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Citation:

ATKINSON, Paul (2007). Design disasters in the history of computing. In: BALCIOĞLU, Tevfic, TOMBUŞ, Özlem Çağlar and IRKDAŞ, Derya, (eds.) EAD 07 conference proceedings : dancing with disorder: design, discourse, disaster. Izmir, Turkey, European Academy of Design/Izmir University of Economics, 797-806. [Book Section]

DESIGN DISASTERS IN THE HISTORY OF COMPUTING

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Abstract

The timelines of computing history are stories of successful products or important technological developments, which are stated to have changed the course of computing history. These timelines present prima facie evidence of technological developments in isolation, suggesting a smooth, unproblematic developmental progress of an industry and rarely giving any indication of the possible reasons why the items discussed were so successful. In addition these same timelines say little of the numerous products that disappeared from view, although these can tell us just as much about the consumption of technology as the successes.

Design disasters in the computing industry were legion, as numerous companies competed for sales. Why did products hailed as significant breakthroughs fail to maintain a place in the market? The archives of manufacturers brochures present us with computers from large and small manufacturers no longer in existence, and show products which in many cases were years ahead of the competition but for one reason or another failed to make a mark.

This paper explores how these developments have been analysed from the perspectives of different theories, including technological determinism, social constructionism and actor network theory. Using the tablet computer as a case study, this paper explores the connections and interactions between these differing viewpoints.

Introduction

This paper is essentially about the design, production and consumption of artefacts and the numerous factors which can affect their success or failure. For any company bringing a product to market the amount of time and money invested in the research, design and development of the product itself and in the market research, marketing promotion, packaging and distribution and retailing of a product means that an unsuccessful take up of that product by the target audience is by any definition a disaster. Although, as will be discussed, the reasons for that failure may be placed at different points in the production-consumption process, the integral role of design in that process means that such disasters can legitimately be seen as design disasters irrespective of the quality or otherwise of the design work itself. Such occurrences are perhaps disasters <u>for</u> design if not disasters <u>of</u> design.

This situation is perhaps understandably more common where the products concerned are complex technological products in a fiercely competitive field, where the technology itself is still relatively young, not yet stable, and in a constant state of flux. Consequently, the historical development of the personal computer is (quite literally) littered with examples of products that have failed in the marketplace. Occasionally the result of poor manufacture; the subject of misdirected marketing or promotion; often the result of software not quite living up to consumer expectations, some of these products could be said to have ‘deserved’ to fail. However, having said that, advances in production technology and quality control in recent years has acted to at least reduce manufacturing failures (notwithstanding some very well publicised events such as the poor battery life of earlier iPods, the cracked screens of the first iPod Nano and exploding batteries in Sony laptops (Johnson 2005, Yeoman 2006)). We are still faced, then, with a number of examples of products which have clearly been very well designed (often winning design awards), produced to a very high standard, been heavily promoted, and have performed their advertised functions, yet have still not managed to succeed as products in the marketplace. The variables at play here which cannot be controlled are social ones.

Theories of Technological Change

A great deal has been written about why technological products fail in the market place, from a number of different perspectives including economic and business analyses, marketing critiques and design critiques, and sociological enquiries. The body of work would be far too large to describe in any depth here, but a small selection provide some useful starting points for discussion.

'The Invisible Computer' by Donald A. Norman is a fairly pragmatic text which attempts to describe the situation without over-theorising. Norman refers to the notion of 'disruptive technologies' - technologies which have the ability to change people's lives and the entire course of the industry (Norman 1998:232). This ability to disrupt inherently produces products to which there is initially a large amount of resistance. Bringing together a number of previous pieces of research, Norman concludes that part of the problem is that companies do not take new technologies seriously due to a number of factors:

- New technologies are usually initially inferior to existing ones
- Large companies require large business markets
- Investing in improving existing products will bring a greater return in the short term than developing new products
- The need to show profits on a yearly basis deters long-term investment
- New products often require collaboration between competing departments of a company
- New products get compared unfavourably with existing successful products

(Norman 1998:235-237)

Norman's argument is that in order to be accepted in the marketplace, three aspects have to be completely right – the technology, the marketing and the user experience. As an example, he quotes the well-known story of the Xerox Star computer designed at Xerox PARC in the early 1980s.

