32kg: Performance Systems for a Post-Digital Age

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ABSTRACT

Why is a seemingly mundane issue such as airline baggage allowance of great significance in regards to the performance practice of electronic music? This paper discusses how a performance practice has evolved that seeks to question the binary and corporate digital world. New 'instruments' and approaches have emerged that explore 'dirty electronics' and 'punktronics': DIY electronic instruments made from junk. These instruments are not instruments in the traditional sense, defined by physical dimensions or by a set number of parameters, but modular systems, constantly evolving, never complete, infinitely variable and designed to be portable. A combination of lo- and hi-fi, analogue and digital, synchronous and asynchronous devices offer new modes of expression. The development of these new interfaces for musical expression run side-by-side with an emerging post-digital aesthetic.

Keywords

Post-digital, modular, dirty electronics, bastardisation, punktronics, portability, DIY, eBay, performance, live electronics.

1. INTRODUCTION

The scope of this paper is to look at the artistic, cultural and social impact of new interfaces for musical expression in the field of live electronics. The term live electronics is used here to define a performance practice of electronic music that can loosely described as experimental, often improvised and of an interactive nature. The economics of live electronics are also considered. It is safe to say that budgets for most concerts in this field are relatively small and that the venues for such performances are also small. These concerts are often run and promoted by dedicated enthusiasts not for profit.

2. FROM ON-LINE TO OFF-LINE

In a world where there is an ever-increasing miniaturisation of technology, why are so many musicians working in the broad field of live electronics having to consider the weight and size of their performance set-ups? In some respects, international travel has never been easier with frequent and relative cheap flights from continent to continent. Passenger air traffic continues to grow. There was a 6.5% rise in 2005 compared to the previous year [1]. The need to travel has in part been due to the development of global networks and new communities created by the Internet. The ideas expressed by radical publications such as *Mondo 2000* [2] on virtual reality - cruise the datascape, ride the electronic range, vacation in virtual reality - have only been part of the consequence of the digital age. Conversely, the Internet, despite its virtual nature and the potential for hidden and false identities, has physically brought people together. As Nicholas Negroponte [3] states in his seminal text *Being Digital*, the Internet is "all about people not places." Nevertheless, in many cases it is inevitable that through the power of communication there will be the desire to meet in a 'real' place. For example, there are current blogs that are also initiating blogwalks [4] with "face-to-face" meetings and where "minds can meet and inspire each other in direct conversation." Musicians working in specialised areas of music have benefited greatly from the Internet. In the case of live electronics, an international circuit has developed with musicians travelling on regular basis to perform in different venues. This has become the norm rather than the exception. To quote Negroponte [3] once more: "The global nature of the digital world will increasingly erode former and smaller demarcations." The concept of a travelling musician is by no means new, but it is the distance and means, air travel, and what is being carried that are relevant to this paper.

3. BASTARDISATION AND THE POST-DIGITAL

The interest in what could be loosely described as 'digital music' is beginning to wane. Negroponte [5] in *Beyond Digital* highlights changing attitudes towards the digital: "… the technology, is already beginning to be taken for granted, and its connotation will become tomorrow's commercial and cultural compost for new ideas." The term post-digital is becoming increasing used, although there is still relatively little in print on the definition of the term in relation to music or sound. Kim Cascone [6] in "The Aesthetics of Failure: 'Post-Digital' Tendencies in Contemporary Computer Music" has undoubtedly begun the lengthy process whereby there will be many subsequent discussions on the definition of the term post-digital. The notion of 'failure' is central to Cascone's [6] argument in outlining a post-digital aesthetic: "… it is from the 'failure' of digital technology that this new work has emerged: glitches, bugs, application errors, system crashes, clipping, aliasing, distortion, quantization noise, and even the noise floor of computer sound cards are the raw materials composers seek to incorporate into their music." What would seem more central to a post-digital aesthetic is the bastardisation of technology. This certainly goes beyond the digital (this will be discussed in more detail later). Bastardisation implies forcing a system in to a state in which it was never intended, or appropriating something for a use other than what it was initially designed for. For example, in analogue terms, this may involve circuit bending or hacking a sound generating device, or forcing a circuit to oscillate through a feedback loop. The process of

bastardisation is as much about success as it is failure, where the musician is able to find a latent 'music' inside the technology. Cascone's paper is more about defining the musical genre of glitch. The glitch as a digital artifact would seem to purport a purer, more uniquely digital aesthetic, with its own distinctive voice - some form of higher expression of digital music.

