. Other terms such as 'defect' defined as "the difference between the actual outcomes and expected outputs" might better describe what we encounter and think of as errors [7]. Some taxonomies further divide the error into "syntax errors (grammatical errors in a program), logic errors (errors in an algorithm), and exception errors (arising from unexpected conditions and events)" [9]. These subdivisions produce an even more granular understanding of the error, albeit one that most people outside of computer programming will not be familiar with, and which, if the programmer has been successful, will have already been eradicated.

What these taxonomies show is that the error is a complex and important concept in computer programming, and the many ways in which computers can fail. Much thought is given to their causes and how to remove or mitigate them. Here we can see the 'corrective' character of the error and how it can function as part of a feedback loop that is intended to identify deviation from a predetermined path [8]. This sees the error as part of a wider process, largely concerned with efficiency and assumptions about what

the underlying goal is. However, this understanding of errors may leave little room for the actual relationship between intention and the human experience of coding.

Revealing Errors

One well known study of errors shows the complex relationship between, hardware, intention, technology and human fallibility. In his paper 'The Errors of TEX' Donald Knuth recorded the changes made in the development of the 'TEX' programme over a 10 year period [10]. Knuth details over 850 errors recording the causes which range from the technical to the very human 'a forgotten function' or 'a trivial typo' [10]. What Knuth's detailed record and reflection hints at is that each error has a story behind it. Each is embedded in a context and is a form of encounter. Knuth also notes the ambiguity between error and change. Is this he wonders a log of changes or of errors? Knuth's error log is a record of the programme's evolution. Clearly the error can be a prompt for action and change as part of a wider process. It also suggests that error is something that we have identified and acted upon. In one sense Knuth's is a record of noticed or noteworthy errors.

Since 2012, the Algopop blog has recorded the many instances of 'algorithm failures', highlighting the way in which they have come to influence so many aspects of our lives [11]. Among the found examples documented on the blog are racist slogans on automatically generated T-Shirt designs offered for sale on websites and 'photo app' fails that show how facial recognition can have a very limited understanding of what a face looks like. This is part of a critique of digital culture that employs error as a means of addressing and

questioning dominant discourses and power relationships. As the many examples on the algopop site show, they can be arresting, often offensive, surreal, disturbing or simply amusing. Each example reveals something about the underlying algorithm that might otherwise have gone unnoticed. These are noteworthy errors that show us the biases, encoded prejudices and unforeseen juxtapositions that can occur. Mark Nunes argues that errors can act as a critical lens that "reveals a system's failure" as well as its "operational logic" [8]. By contrast other errors might not be considered as noteworthy even though or perhaps because they are encountered so regularly.

Technological Imaginary of the Error

HTTP status errors and especially the 404 'page not found error' encapsulate a particular relationship with errors. Here the error is not hidden, waiting to be revealed or highlighted as an exception, but instead are 'hidden in plain sight' by their ordinariness and ubiquity. In one sense they are not an error at all but a sign of the program functioning as intended, the 'error' having been caught. But they are also a clear sign of a rupture and deviation from our expectations. The many imaginative 404 pages shows some of the creative potential in the error or at least in our encounter with it.
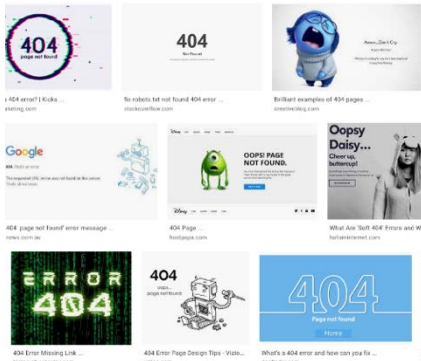
Fig 1: Image search results for a 404 error

The often humorous 404 sympathises with us and encourages us to find irony in our predicament. In doing so they also acknowledge our acquiescence, impotence and normalise our relationship with errors.