[Insert Figure1 and Figure 2 here]

The Star was a product well ahead of its time, having the first commercially available graphical user interface, and a design philosophy of user interaction which set the standard for an entire generation of PCs (Fig. 1). Unfortunately, the product was a consumer product before the consumer existed. The product had not gone through the process of exposure to the marketplace which occurs when a new technology appears, is accepted by 'early adopters' of technology, and then refined for the mass market. The same happened a few years later when Apple introduced the Lisa – a larger, more expensive precursor to the Macintosh (Fig. 2). In both cases, the technology wasn't quite ready – they were both painfully slow, had limited functionality as no one had written applications for them, and were extremely expensive. Therefore, there was no benefit for 'early adopters' of technology in using these products, as despite the novelty of the graphical user interface, the lack of applications meant it didn't do anything other computers could do. The fate of the Star and the Lisa would have happened to the Macintosh itself, had it not been saved by the advent of a 'killer application', making it indispensable to a groups of users. In the case of the Macintosh, this was through the invention of the laser printer and desktop publishing software.

Norman's point is that the Star and the Lisa both had superb user experiences, but insufficient technology and marketing. (Norman 1998:41-43) Not having all three was the reason for failure.

This is an acknowledgement that the reasons for failure in the marketplace of any product are more complex than at first might be imagined. At the very least there is usually more than a single reason for design disasters. This notion is explored in other theories which address the same issue, to a greater or lesser extent.

The theory of the social construction of technology takes the view that a complex range of factors are involved in the success of products, and that social factors have precedence in the process. As a counterpoint to a physical reality affecting outcomes (i.e. the technology itself), social constructionists see a web of relationships between people, between institutions, that share beliefs and meanings as a collective product of a society, and that these relationships are the basis of subjective interpretations rather than physical or objective facts. The notion of the 'truth' of a socially constructed interpretation or piece of knowledge is irrelevant – it remains merely an interpretation (Pool 1997). It is an interpretation, though, which has significant agency.

This is in direct contrast to the view of technological determinism – the view that technology and technological change are independent factors, impacting on society from the outside of that society -that technology changes as a matter of course, following its own path, and in doing so, changes the society on which it impacts. (A good example is the notion of 'Moore's Law', which states that the power of a microchip doubles every year as if it was a 'natural' phenomenon). There is an element of truth contained within this, that technological products do of course affect and can change our lives, but it is simplistic to imagine other factors are not at play. Put more simply as 'interpretive flexibility', the argument of social constructionism is that different groups of people (i.e. different relevant social groups of users) can have differing views and understandings of a technology and its characteristics, and so will have different views on whether or not a particular technology 'works' for them. So, it is not enough for a manufacturer to speak of a product that 'works'; it may or may not work, depending on the perspective of the user (MacKenzie and Wajcman 1999).
The above arguments on social constructionism have most famously been promoted by the sociologists Trevor Pinch and Wiebe Bijker (1987), where they use examples such as the developmental history of the bicycle to show how a linear, technological history fails to show the reasons for the success or failure of different models, and that a more complex, relational social model is required.

An alternative view is held by some others, such as the historian of technology Thomas Hughes, where technological, social, economic and political factors are seen as parts of an interconnected 'system'. In this instance, different but interconnected elements of products, the institutions by or in which they are created, and the environments in which they operate or are consumed are seen as a complete, interdependent network. However, a technological system remains a socially constructed one: 'Because they are invented and developed by system builders and their associates, the components of technological systems are socially constructed artifacts' (Hughes 1987:52). There is still a distinction here, though, between human and non-human components of a system: 'Inventors, industrial scientists, engineers, managers, financiers and workers are components of but not artefacts in the system' (Hughes 1987:54).