4. ONES, ZEROES AND CONTINUUMS

In *The Postdigital Membrane: Imagination, Technology and Desire* Robert Pepperell and Michael Punt [7] question the logical states of 'yes' and 'no' of a digital world. They argue that human experience is all about a continuum between different states: "… identifiable parts are not reduced to oppositions and analysed as dialectical constellations but considered as continuous with each other." They also suggest that: "For the anthropological notion of the 'binary' to be compatible with the computational notion of 'binary' the two terms must be exclusive. '1' or '0' can only be '1' or '0' - there can be no ambiguity or irrationality." A frustration with logic and a desire for the irrational, are key issues concerning a post-digital aesthetic. It is not surprising that many musicians are fascinated with the analogue in its various guises from virtual software synthesisers to 'antique' hardware equipment. This would appear not just a case of nostalgia or retro, but an active stance to expand the range of musical expression currently offered by the use of digital technology. The musician has returned to the analogue with rigour. It is not a question of discarding the digital, but having greater choice. Peter Lunenfeld [8] presents the idea of the analogue and digital representing the 'curved' and the 'crisp' respectively: "We have, in fact, come to expect a certain crispness from digital media precisely because of this stepping, leading some to categorize the analog as somehow natural, less polarized, more curved." Analogue and digital systems also present asynchronous and synchronous ways of thinking and doing. A digital system will always be asynchronous: an analogue source is converted into a binary code, possibly analysed and modified in some way, then converted back to the analogue. Many digital tools for the creation of music are designed to behave in a pseudo synchronous way giving the illusion of working in real-time. This is being blind to the real potential of digital technology. It is also not to say that an asynchronous way of working is any better or worse than the synchronous. There are some benefits musically by being asynchronous. For example, the written score allows a composer to work with sound in a more formal way. In the post-digital, the asynchronous and the synchronous can be themselves. This new musical crossbreed, where different modes of thought and resulting practices co-exist side-by-side, offers greater scope for musical expression.

5. MODULARITY AND OBJECTS

Nic Collins [9], in his introduction to a *Leonardo Music Journal* edition on David Tudor remarks: "The introduction of the microcomputer and MIDI at the start of the 1980s prompted many musicians to swap the soldering iron for software and increasingly affordable commercial music synthesizers". However, current trends in circuiting bending and hardware hacking have helped rekindle an interest in the work of David Tudor, and musicians are returning to their soldering irons. Tudor developed an approach that would seem to have obvious links with currently emerging post-digital aesthetic. Again, it is not just a case of Tudor working in the analogue domain. In an interview with Joel Chadabe, Tudor [10] highlights his interest in DIY electronics and 'small instruments' due to their flexibility, portability, and cost. This was in addition to these instruments providing him with the sound he wanted to hear. Tudor also sought to explore the sonic and musical potential of a circuit, whether this was from a discarded electronic appliance or a circuit made from scratch, and 'composing' inside electronics (this was also the name given to one of Tudor's ensembles). What is of greater significance is that Tudor combined these small devices to make-up larger modular performance environments.

With the advancement of digital technology, Tudor's modular approach towards working in the field of live electronics has not been supplanted. On the contrary, software developments such as Max/MSP [11] and PD [12] have helped reinforce an analogue model that is modular. The object in Max/MSP is synonymous with the module: the user patches components together to construct an 'instrument'. As Negroponte [3] argues being digital is all about doing: "Don't Dissect a Frog, Build One". In a digital world nothing is ever finished. The Internet presents dynamic texts that can be constantly altered, operating systems and software are constantly upgradeable, and computers themselves comprise of interchangeable modules. Doing is easy. In the virtual world when mistakes happen there is always the undo key. It stands to reason, therefore, that this spirit of 'doing' is shaping a post-digital practice. Hack, build, modularise, re-configure, upgrade, discard - these techniques and ways of thinking have spread across different domains to suggest a new form of musical instrument.