The 'bug' is another catch all term but one with a very different character. Much like the error, it is associated with computing although it predates computers, some sources attributing its first recorded use to Thomas Edison [12]. In contrast to the error, the bug anthropomorphises the error, imagining it as a gremlin in the machine, and in doing so gives us something that blame can be attributed to. This concept seems to resonate with the way that we think about our relationship with computers and machines. It expresses something of our desire to control them and our inability to do so completely. The bug becomes a useful scapegoat. A prominent example of how the bug has entered the public imagination is the 'Y2K bug' or 'millennium bug' that threatened to bring disruption to computer systems worldwide on the 1st of January 2000. This bug was frequently depicted as a literal bug or insect in public awareness campaigns and news media, and suggested something malevolent lurking within our machines (figure 2).

Errors can be thought of in functional or technical terms. However, when we encounter them, we are more inclined to understand them in subjective terms, framed by control or our lack of over computers. In order to understand how errors shape our relationships with media we need to consider not only what causes them but how they are understood and what they represent. A 'technological imaginary' of the error perhaps. One that thinks of the error "in terms of its hardware and as a representation of cultural aspirations – imagined and actual" [13].

Figure 2: Millennium or Y2K bug, BBC News

The error also brings with it a connection to the term's origin, to 'err' or 'wander'. It is perhaps this quality that manages to describe both the adherence to a path as well as the deviation from it. Both the corrective and revealing. A dual nature that makes it worth considering further in relation to the intersection between digital culture and creative practice.

Error and creative practice

Creative practice has a long association with the error and what deviation from prescribed paths can offer. Failure is seen as essential to creative practice since, as Colson Whitehead writes, "It is failure that guides evolution; perfection offers no incentive for improvement." [1].

Here the error guides evolution just as Knuth's 'evolution' of TEX but with a very different intention. This is wandering as exploration rather than wandering from an intended path. The concepts of 'trial and error', and the 'happy accident' are accepted parts of the creative process. As Lisa Le Feuvre puts it "Artists have long turned their attention to the unrealizability of the quest for perfection" [14]. In the arts, failure is not just a part of practice but a subject of investigation. As Peter Krapp notes much of digital culture embraces the "reserves that reside in noise, error and glitch" [15]. Set against the prevailing drive for the perfection of transparent immediacy "failure has become a prominent aesthetic in many of the arts in the late 20th century" [1].

A prominent example of embracing the potential of the error is that of what might be termed 'glitch art'. Artists such as JODI and Rosa Menkman have presented the error and the glitch as an experience that ruptures the flow of media. The dysfunctional websites of JODI seem to encapsulate the "omnipotence of computing systems and despairing agency panic of the users" [15]. Such work interrupts the transparent immediacy described by Bolter and Grusin and in doing so creates its own form of immediacy or 'hypermediacy' that confronts us with the act of mediation and media's constructed nature [6]. Rosa Menkman's Glitch Manifesto sets out a clear agenda to challenge the dominant media channels in which the glitch is an act of resistance.

However, the success of the glitch has seen it become reabsorbed into the dominant media streams it has sought to disrupt. Many of the visual disruptions employed by glitch artists have been adopted as an aesthetic and visual short hand for 'resistance' in main stream media. It has been used as a visual effect applied to TV adverts, films, and photography. An app store search for 'glitch' returns several apps that will automate creating a glitch effect, while numerous tutorials exist online showing how to achieve a glitch effect using Photoshop.

The glitch has allowed us to metaphorically peek behind the curtain, and remind us of the constructed nature of media. But perhaps we have now become accustomed to the idea of what lies beneath and have acquiesced to our lack of control. It also shows how quick we are to turn to the convenience of automation by using glitch filters. We are happy to automate the act of resistance.

Kim Cascone describes how glitch music emerged as a product of the "immersive experience of working in environments suffused with digital technology" [1]. The whirring and buzzing of hardware and the 'failures' of system crashes, clipping and distortion being incorporated into the music of what Cascone terms 'post-digital' artists. Glitching allowed musicians to reveal a subtextual layer and was a direct result of their experience of the creative technologies they were employing.

Twenty years have passed since Cascone described the environment that led to glitch music. The question now is what is the nature of the environment that we currently experience and how does it contribute to and influence media practice? Has the normalisation of the error and acceptance of the glitch closed off its potential as a critical lens?

Error and the Hidden Curriculum

Many of these issues relating to the error and creative practice came to the fore while teaching on an interdisciplinary media arts course. One module in particular encountered issues when asking students to take a more experimental approach to media practice. It raised questions about how their prior experiences of media tools, including notions of failure, error and success were informing and possibly constraining their approaches.