Taking this 'system' based approach a stage further leads us to Actor Network Theory, associated with the sociologists Bruno Latour, John Law and Michael Callon. Actor Network Theory (or ANT, as it has come to be referred to) breaks down 'the distinction between human actors and natural phenomena. Both are treated as elements in 'actor networks'' (Bijker et al. 1987:4).

In ANT, all parts of a system or network are equally empowered as actors having an influence on technology – there is no distinction between small or large elements, animate or inanimate, real or virtual. Technology is conceived of as a growing system or network. The actors (and the relationships between the actors) 'shape and support the technical object'. (Bijker et al. 1987:12) An important aspect of the theory is that:

> The actor network is reducible neither to an actor or a network alone nor to a network. Like networks it is composed of a series of heterogeneous elements, animate and inanimate, that have been linked to one another for a certain period of time. The actor network can thus be distinguished from the traditional actors of sociology, a category generally excluding any nonhuman component and whose internal structure should not, on the other hand, be confused with a network linking in some predictable fashion elements that are perfectly well defined and stable, for the entities it is composed of, whether natural or social, could at any moment redefine their identity and mutual relationships in some new way and bring new elements into the network. An actor network is simultaneously an actor whose activity is networking heterogeneous elements and a network that is able to redefine and transform what it is made of. (Callon 1987:93)

In other words, the role of any particular actor in a network is not fixed, but indeterminate and changeable, being at times dominant, or at other times, insignificant in its agency.

I have previously used the theories of Pinch and Bijker to examine the historical development of the laptop computer, and presented a case that despite a number of attempts to introduce a portable computer for the executive market in a variety of different forms, the proposed 'solutions' continually failed to be accepted by the relevant social group of users.

[Insert Figure 3, Figure 4, Figure 5 and Figure 6 here]

Some of these attempts failed because the product had limited functionality, others because of limited portability (Figs 3-5). It was not until available technology reached a point where all these issues could be resolved, and the product was presented in a physical form that also addressed the users' expectations that the laptop computer became widely accepted as a product form (Fig. 6) (Atkinson 2005).

In this paper, I wish to pursue a case study of a range of products, which have been put forward by different manufacturers for a number of years, yet which (despite the predictions of people such as Bill Gates) have failed to make an impact in the marketplace – namely, the tablet computer. Tablet computers, or tablet PCs, are essentially notebook or slate-shaped computers which utilise touch-screen technology to enable operation by a stylus or fingertip rather than a mouse or keyboard (a process known as Pen Computing).

Tablet computers have taken a number of different forms over previous years, but can be grouped into four general categories:

- Slates – these are computers with no keyboards, although keyboards can be attached. They have been more successful in specialised fields such as health care, education and for field work. 'Rugged' tablet PCs are usually 'slates'.

- Thin-client Slates – these are basically wireless versions of 'slates' which have no onboard processor or storage and link remotely to a server. Used where portability is the key concern.

- Convertibles – these are laptop/notebook computers with screens that rotate, swivel or slide to form a writing surface, converting the laptop to a tablet PC. They are the most commercially successful form of tablet, as they provide the benefits of both laptops and tablet computers.

- Hybrids- these are convertible tablets where the keyboard can be completely detached. These have not been commercially successful at all. (Wikipedia 2007a)

The History of Tablet Computers and Pen Computing

Historically, the conceptual roots of the tablet computer are the same as those for the laptop computer, both arising from the original 'Dynabook' concept proposed by Alan Kay and the Xerox Palo Alto Research Center (PARC) in the late 1960s (Fig. 7).

[Insert Figure 7 here]

The Dynabook concept was for a book or "slate type computer with nearly eternal battery life and software aimed mostly at giving children unlimited expression opportunities with all digital media imaginable. Adults could also use a Dynabook from the start, but the target audience would be children, and the software would grow up with them" (Wikipedia 2007b).

