When ‘Risk’ is Taboo:

fun, spectacle and citizenship in science centres

Science centres have shown that science can be extremely popular when presented in lively and engaging ways, encouraging many traditional science museums to rethink their style of presentation. San Francisco’s Exploratorium and Toronto’s Ontario Science Centre were the first science centres. Both opened in September 1969 and have inspired the creation of dozens of similar institutions around the world. Science centres have proved very popular with visitors, not least because many represent science within discourses of fun and spectacle and promote themselves as sites where science equals entertainment. Indeed, at many science centres, science is totemic — emblematic of the good fortune of contemporary societies — and critical appraisal is effectively taboo. The effect is that visitors are prevented from acquiring science literacy — the critical resources required to evaluate discourses of science, representations of science and scientific reports, in order to hold scientists to account. Thus, as well as scientific laws (e.g. gravity and magnetism), it includes an understanding of science’s underlying principles (e.g. linearity, consistency and determinism, as well as indeterminacy, inconsistency and complexity). I will argue that science illiteracy is especially problematic in a ‘risk society’ (Beck 1992) where science appears as a problem, not as a source of solutions. It is also especially problematic at a time when some areas of science are shifting away from nineteenth century linear determinism and towards twentieth century science’s emphasis on indeterminacy.

The discursive construction of science

Inevitably, we think about science within one or more competing discourses of science — social frames or ways of defining science associated with structures of social, economic and political power prevailing in a specific society at a specific time. Using critical discourse analysis (Caldas-Coulthard & Coulthard 1996; Birch 1989 and 1995), I have examined the exhibits, signage and promotional materials of science centres in Australia, New Zealand and the USA, as well as the promotional materials of science centres in other countries, including Canada and the UK. I found that most centres represent science primarily within one of two discourses: science as family fun and science as spectacle.

Science as family fun

Science centres have proved very popular with visitors, not least because many (but not all) have consistently promoted themselves as sites of family fun, where science equals entertainment, especially in their emphasis on ‘interactive’ exhibits. Some examples are (emphases added):

- ‘Hands On Science’ is 2,000 square feet of hands-on learning *fun*. … Other *fun* phenomena include inquiry into magnetism, balance, gravity and momentum. (The Fort Worth Museum of Science and History, USA. Web site.)
- Hands-on science centres display scientific and technological phenomena in an innovative and *entertaining* way. … At weekends and during holidays, the (Guildford) centre is attractive to people of *all age groups* who come to

experience the interest and *fun* of science at first hand. (Guildford Discovery Centre, Guildford, UK. Web site.)

- The Investigator is a … *fun-filled* environment … where visitors can have *fun* and learn at the same time. (The Investigator Science and Technology Centre, Adelaide, Australia. Web site. The Centre's 'Birthday Parties' brochure states that, 'Your party includes … Heaps and heaps of *fun* (and) Access to Science Show.')
- Activities and *fun stuff* for *the whole family*. (Ontario Science Centre, Toronto, Canada. Web site. The site includes a navigation button titled, 'Family Fun'!)
- Visitors *young and old* can have hours of *fun* in the Waterworks area … Want to find something unusual, something *fun* for yourself or to give to someone else? Then visit our gift shops … (Science North, Sudbury, Ontario, Canada. Web site. The page for Science North Enterprises includes: 'Walk On Keyboard … So much *fun*, even Princess Diana had to try it!'; 'Bed of Nails … It's *fun*! It's painless! And it's safe!')
- Vancouver's Science World offers 'fun with fossils' (!) (Visitor leaflet.)