The module Media Frontiers asks students to engage with the frontiers of media practice from a technical and conceptual standpoint. This involves engaging with a range of practices from emerging media to more established and what might be described as old or 'residual' media [16]. The aim is to help students to develop strategies for critically examining practice and developing new ways of working. Students found developing new ways of working challenging and it became clear that this was in part because of a fear of failure. Although the module brief asked them to take risks and be experimental, they were overly focused on the idea of producing a 'final finished piece' that led to conservative approaches and conventional ways of working.

Many students arrive already producing high quality media content for sizable audiences reached through platforms such as Instagram, YouTube and Soundcloud. This made their lack of confidence when asked to experiment with new ways of working all the more puzzling. One possible cause could be the particular context in which they are accustomed to make work which may be prescribing a mode of practice. Concepts such as 'produser' [17] and 'prosumer' [18] describe an ambiguous relationship between media, audience and maker. They imply a doubling up of roles, both producer and consumer simultaneously. While apparently shifting power to the individual, and adhering to the rhetoric of a participatory and convergent culture [19], they may disguise the existence of a third party, the digital/computer that facilitates both the making and the experiencing. This is not a neutral party but is often assumed to be. [3, 21]

While undoubtedly expert users of media systems, they seemed to struggle to locate or understand them in a wider context. This became especially noticeable when they are asked to develop new ways of working with media. It is as though they are constrained by their role as a 'producer of content', something which runs contrary to the way we typically think about participatory culture and the empowerment this can apparently provide [19]. It is as though the ubiquity of digital media, as Berry notes in relation to computation itself, "is increasingly not seen, obscured or ignored by virtue of its everydayness." [20].

It may also be a case of "Misprescribed digitality" [21]. The term 'digital native', while no longer seen as a useful concept [21], still reflects an assumption about the way that digital skills are acquired instinctively. However, this assumption about prior knowledge and innate understanding may be unhelpful when teaching critical approaches to media practice [21]. Instead, their prior experiences may form what has been described as a 'hidden curriculum' [21].

Douglass Rushkoff questions the neutrality and passivity of digital technology. For Rushkoff, digital technologies are not mere tools but more

akin to autonomous agents [21]. It is from this position that Aaron Knochel critiques Photoshop and examines the ways in which digital tools in effect teach without us in a form of "non-human pedagogy" [21]. The 'photoshop fail' shows how digital tools encode preconceived notions of the correct image. Seen in this way the concept of 'retouching' an image applies social codes that teach about issues such as the female body, gender and objectification [21]. The terms of failure have been preassigned, reinforced by the many collections of 'photoshop disasters' shared online.

Prescribed ways of using digital tools are further reinforced by the incorporation of instructional manuals and training into the interface itself. This is especially visible in the propriety Adobe suite of tools. Hovering over tools will produce a window with a short description of the tool and even animations demonstrating how it can be used. While invaluable as ways of learning about a new software tool, these guides may also reinforce an assumed use and in turn a path to be followed.
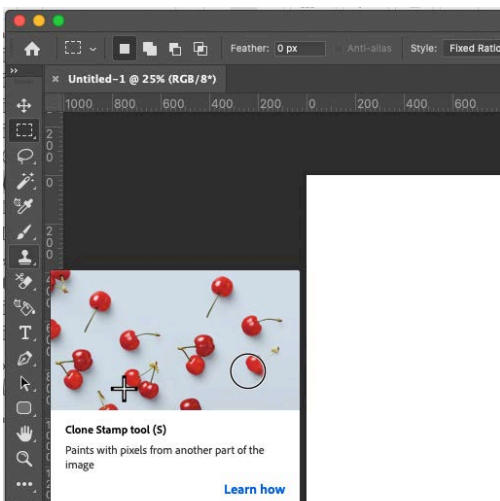

figure 3: Photoshop in-built user manual

pop-up

I have already written about the role of pre-sets and preferences in shaping the use of digital tools [22]. Pre-sets and preferences, while facilitating use, can also contribute to a passivity on the part of the user. Going outside the predetermined parameters returns error messages preventing you from taking the tool to its actual breaking point.