6. DIRTY ELECTRONICS AND LIVELY INSTRUMENTS

"… miniaturisation has changed our experience of mechanism … Our best machines are made of sunshine; they are all light and clean because they are nothing but signals, electro-magnetic waves, a section of a spectrum." [13] Our new digital technology is indeed clean, bright and weightless. It is also elliptical, intangible and sterile. To quote Nic Collins [9] again: "The electronic future, as envisioned for the past 80 years or so, has usually taken one of two forms: the streamlined, antiseptic, utopian vision in which technology allows us ever more control (the iPod future) and the messy, chaotic, dystopian vision in which electronics multiply and decay, leaving us at their mercy …". In terms of the appearance of the home computer, we have moved from beige plastic casing to silver and white finishes and minimalist design looks. Although there may be some novel software, and ways of personalising computer settings, for example, by having a background image of your skiing holiday or pet, these machines are faceless and characterless. It is natural that a musician has a unique relationship with the instrument with which they work, and that these instruments assume great importance. In a post-digital age electronic instruments are 'lively' instruments with character and unique voices. This is due to the 'doing' in the post-digital where self-made instruments take on personalities. These lively instruments are exemplified by the instruments of Reed Ghazala [14, 15] with their futuristic names and imaginative appearance, the infra-instruments of Phil Archer [16], the analogue cast-offs of Merzbow [17], Tom Bugs' Bits and Bobs Modular [18] and the modified toys of Brian Duffy [19]. This is only a snapshot of instruments and interfaces that are being used that reflect a much broader current trend towards the post-digital.

There would appear a backlash or reaction against the corporate hi-tech multi-nationals. The post-digital is characterised by a desire to subvert and challenge, what has become in many quarters, an acceptance of a digital hegemony. The influences of cyberpunk and post-cyberpunk

seem to be spilling-over in to music; or perhaps just the essence of punk is re-emerging within certain music circles. A development and interest in what could be described as 'dirty electronics' has taken root. These are electronic instruments and working methods that are directly opposed to those of a mass produced digital culture and may include some of the following characteristics: designer trash (deliberately made to look beaten-up or broken), ugly, cheap, heavy, hand-made, designed to be handled or to come in contact with the body, ready-mades, hacked, bent, fedback and kitsch. The battered and bubble gum glued instruments of John Olson and Nathan Young from the group Wolf Eyes [20], or the bow-stab infra-violin of Phil Archer [16] are but two examples of this development. This practice could be further defined as 'punktronics'.

The electronic circuits for the instruments discussed above are often crude and built by modifying existing sound generating devices or by constructing circuits with stripboard or dead bugging. These instruments are also a result of a profligate attitude towards technology that is prevalent in the West. This point is well put by Norbert Möslang [21] in his article "How Does a Bicycle Light Sound?: Cracked Everyday Electronics": "For the last 20 years, various small electronic tools have been mass produced and thrown onto the market ... just waiting to be cracked! This is the wreckage of Western civilization, as it were, and the musician is the ethnologist who collects and cracks this wreckage."

The re-assemblage of this 'wreckage' has become a fixation mainly due to global access to jumble and junk through the Internet and companies such as eBay [22]. Access to the most obscure electronic component or musical artifact is now possible as obsolete technology is sought on-line with the intention of appropriating it for a new use. The full affect of eBay on musical culture is still being felt. It is not a question these days of getting hold of something, but rather what is to be done with it. There is a kind of scavenging mentality where the whole course of recent music history can be picked over and elements extracted to build a new musical vision of the future. The pickings are rich.

7. DISEMBODY - RE-EMBODY

'Physically' reconnecting to an instrument or interface would seem part of a post-digital aesthetic. This may not necessarily mean playing an instrument in a 'traditional' way. The bio art of Eduardo Kac, where technology may penetrate the skin, for example, a microchip is implanted in Kac's ankle in his piece *Time Capsule*, demonstrates how the physical and technological can co-exist in a radical hybrid [23]. The concept of body contacts expressed by Reed Ghazala also re-embodies the performer in a very direct and tangible way in regards to a musical interface. A body contact is where the human body, being able to conduct electricity, becomes physically part of an electronic circuit. Ghazala [14] termed this way of working as BEAsape: "BEAsape is an acronym for BioElectronicAudiosapian. Instrument/animal, mutant or hybrid, both musically and zoologically the BEAsape pushes boundaries". Ghazala [14] also writes: "I felt that a new, albeit temporary, creature was created when a musician played a body-contact instrument - in this moment when the electricity of both bodies intertwines, the same essential electricity that if interrupted would cause each body to die. I was changed and the circuit was changed, and I had trouble deciding where each of us began and ended. I simply concluded that we were something new, and we were one." The idea of using the human body to conduct electricity for artistic purposes in not new. As early as 1744, Georg Mathias Bose created the 'salon' performance piece *Venus Electrificata* (also known as the Electric Kiss) [24].