'Family fun' is a discourse of science that is prominent and widespread. It defines science primarily as entertainment and secondarily (and inconsistently) as something to learn about; and it defines 'scientific' primarily as fun. This discourse encourages people to become involved in science (by having family fun), thereby reinforcing scientists', industrialists' and governments' efforts to create so-called smarter workforces by increasing public understanding of science and by increasing enrolments in secondary-level and tertiary-level science courses. However, science-as-fun precludes the development of scientific literacy because it's uncritical, it's dated and it's commodified. First, it's uncritical. When science centres represent science as family fun, they effectively protect it from critical appraisal. After all, fun is A Good Thing, so anyone who criticises a discourse of science-as-fun risks being marginalised as a killjoy. Second, the science within science-as-fun is associated with the definite, linear and determinate outcomes of nineteenth century positivism and ignores the focus on indeterminacy that marked much twentieth century science. Third, at science centres, the science on display is implicated in a set of promotional social relations associated with its commodification (Wernick 1991). The scientific method of investigation is commercially attractive: its focus is objects and events that are easily commodified as original/reproduction memorabilia. When these are sold in science centre shops, they lose their autonomous significance and become just further instances of commodified fun. In consequence, the individual visitor's subjectivity is imprisoned in a commodified world of science, where *being* is reduced to having fun, *desire* is reduced to seeking the next fun site and *understanding* is equated with ownership.

In April 2001, some exhibits at Toronto's Ontario Science Centre illustrated the problems of science-as-fun. The dated emphasis on linearity and determinism was illustrated in an exhibit called 'K'NEXhibition', based on the K'NEX games and toys. The Centre's Visitors' Guide Map invited spectators of this exhibit to, 'See motorized dinosaurs and sharks and make your own creations with K'NEX interlocking plastic rods and connectors. Build anything from a ship to a space shuttle.' While visitors are invited to 'build anything', the two suggestions are vehicles in which indeterminacy is anathema — ask the crew of the ship *Titanic* and the space shuttle *Challenger*! As if to emphasise determinacy, the exhibition was sponsored by Professional Engineers Ontario, who are among the centre's major sponsors. 'K'NEXhibition' reminded me of my visit to the Baltimore Science Centre in 2000, where I saw the winning entry in

the annual ‘Spaghetti Bridge Competition’, sponsored by the Di Pasquali Family of Italian Marketplaces. The winning entry was an intricate structure of (uncooked!) spaghetti spanning several feet. It was displayed in a glass cabinet containing brand-name packets of spaghetti and brand-name tins of tomatoes. There, engineering’s linearity and determinacy was harnessed to marketing a brand of pasta — a good example of the commodification of positivism.

Such commercial relationships were also evident at the Ontario Science Centre in the form of an exhibition titled, ‘CIRCUS! At the Science Centre’. The Centre’s Visitors’ Guide Map promoted this exhibition as follows:

> Starting June 23, you and your whole family can run away to the circus. Discover the secrets of The *Flea Circus* and *Sword Swallower*. How good is your balancing act? Test it on *The High Wire*. Explore *the greatest show on Earth*, hands-on, under the big top. (Original italics.)

The exhibit’s commercial significance became clearer at another point (‘What’s coming’) in the Visitors’ Guide Map, which invited visitors to, ‘Explore science under the big top and then see the OMNIMAX film, *Cirque du Soleil*™.’ By paying an extra charge, visitors to the Science Centre could enter the centre’s ‘Shoppers Drug Mart® OMNIMAX® Theatre’ and see a film about the Cirque du Soleil called, ‘Cirque du Soleil™ Coming of Man (Coming June 23).’ Thus the exhibit promoted the film and vice versa. A nice promotional circle would be created if visitors/viewers could then attend a performance of Cirque du Soleil, but as far as Centre staff knew, that particular circus wasn’t in town during the exhibition and film. That promotional circle could have been expanded still further to include a television program about Cirque du Soleil. The program was transmitted in Australia in early 2001, but the Centre staff knew of no plans to screen it in Toronto.

Science as spectacle

In common parlance, ‘spectacle’ normally refers to an event or phenomenon, whether natural or social — a streak of lightning, a giant flock of parrots, the Millennium fireworks displays, the opening and closing ceremonies of the Olympic Games. Science centres certainly present science as spectacular in that sense. Some examples:

- A centre’s stage-mounted demonstrations will often include the ‘hair-raising’ spectacle created by a Van der Graaf generator;
- During my visit to the Investigator in Adelaide, I was exhorted to watch so-called lightening created by discharging a huge capacitor;
- The ‘Foundry’ demonstration in Toronto’s Ontario Science Centre features ‘the fiery spectacle of molten metal’ (Visitors’ Guide Map). One of the Centre’s sponsors is chemicals multinational DuPont, whose (trademarked!) slogan is ‘The miracles of science’.