A clear answer to the more prescribed ways of working that propriety software present are open source and creative coding tools that allow practitioners to take far greater control. These tools, especially ones involving coding which offer the most control, come with a learning curve for those unfamiliar with them. By comparison to the tools offered by social media, which are designed with ease of use as a central concern, they are more complex to use and require greater investment to master. This in itself forms part of a hidden curriculum that turns students away from tools that could potentially give them far more control.

The influence of errors as part of a hidden curriculum takes many forms. These include the way that error messages may simply be accepted, closing down possibilities without question. It also includes an understanding of the error as part of a feedback loop leading to success. This is reinforced by assumptions about what tools are capable of and what they should be used for, and prompted by the software itself in the form of in-built tutorials. Meanwhile concepts such as the 'Photoshop fail' define the terms of success and enforce societal norms.

Creating the Space for Error

In order to address the issues that students were facing and encourage more experimental and critical approaches to media, changes were made with the intention of creating a space in which they could 'safely fail'. Rather than being asked for a final piece of work, they were asked to produce a series of experiments. The aim was to remove the pressure of arriving at a resolved piece of work in order to encourage risk taking. Instead of a brief they were asked to develop their own research questions in response to a range of themes. These questions gave their experimentation a sense of enquiry and purpose.

This approach was heavily influenced by the teaching team's experience of practice-based research. The overall approach can be seen to reflect a 'research-oriented' and 'research-based' approach, placing importance on the process rather than outcome [23, 24, 25]. It aimed to shift focus from 'research as knowledge demonstration' to 'research as the creation of knowledge' [26] and from practice as the demonstration of knowledge to practice as a means of generating knowledge.

Students were encouraged to see errors as learning opportunities that could be used to turn attention back on to intention and expectations. This encouraged a questioning of prior knowledge and the 'hidden curriculum'. In tutorials, errors became points of discussion that could be used to suggest new avenues. The research questions that they were encouraged to devise provided a scaffold and a context for their reflection on what they learnt from tests, 'mistakes' and encountered errors.

Workshops introduced techniques for glitching and hacking hardware. These aimed to open up possibilities for by-passing conventional tools. FLOSS and creative coding tools such as Processing and P5.js were introduced as an alternative to propriety tools but were used alongside proprietary tools so that the different affordances could become a point of discussion.

Feedback from students in the module evaluation was generally positive. Many students noted a greater sense of freedom to explore, take risks and explore alternative possibilities with comments such as: "This allowed us to come to completely different areas we otherwise wouldn't have considered in such a linear progression we are typically used to. It allowed for a sense of fluidity and feeling of constant evolution – active almost, as opposed to a relatively passive methodology of having your conceived idea and undertaking it." and: "it encouraged us to think outside the box and exhaust the avenues we explored."
However, some reported feeling overwhelmed by the freedom and found it difficult to move away from the idea of working towards a final outcome. For these students the freedom and 'permission to fail' was not as empowering as hoped. Clearly, this strategy does not work for all students and some will benefit from other approaches or from a more structured framework to critique their practice.

Conclusion

Whether described as defects or imagined as bugs, errors are an inherent part of interactions with computers and digital media. Knuth describes a process of identifying errors as part of a learning process. In media arts practice the error is also a means of learning although not necessarily as part of a feedback loop

that assumes a defined path. Our general experiences of error are less prone to be learning experiences and instead are likely to guide us back onto a suggested path. Alternatively, they may simply be ignored, represent a closure or divert us.

These encounters with errors inform our understanding of media and approaches to media practice in ways that are not readily appreciated or acknowledged. When teaching media practice such prior knowledge and experiences potentially form a 'hidden curriculum'. Digital tools are not neutral and encode certain conventions and ways of working. The errors they produce reveal these encoded limits and suggested uses. What we think of as an error and how we choose to respond shapes our understanding of what is possible.

This paper suggests how a research-oriented approach may encourage students to question their assumptions about media practice. This approach aims to create a space where errors and mistakes are seen as ways of generating knowledge. It also aims to help students develop strategies that recognise that the limits of the tools they use are not the limits of possibility.