Quite clearly, such a computer was not technically possible at the time (and Kay still thinks we haven't got there yet[1]), and yet this vision drove the development of computing technology inexorably towards truly portable computing. Interestingly, a company called Dynabook Technologies was set up in 1987 to develop such a computer and it had $37 million in financial backing, yet never managed to overcome technical problems and went bankrupt in 1990 (Kaplan 1999:197).

[Insert Figure 8 here]

An early attempt to produce a 'tablet' type computer which was clearly inspired by the 'Dynabook' concept came as early as 1983, when the 'Workslate' was introduced by Convergent Technologies (Fig.8). This, however, had a small display, had limited capabilities, and used a keyboard input rather than a stylus. As such it was not strictly speaking a 'tablet PC'. The product had few applications, and despite its obvious design qualities, failed in the marketplace.

[Insert Figure 9 here]

The first successful attempt at a commercial tablet PC appeared in the form of the GRiDpad from GRiD Systems, conceived by Jeff Hawkins (Fig. 9). GRiD Systems was the company that produced the first true laptop computer, the GRiD Compass, launched in 1982. Hawkins came up with the idea of a tablet computer with a stylus interface while studying neuroscience at UC Berkeley during a two year leave of absence from GRiD. He returned to GRiD in 1988 to develop the first tablet computer for them, and managed the GRiDpad project (Moggridge 2006:184-185). The GRiDpad was targeted at specialist, vertical, markets such as the medical profession, as this is where Hawkins saw market opportunities. In its best year the product turned over in excess of $30 million (Hawkins 2007).

[Insert Figure 10 here]

The GO computer took a long time to get to market. It was already being planned when Jeff Hawkins went to visit GO in 1988, yet despite having over $35 million in financial backing and the enthusiastic support of IBM and AT&T, it suffered all kinds of engineering setbacks, and was not launched until 1992 (Fig. 10). Rather than use a proprietary operating system, GO insisted on developing their own, putting them in direct competition with Microsoft. When Microsoft launched Windows for Pen Computing a huge PR battle ensued (Hawkins 2007). Not surprisingly, GO lost. GO was founded by Jerry Kaplan and Mitch Kapor, and Kaplan went on to write an autobiography in which he said "The real question is not why the project died, but why it survived as long as it did" (Kaplan J. cited in Kaplan 1999:199). GO was taken over by AT&T in 1994 and eventually shut down.

[Insert Figure 11 here]

After the GRiDpad, Jeff Hawkins tried to develop a product 'that offered the best of both the laptop and tablet' (Moggridge 2006:189). The result, with industrial design work by IDEO, was the GRiD Convertible launched in 1993 (Fig. 11). This used a clever mechanism which allowed the screen to slide and pivot to cover the keyboard and convert the laptop into a tablet. 'Bill Gates loved it. It failed in the market place. I learned at that time that people didn't really want to write on their display' (Hawkins 2007).

[Insert Figure 12 here]

Apple ran a whole series of projects during the late 1980s and early 1990s to develop tablet computers, most of which were cancelled (Kunkle 1997:passim). These included a notebook-sized, slate-type computer concept codenamed 'Figaro' between 1987 and 1991 (which evolved into the Newton), the PenMac, the Macintosh Folio, and SketchPad, all in 1992, and the WorkCase and Newton MessageSlate in 1993. It was felt by Apple that a tablet computer might compete with and detract from sales of the Macintosh, so the project was rethought as a Personal Digital Assistant (PDA).

The Apple Newton MessagePad was eventually unveiled in May 1992 at the Consumer Electronics Show with a large-scale publicity drive claiming to have produced the future of computing. It was released the following year, unfortunately to weak reviews. After a number of redesigns culminating in the MessagePad 2000 (Fig. 12), the technology was placed into the Apple eMate laptop computer in 1997 and then discontinued altogether in 1998. Although it was produced for six years and won numerous design awards, the Newton was never the success Apple hoped for, and the intention to reinvent personal computing was never met (Wikipedia 2007c). Although it was marketed as a PDA rather than a tablet computer, the unit itself was too large to fit into any pocket, was expensive (the final models costing $1000) and initially suffered from poor handwriting recognition software, which many regard as being the main reason for its failure (Moggridge 2006:198).