I will use ‘spectacle’ in the more specific sense associated with Guy Debord, who called the spectacle, ‘the existing order’s uninterrupted discourse about itself, its laudatory monologue.’ (1977: 24). At the heart of Debord’s argument is the notion of non-reflexive action and some of the earlier critical writing about science centres focused on just that. For example, when Chambers and Faggetter (1992: 555) reviewed the opening of the Powerhouse Museum in Sydney, they focused on its ‘laudatory monologue’ of science-as-progress:

> As one moves from gallery to gallery (in the Powerhouse) there is little to dim the bright and celebratory vision of modern technology. The familiar

> simplistic formulas (technical change equals technical advance, technological progress equals social progress) are everywhere implicit and often explicit.

At the Powerhouse, for Chambers and Faggetter, science was synonymous with progress and advance and 'scientific' described contributors to humanity's advancement and improvement. Implicitly, the then-current structures of social, economic and political power represented the best of all worlds, precluding any critical appraisal of them. While softened somewhat, this perspective continues at the Powerhouse. Just two examples from its current offerings: The 'Steampower' exhibition presents steam power as a force acting independently of real human actors and outside of any detailed social, economic and political circumstances. It celebrates steam's contribution to increased industrial productivity, but pays virtually no attention to the political and economic relations through which human labour was subordinated to the demands of steam-based mechanised production. The 'Innovations' exhibition celebrates new technologies and while it includes a couple of inventions that failed to succeed in the market, they appear as exceptions that prove the rule of continuing, technologically determined human progress. This perspective is echoed in Neil Postman's appraisal of the Experimental Prototype Community of Tomorrow (EPCOT) in Orlando, Florida focused precisely on its role in expressing, 'the existing order's … laudatory monologue.' Postman (1990) argued that when science museums (and, we could add, science centres) celebrate contemporary society's technocratic values and ambitions, they abdicate the museum's traditional role of critically evaluating its society's values and ambitions. The effect is to prevent visitors from contemplating alternative visions of their society. In Postman's view, EPCOT says to visitors, 'This is what you are. Come and applaud yourself':

> In every exhibit, in every conceivable way, EPCOT proclaims that paradise is to be achieved through technological progress, and only through technological progress. The message includes the idea that new is better than old, that fast is better than slow, that simple is better than complex — and if they are not, we must change our definition of 'better'. … People who flock to EPCOT warm to this message, as a miser will warm to being told that a penny saved is a penny earned. But these people will learn nothing from it. (pp. 56-57.)

For Debord, a spectacle's significance lies not in its action, colour, or sounds, but in its creation of particular social relations: 'the spectacle is not a collection of images but a social relation among people, mediated by images.' (p. 4). Science centres' celebrations of science are spectacles in that they create social relations among visitors and between visitors and scientists that are mediated by so-called interactive exhibits. Many science centres have installed interactive exhibits in the belief that they involve visitors in science by giving them hands-on experiences of it. These centres are responding to the traditional view that science is distanced from most people's everyday lives and something to which you don't (can't?) relate directly:

> Traditionally, science has been something to respect, to defer to, to strive to understand; it has not been something to admire, to participate in, or even to criticize. (Durant 1996: 15.)