References

1. Cascone, K. (2000) 'The Aesthetics of Failure: 'Post-Digital Tendencies in Contemporary Computer Music', in Computer Music Journal, Vol. 24, No. 4, pp 12-18, The MIT Press
2. Cramer, F (2014) 'What is Post-Digital?', APRJA, Vol. 3, Issue 1, available at: http://lab404.com/142/cramer.pdf , accessed 8th November 2021
3. Campanelli, V. (2010) 'Web Aesthetics: How Digital Media Affect Culture and Society', NAi, Rotterdam
4. Wieser, H. (2016) 'Beyond Planned Obsolescence: Product Lifespans and the Challenges to a Circular Economy', in GAIA – Ecological Perspectives for Science and Society, Vol. 25, Iss. 3, pp 156-160
5. Weiser, M. (1994) 'The World is not a Desktop', in Interactions, Vol. 1, Issue 1, pp 7-8
6. Bolter, D. J. and Grusin, R. (2000) 'Remediation: Understanding New Media', The MIT Press
7. Java T Point (2021), Difference between Bug, Defect, Error, Fault & Failure, available at https://www.javatpoint.com/bug-vs-defect-vs-error-vs-fault-vs-failure, accessed 9th November 2021
8. Nunes, M. (2011) 'Error, Noise, and Potential: The Outside of Purpose' in Error, Noise, and Jam in New Media Cultures', Nunes, M. (ed), Bloomsbury
9. Goriunova, O and Shulgin, A. (2008) 'Glitch', in Fuller, M. (ed) 'Software Studies: A Lexicon', The MIT Press
10. Knuth, D. (1989) 'The Errors of TEX', in Software-Practice and Experience', Vol. 19(7), pp607-685, available at: https://yurichev.com/mirrors/knuth1989.pdf , accessed 17th May 2021
11. Algopop (2021) '#Algopop: Studying the appearance of algorithms in popular culture and everyday life', available at: https://algopop.tumblr.com/ , accessed 9th October
12. Ajmal, A (2018) 'This is Where The Term 'Computer Bug' Came From', Wonderful Engineering, available at: https://wonderfulengineering.com/this-is-where-the-term-computer-bug-came-from/ , accessed 11th June 2021

13. Punt, M. (2000) 'Early Cinema and the Technological Imaginary', The Postdigital Press

14. Le Feuvre, L. (ed) (2010) 'FAILURE', Documents of Contemporary Art, The MIT Press

15. Krapp, P. (2011) 'Noise Channels: Glitch and Error in Digital Culture', University of Minnesota Press

16. Acland, C. R (ed) (2006) 'Residual Media', University of Minnesota Press

17. Bruns, A. (2006) 'Towards Produsage: Futures for User-Led Content Production',
available at:
http://eprints.qut.edu.au/4863/1/4863_1.pdf , accessed 25th July 2021

18. Toffler, A. (1980) 'The Third Wave', Bantam, New York

19. Jenkins, H. (2008) 'Convergence Culture: Where Old and New Media Collide', NYU Press

20. Berry, D. (ed) (2012) 'Understanding Digital Humanities', Palgrave Macmillan.

21. Knochel, A. (2016) 'Photoshop Teaches With(out) You: Actant Agencies and Non-Human Pedagogy', in Visual Arts Research, Vol. 42, No. 1 pp 71-87, University of Illinois Press

22. Fry, C. (2020) 'Certainty And Fragility: Reassessing The Role Of Automatically Generated Aids To The Making Process', XXIII Generative Art Conference, available at
https://generativeart.com/reserved_to_participants/07_C_FRY.pdf
accessed 31st October 2021.

23. Healey, Mick, Fiona Jordan, Barney Pell, and Chris Short. (2010). 'The Research-Teaching Nexus: A Case Study of Students' Awareness, Experiences and Perceptions of Research' in Innovations in Education and Teaching International, 47 (2): 235–246.

24. Winters, T. M. (2016) 'A developing research-oriented pedagogy for undergraduate teaching in art and design.', International Journal of Education through Art, 12(3): 257–270

25. Fry, C. and Marsh, J (2019) 'The benefits of a 'research-oriented' approach to teaching and learning at undergraduate level', paper presented at the 'Research Matters' conference, University of Westminster

26. Stancliff, M. and Goggin, M. D. (2015) 'Research as Creative Practice: Two Metaphors for Teaching and Learning', in English Journal. 105.2: 27–33