For some performers, there is something appealing about physical exertion in creating a sound or playing an instrument. Micro-gestures suitable for many digital interfaces only allow for a fraction of the gesture range of the human body. The interface in the post-digital provides 'something to hold on to': larger knobs or controls (the bigger the better), heavy metal body contacts, and connectivity through cables and wires.[1] Masami Akita (Merzbow) [17], refers to 'noisehands' in an interview with Arthur Potter: "Most Japanese noise artists never use computers or very high-tech equipment. We tend to be very low-tech and analogue, so our actions show the effects of expanded noisehands, muscles … the body's movement." Ergonomics and biological condition have again become central to the idea of musical interface.

This ties back in with the idea presented earlier in this paper of lively instruments, and in some respects, cultural references to machines of a bygone era. Erkki Huhtamo [26] has presented the idea of "familiar aliens", where machines that have been portrayed and personalised in the media and everyday life have become part of our cultural tradition. So, the use of a large Bakelite knob, for example, as part of an interface for a musical instrument, aside of the ergonomics, is loaded with cultural references. In the post-digital, the significance, or our relationship towards this interface (the Bakelite knob), is different in relation to its original context. The post-digital musician seeks to find the new in the old.

8. EXCESS BAGGAGE

There is a synergy between developing a post-digital aesthetic in music and the need to perform and communicate on a global scale. The modular approach towards creating new musical interfaces discussed in this paper offers a convenient and practical solution to transportation. As already mentioned, David Tudor considered the benefits of small modular devices, and some examples can be found where issues of portability influenced his performance set-up. In an interview with Joel Chadabe, Tudor [10] in discussion on the piece *Untitled* comments: "The number '60' came about because there were sixty components involved, and I was not about to travel with sixty components to create the source material, so I recorded it and then subjected it to the feedback loop which was under my control, and that was one of my most enjoyable experiences." This demonstrates that Tudor had to think very carefully about his performance set-up as well as its transportation. The following quote from Lowell Cross [27], whom Tudor collaborated with on many occasions, provides enlightening information on some of the problems Tudor faced when transporting his equipment in 1973. The five bags Cross [27] refers to contained Tudor's "electronic gadgetry and cables": "When the time came for David Tudor to leave, I was dreading the prospect of helping him to carry his heavy footlocker-style cases and other baggage up the basement stairs so that I could take him and his belongings to the Cedar Rapids Airport, a half-hour drive from Iowa City. However, he announced that he was departing not from Cedar Rapids, but from the Des Moines Airport, 120 miles/200 km to the west. David Tudor was not by disposition an early riser, and when Nora and I heard his

[1] This is not the same definition of "something to hold on to" given by Leigh Landy [25] that refers to a musical parameter or reference.

travel plans, he was running precipitously late to catch a flight out of Des Moines. We hastily loaded the car and took Karen with us. We arrived in time for his flight, fortunately, and I began the chore of unloading his cases as David Tudor engaged a skycap. The man was taken aback by what he saw, and he was even more taken aback when he began to lift the first case onto his cart. We left David Tudor with that bewildered man and took a leisurely drive back to Iowa City."

Tudor had a major influence on the group of composers known as the Sonic Arts Union (Robert Ashley, David Behrman, Alvin Lucier, and Gordon Mumma) who also adopted a DIY modular approach to live electronics. Robert Ashely [28] remarked that: "A Sonic Arts Union concert was about 1,000 miles of wire and all these little boxes that plugged into each other". The economics of organising and performing concerts, of which transportation of the equipment must have been an issue, resulted in Robert Ashley taking the radical stance to stop performing and composing.

Air transport in general is a fundamental problem for musicians given that there are weight and size restrictions for baggage and there are growing security concerns over any baggage anomalies. Kaffe Matthews [29] in an account of her concert in Bologna in 2001 announces: "watch out, BOLOGNA (Forli) airport is 70 km away from Bologna and Ryan Air only allow 15kg [of] luggage." The current economic trends of the airline industry suggest there could be some serious financial implications for musicians travelling with the type of performance set-up discussed in this paper. As Toshimaru Nakamura points-out, the baggage allowance presently offered by many airline companies is also as much that can be physically carried by one person [Nakamura, personal communication]. It is not just the flight, but also transporting the equipment in general that is an issue. This idea will be discussed in more detail later. Nevertheless, some musicians tend to push the restrictions of baggage allowances to the limit, cramming every nock and cranny of their luggage with equipment. Some facts and forecasts regarding air transport and excess baggage follow.