Interactives allegedly invite visitors to become personally involved in science (as scientists are) and to bridge the gap between science and their everyday lives (as scientists do). Interactives allegedly change visitors from passive recipients of

scientific knowledge to active participants in its (re) production. However, for all their alleged novelty, interactives often express and reinforce a traditional (modernist) Enlightenment model of science, in which the individual scientist investigates a world of linear, determinist relationships. Many interactive exhibits are designed for use by single individuals — especially the exhibits that use personal computers, since keyboards, mice and trackballs are individualistic by design. Also, many interactives embody and express a linear relationship between cause and effect recalling, again, the determinism of nineteenth century positivism. Pushing a button or pulling a lever activates the exhibit — perhaps a video or a recorded spoken commentary starts to roll; or a light flashes; or some mechanised display comes to life. These features reinforce Durant's (1996: 155) argument that creating 'active' visitors requires not new technologies but new models of science:

> If the museum visitor accepts the role of passive recipient (as opposed, say, to that of active participant or critic), then he or she is likely to be overwhelmed by the dead weight of scientific authority. The remedy for this is not (as some have supposed) cleverer use of graphics or multimedia, but rather a change in the visitor's perception of his or her role in relation to science; and such a change presupposes the possibility of thinking about science in a different way.

In the final section, I will assess the contribution to scientific literacy and, therefore, to active citizenship, of one 'possibility of thinking about science in a different way' — the notion of a risk society. Here, however, I wish to argue that science-as-fun and science-as-spectacle share two features that prevent them from promoting science literacy and contributing to active citizenship. Each discourse positions visitors as passive receivers of knowledge, rather than as active investigators who critically reflect on the discourse they are investigating; and each discourse presents science as something to celebrate, enjoy and wonder at, rather than a socially-specific and historically-specific form of knowledge open to scrutiny and appraisal. First, the positioning of visitors. While visitors to science centres may well actively participate in fun activities, those activities are designed to induce passive absorption of their message. I interviewed a science educator ('B') at a science centre in Australia, who put it thus:

> Self-inquiry is one of the better ways, I think, of people actually developing an understanding, so if you can spark some sort of interest, give some sort of launching point, then people can take that further if they want to. But you don't have to give them a lot of 'hard core' science to do that. If you can make it interesting and stimulating so that people are learning, I guess, a little bit by stealth, by enjoying themselves as opposed to the sort of traditional 'sit in the classroom and be lectured to' or 'watch this video and write down four things of importance' or whatever it happens to be. It's a different sort of learning environment and hopefully it will stimulate people to do that.

I also interviewed the Director of another Australian science centre, who voiced similar views about the role of fun in 'passive' learning:

> Because it's interactive, kids come here, they have fun. First and foremost, they have fun. They have no idea that they're learning and if they did, they probably wouldn't enjoy it. If it was a school situation, if it was a classroom situation — 'Oh, don't like school!'. … I think they learn by osmosis — they have no idea that it's happening and that's why they enjoy it.

Secondly, within both science-as-fun and science-as-spectacle, science is something to celebrate, enjoy and wonder at and scientists and scientific institutions appear to be 'merely' the origins of fun and spectacle. The whole scientific enterprise is thus protected from scrutiny and appraisal. Indeed, science appears to be a totem — something to be venerated as a symbol of contemporary society and an emblem of its good fortune. Such veneration of science underlies the responses by two science educators ('A' and 'B') at an Australian science centre whom I asked, 'What role does science play in your life?':

> A: I find that you become infected by it. … I think it's fairly central, actually, to my intellectual life and it's a many-splendoured thing, it's wonderful.
>
> B: One thing that science has done for me is to develop a way in which I look at the world and what's going on. … On the other hand, I certainly appreciate all the benefits that we've got from science … whether it be the aeroplane, the car, satellite communications … achievements in medicine … things which make life easier, things which make life more interesting.
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> A: All those things that (B's) talking about — the social benefits and the societal benefits, the break-throughs, you know the reduction in human misery and the increase in human happiness, all those things.

What connects these discourses of science with the notions of totem and taboo? In traditional terms, a totem is often a specific animal or plant that will protect a social group from external and internal threats as long as the members of that group refrain from behaviours proscribed as taboo. For example, killing or eating one's totem is strictly taboo, punishable by violent expulsion from the social group or even death. Like any totem, science will protect the members of a society as long as they refrain from taboo behaviour … and at science centres, critical appraisal of science is strictly taboo! Indeed, science's totemic status invests it with mythical powers that place it beyond the reach of individual citizens. As Durant (1996: 155) suggested:

> In contrast to the arts, science has often been portrayed as something that one either takes or leaves, rather than as something to which one is invited to make some sort of personal response.