The end of the line?

The Apple Newton would seem to mark the transition from tablet computer to the Personal Digital Assistant. Other manufacturers did start producing tablet computers during the 1990s, with similarly low amounts of success - IBM produced tablet versions of the 'ThinkPad' in 1993, and Sony produced a Pen Tablet PC in 2001, but discontinued it due to low sales only a year later (Kanellos 2007). Despite this, a number of manufacturers including IBM and HP continue to produce a variety of models (Microsoft 2007) and Bill Gates openly defends them, predicting they will shortly come into their own as products and ensuring that the latest version of Windows, 'Vista', supports pen computing.

The story so far of the tablet computer covers some 40 years from its conception, with real products being produced for 18 years. As a product group, they have swallowed billions of dollars in investment capital and thousand upon thousands of man hours in R&D, design and promotion. Sales remain pitifully low, and yet manufacturers and a small number of users still cling to the concept, convinced of its potential. Coming from Microsoft, the tablet PC is most prominently promoted by one man – Bert Keely, who has the job title 'Architect, Mobile PCs & Tablet Technology'. Keely constantly attends research seminars and computer shows and appears in the media demonstrating the advantages of pen computing. He admits that tablet technology has a number of flaws and a long way to go (Keely 2005), but remains convinced that the future of pen computing will be 'astounding' (Moggridge 2006:198).

Conclusions

So, why has the tablet computer not been a successful product? As proposed by all of the theories explored in the first section of this paper, there will always be more than one reason for any product failure. Yet many of the factors mentioned in the case study as to why certain individual tablet computers had failed are issues which have consequently been resolved. Clearly the technical problems which plagued early products such as slow processor power and software reliability have been overcome. The compatibility of software means that applications for such computers are far greater in number and that while still not perfect, issues of functionality such as the reliability and accuracy of handwriting recognition software have apparently been solved. The manufacturers involved are not start-up enterprises lacking in financial support or backing, and the products are now parts of large ranges of computing equipment from well-known and respected companies, and have received marketing support of a suitably high level. Yet despite the sales predictions and assurances of Bill Gates and the enthusiastic promotion of people such as Bill Keely, tablet computers still account for less than 5% of the personal computer market.

Social constructionism suggests that a complex range of social factors are the most significant elements to take into account in the success or failure of technological products, and indeed it would appear from the technical factors that have been resolved that the only possible barriers left to the acceptance of tablet computers are social ones. The notion of 'interpretive flexibility' proposes that different groups of people will have different views on the extent to which a particular technology 'works' for them. However 'natural' a form of communication writing may appear to be, perhaps as Jeff Hawkins states, people don't want to write on computer screens, and a pen on a large display is not a good user interface for a computer (Hawkins 2007). The complexity of a personal computer, which is clearly accepted if not desired in a desktop PC, may not be acceptable in such a portable format of the tablet PC. Slow start-up times, large size and weight, and the compromises inevitable in multi-functional products such as a full computer, do not cross over well to situations where the computer is held and carried around by the user and constantly turned on and off. Factors such as these, which may appear to be small problems, or even insignificant by some, are held by Actor Network Theory to have the potential to be highly significant in the successful take up of new products. The interesting aspect of ANT, though, is the understanding that the significance of these factors is not seen as fixed, but fluid. At any moment, a factor can move from being significant to insignificant, even as the result of forces outside of the network itself. With this level of uncertainty in mind, it must be recognised that the current public attitude to tablet computers and to pen computing itself could change at any moment.

Where the tablet computer has failed to capture the public imagination, the Palm Pilot PDA has succeeded – but that's another story. The reasons for the failure of tablet computers, as for any complex technological product, are not straightforward. Each or any of the reasons above, or a combination of small details which together constitute the nature of the experience of using a tablet computer, could be equally responsible. As social construction theory would have it, the acid test of computing equipment is not the technology, but user acceptance; and as Actor Network Theory shows, however small or inconsequential an agent may appear to be in the overall scheme of things, it can still have the ability to make or break any product.