The International Air Transport Association (IATA) - the governing body of international air transport - reported that in 2005 the air transport industry lost six billion pounds. This was mainly due to the rise in crude oil prices that rose by approximately a third from the previous year. Furthermore, fuel bills in the industry have doubled since 2003 and the industry has made a financial loss consistently since 2001. These statistics have forced the IATA to come up with a Fuel Action Campaign [1]. Reduction of fuel consumption, which is connected to the weight of the aircraft, is the main priority of the campaign. The rise in the cost of fuel is gradually beginning to reach the customer in the form of baggage restrictions and surcharges. In 2004 British Airways [30] introduced a fuel surcharge to its customers that has continued to rise. Whilst in January 2006, Ryanair [31] announced a charge for handling baggage. The pay for what you have/use approach adopted by many budget airlines, such as easyJet, will undoubtedly be applied to baggage in the future. The cost of a flight will depend on the number of kilograms to be transported.

If the cost of excess baggage increases or the weight and size allowance for baggage decreases, there will be an impact on musical interfaces that are currently used for live electronic performances. This in turn will indirectly affect which musicians can travel and the type of music that is performed. This might seem an exaggerated point, but these practical issues also are key in shaping broader musical aesthetics. Changes in excess baggage rules will have cultural repercussions.

9. DO NOT REMOVE COVER FOR RISK OF ELECTRIC SHOCK

Due to the necessity to travel light, 'scavenged' hardware and electronic sound generating devices have taken on a deconstructed look. The housing or casing of these devices is the first thing to go to reduce weight, leaving components and wires exposed within an exoskeletal frame. Function prevails over form. Redeployed hardware is customised and re-constructed in aluminum and fiberglass enclosures. The appearance of these interfaces resembles, for example, the architectural work of Richard Rogers [32]. Rogers, whilst discussing the Lloyds Building, London, states: "Whereas the frame of the building has a long life expectancy, the servant areas, filled with mechanical equipment have a relatively short life, especially in this energy-critical period. The servant equipment, mechanical services, lifts, toilets, kitchens, fire stairs, and lobbies, sit loosely in the tower framework, easily accessible for maintenance, and replaceable in the case of obsolescence." The modular system of electronic devices discussed here, part exposed, part insulated, takes on a futuristic look. There is an analogy to the body and its outer surface, the skin, being removed revealing the 'cyborg/android' inside: for example, these types of images are common in popular science fiction films such as *Terminator 2* [33]. In the case a laptop, the danger of electricity is disguised beneath a smooth external casing. With the aforementioned de-housed interfaces, the performer is taking serious safety risks. Further weight reducing techniques include replacing power transformers, particularly in older devices, with a lighter switch mode power supply. As already referred to, these interfaces extend beyond their housings to include wires and cables. Many cables also undergo surgery and are shorn and stripped down to exact sizes. Plastic cased plugs and 'direct wiring' are also employed.

10. CONCLUSION

Although air transport and excess baggage problems are a real concern for a musician, '32kg' can also be used as a metaphor. Performances of live electronics are often concerned with the broader subject of chamber music. These include, for example, small group work, improvisation, intimate performance settings, a focus on instrumental nuance and 'discrete' voices, and the idiosyncrasies of a performer or their instrument. This approach is dependent on a close relationship between performer and their instrument. Transportation of an instrument is therefore a primary concern. The modular system outlined in this paper allows for an instrument/interface to be on a 'human scale': something which can be held in the hand as well as being portable. This paper highlights how theory and practice are inextricably bound. An anything goes, hybridisation, approach is gathering momentum, questioning the very nature of musical interface.

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12. REFERENCES

[1] International Air Transport Association (IATA) industry facts. Available at: http://www.iata.org/

[2] Rucker, R., Sirius, R.U. and Mu, Q, ed. *Mondo 2000: A User's Guide to the New Edge*. Thames and Hudson, London, 1993.

[3] Negroponte, N. *Being Digital*. Hodder & Stoughton, London, 1996.