Taboo prevents science centres from representing science as, for example, a mode of inquiry operating in and through specific social, economic and political institutions and producing socially-specific and historically-specific knowledge open to scrutiny and appraisal. In contemporary societies obsessed with 'the market', breaking taboos by critically appraising science may lead to the equivalent of 'violent expulsion or death' — commercial failure! For example, a designer ('C') at a science centre in Australia recounted how market researchers had persuaded her team that their original aim of inviting visitors to become familiar with science was commercially risky:

> Originally we had called this exhibition 'Science is …', because everywhere there were going to be labels saying 'Science is … making guesses', 'Science is … making fair tests'. Our market research said if you call it 'Science is …', a lot of people will be frightened off and you won't get your audience. That was both with teachers and the general public. So we actually went right away from using any reference to science — (the current title) is fun, catchy and proved more successful marketing-wise.

The ultimate effect of that taboo on critical appraisal is that much contemporary science education and communication occurs within narrow, outdated discourses of science that offer visitors very restricted opportunities to acquire the critical and discursive resources required to evaluate representations of science and to hold scientists to account. In the next section, I will outline some ways in which science centres could encourage science literacy and promote active citizenship.

Citizenship in a risk society

I suggest that science centres are currently failing in their self-imposed mission to increase public interest and understanding concerning science. Many science centres are time warps, where 'science' frequently means the linearity and determinism of nineteenth century positivism and where the twentieth century's paradigms of indeterminacy, such as quantum mechanics, relativity, fractal geometry, chaos theory and complexity theory are yet to happen. Further, many science centres are vacuum flasks, sealing-off science from any social, political and economic relations, because positivism seeks to abstract knowledge from the circumstances of its production. Some might show specific scientific institutions and practices operating in historically-specific circumstances, but they present little evidence that science itself — as a mode of inquiry — is always grounded in specific social, political and economic relations. For example, science centres very rarely address the rising and diverse public concerns about science. If they did, it would temper their current emphasis on science as a totem and lift the taboos on critically appraising it. More specifically, science centres could use the notion of the 'risk society' as a theoretical means of expressing those public concerns; and they could relate those concerns and their origins both to the determinacy of nineteenth century positivism and to the indeterminacy of twentieth century science.

Science frequently appears on public agendas and in the news as a source of risk — chemical or biological spills, genetically modified plants and animals, toxic wastes and global warming (Allen 2000). Beck (1992) and others have described contemporary (Western) societies as risk societies because they exhibit four 'risky', science-related characteristics:

- Risk is manufactured rather than a side effect of other processes;
- Scientists increasingly disagree with each other, making it hard for us to rely on their expert opinions (Giddens 1998);
- Science is regarded as a problem, not a source of solutions and the public is increasingly aware of scientific ignorance and uncertainty (Durant 1998);
- The question, 'How do we wish to live?' becomes increasingly prominent, undermining scientists' monopoly on rationality.

In a risk society, active citizenship requires a high degree of scientific literacy in order to judge the risks involved in high profile scientific endeavours such as nuclear power generation and the human genome project. We can hold scientists to account and exert social control over scientific research and development only if we understand the increasingly risky nature of science itself as it moves away from positivism's regularities and certainties and towards the irregularities, skips and jumps

of the quantum universe. Science centres currently show no sign of promoting such science literacy. Instead, many are pursuing allegedly market-driven promotional strategies that play-down science in favour of entertainment — fun and spectacle. Seattle's Pacific Science Center illustrates where such strategies lead. The centre has abandoned any pretence at science education — the word 'science' appears in its promotional material only because it is part of the centre's title:

> Adventure awaits you at Pacific Science Center! Explore our new and exciting Dinosaurs! With tons of interactive exhibits, Pacific Science Center has hands-on fun for kids of all ages, including laser shows and IMAX & IMAX3D films. (Advert in a Seattle tourist magazine.)

At Seattle, science has lost its totemic status to entertainment, yet critical appraisal remains taboo.