Acknowledgements

My thanks go to Bill Moggridge and Jeff Hawkins for their help in this research.

Figures

Fig. 1: Xerox Star, 1981
(Courtesy of Palo Alto Research Center, Inc.)

Fig. 2: Apple Lisa, 1983
(Courtesy of Apple Inc.)

Fig. 3: Texas Instruments ‘Silent 700, 1972
(Courtesy of Texas Instruments Incorporated)

Fig. 4: Osborne 1 Transportable Computer, 1981
(Courtesy of Computer History Museum)

Fig 5: Husky Rugged Handheld computer, 1981
(Courtesy of Intronix Corporation)

Fig 6: The GRiD Compass Laptop Computer, 1981
(Courtesy of IDEO)

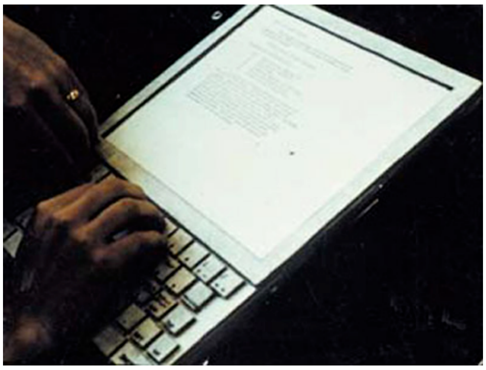

Fig. 7: Alan Kay's 'Dynabook' concept, circa late 1960s

Fig. 8: Convergent Technologies Workslate, 1983
(Courtesy of IDEO)

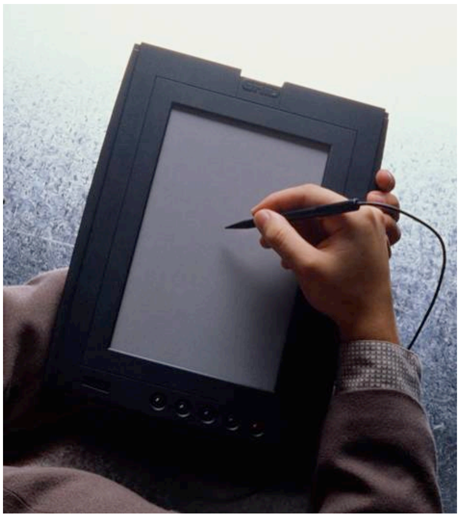

Fig. 9: The GRiDpad, 1989
(Courtesy of Jeff Hawkins)

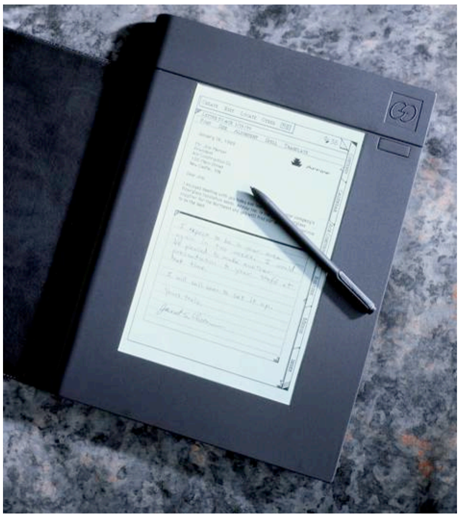

Fig. 10: The GO computer, 1992

Fig. 11: The GRiD Convertible, 1993
(Courtesy of IDEO)

Fig. 12: The Apple Newton MessagePad 2000, launched in 1997
(Courtesy Apple Inc.)

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Footnotes

[1] For an interesting interview with Alan Kay and the thought processes behind the Dynabook concept, see: http://www.squeakland.org/school/HTML/essays/dynabook_revisited.htm (accessed 18 January 2007)