[4] Information on blogwalks. Available at: http://blogwalk.mediapedagogy.com/AboutBlogWalk

[5] Negroponte, N. Beyond Digital. *Wired, 6*, 12, 1998. Available at: http://www.wired.com/wired/archive/6.12/negroponte.html

[6] Cascone, K. The Aesthetics of Failure: 'Post-Digital' Tendencies in Contemporary Computer Music. *Computer Music Journal 24*, 3, 2000, 12-18. Available at: http://mitpress.mit.edu/catalog/item/default.asp?ttype=6&tid=2289

[7] Pepperell, R. and Punt, M. *The Postdigital Membrane: Imagination, Technology and Desire*. Intellect, Bristol, 2000.

[8] Lunenfeld, P, ed. *The Digital Dialectic: New Essays on New Media*. MIT Press, Cambridge Mass., c1999.

[9] Collins, N. Composers Inside Electronics: Music after David Tudor. *Leonardo Music Journal, 14*, 2004, 1-3.

[10] David Tudor interviewed by Joel Chadabe, Tomkin's Cove, 9/8/93. Available at http://www.emf.org/tudor/Articles/chadabe.html

[11] Max/MSP software. Available at: http://www.cycling74.com

[12] PD software. Available at: http://www-crca.ucsd.edu/~msp/software.html

[13] Haraway, D. A Cyborg Manifesto. In Trend, D, ed. *Reading Digital Culture*. Malden, Mass.: Blackwell, Oxford, 2001.

[14] Ghazala, R. Q. The Folk Music of Chance Electronics: Circuit-Bending the Modern Coconut. *Leonardo Music Journal, 14*, 2004, 96-104.

[15] Ghazala, R. Q. *Circuit-Bending: Build Your Own Alien Instruments*. Wiley Publishing, Inc., Indianapolis, 2005. Reed Ghazala website at: http://www.anti-theory.com/

[16] Bowers, John. and Archer, Phil. Not Hyper, Not Meta, Not Cyber but Infra-Instruments. *Proceedings of NIME 05*, Vancouver, BC, Canada, 2005, 5-10.

[17] Merzbow (Masami Akita) selection of edited interviews. In *Expanded Noisehands: The Noise Music of Merzbow*. Ed. Carlos M. Pozo. Available at: http://noiseweb.com/merzbow/all.html

[18] Tom Bugs website at: http://www.bugbrand.co.uk/

[19] Brian Duffy website at: http://www.warmcircuit.com/

[20] Wolf Eyes interviewed by Sam Frank and Ben Tausig. Available at: http://www.dustedmagazine.com/features/238

[21] Möslang, N. How Does a Bicycle Light Sound?: Cracked Everyday Electronics. *Leonardo Music Journal, 14*, 2004, 83-84.

[22] eBay website at: http://www.ebay.com/

[23] Machado, A. A Microchip Inside the Body. Originally published in English on the Nettime list, February 22, 1998. Available at: http://wearcam.org/kac.html

[24] Elsenaar, A. and Scha, R. Electric Body Manipulation as Performance Art: A Historical Perspective. *Leonardo Music Journal, 12*, 2003, 17-28.

[25] Landy, L. 'The Something to Hold on to Factor' in Electroacoustic Timbral Composition. *Contemporary Music Review, 10*, 2. 1994, 49-60.

[26] Huhtamo , E. Cybernation to Interaction: A Contribution to an Archaeology of Interactivity. In Lunenfeld, P, ed. *The Digital Dialectic: New Essays on New Media*. MIT Press, Cambridge Mass., c1999, 96-110.

[27] Cross, L. Remembering David Tudor: A 75th Anniversary Memoir. Available at: http://www.lowellcross.com/articles/tudor/

[28] Ashely, R. In Holmes, T. *Electronic and Experimental Music,* Routledge, London, 2002.

[29] Kaffe Matthews website at: http://annetteworks.com/

[30] British Airways fuel surcharge. Information at: http://news.bbc.co.uk/1/hi/business/4372439.stms

[31] Ryanair to introduce baggage charge. Information at: http://www.guardian.co.uk/uklatest/story/0,,-5571142,00.html

[32] Cole, B. and Rogers, R. E, ed. *Richard Rogers and Partners. Architectural Monographs*, Academy Editions, London, 1985.

[33] *Terminator 2: Judgment Day*, James Cameron, TriStar Pictures, 1991.