

ACCIDENT + EMERGENCY

Risky intervals in the Design Studio.

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In studio, we often try to alert students to serendipitous aspects of designing.

To make use of unintended effects, things that happen by accident. Sometimes we ask them to work generatively, without direct reference to a final outcome.

Judgement is postponed, and it is hoped that unexpected things will arise.

These are examples of the use of **accidents** in studio

But we also expect students to act in non-arbitrary ways

Students are expected to justify their design choices and validate their design with reference to a framework of theoretical value judgements.

This can produce anxiety for students.

The problem is that accidents are seen as arbitrary incursions into the design process

Something to be winked at.

In this paper I'm going to argue that we need a stronger account of accidents in studio practice.

- theories of emergence
- Paul Virilio's concept of the integral accident
- student work carried out 2006 at University of Auckland.

Emergence

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In his seminal 'Embryological Houses' project (1999), Greg Lynn used scripted modelling and digital manufacturing to produce "a strategy for the invention of domestic space."ⁱ Rather than proposing a house which was a singular architectural object, Lynn established a set of genetic rules (a scripted algorithm) which

was capable of generating an infinite number of houses according to certain variable geometric relationships. The houses are not simply a theme and variations. There is no central thematic object of which the others are versions. Instead, the project "employs a rigorous system of geometrical limits that liberate an exfoliation of endless variations."ⁱⁱ In the language of systems theory, Lynn is manipulating a phase space.ⁱⁱⁱ He does not directly vary the individual values of his system (the thickness of a wall, the position of an opening, or patterning of the surface). He varies the system itself (adding or subtracting environmental variables, setting maxima and minima) in order to control an entire field of possibilities. In this way, an interval opens up between intention and effect. Outcomes are not directly anticipated, but emerge from interactions within the "generic envelope" of the project.^{iv}

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Emergent properties of a system are higher-level properties that arise from the accumulated interactions of lower-level properties.^v Studies of complex systems, from sociology, to the natural sciences, to software design have employed emergence as an explanatory principle. Often-cited examples of emergence are the behaviours of flocks, swarms, and herds: although each member of the group acts independently, the group acts as a single entity through the dynamic interactions of many individuals.

In the last fifteen years an instrumental view of emergence has been particularly influential on spatial practice. Biological studies of morphogenesis such as Thompson's *On Growth and Form* (1917) have been treated as methodological treatises for architectural design. Architectural morphogeneticists see form as a product of the forces acting on it, and advance Lynn's generative strategy by incorporating iteration and environmental feedback as a way of seeking out emergence in the design process. Weinstock writes:

"It is necessary to think of the geometry of a biological or

computational form not only as the description of the fully developed form, but also as the set of boundary constraints that act as a local organising principle for self-organisation during morphogenesis."^{vi}

In generative or morphogenetic design, algorithms and rules are not simply constraints. They are an abstract geometric diagram (a 'local organising principle for self-organisation') which demarcates a field of more or less strongly emergent possibilities. The defining conditions of morphogenesis according to Weinstock are interaction and feedback. A process operating according to these conditions traverses this field, exposing its unexpected potentials.

The Integral Accident

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An alternative way to consider the gap between intention and effect is provided by Paul Virilio. In *Unknown Quantity* (2002), Virilio contends that accidents are inherent in systems. Arguing against uncritical technophilia, he warns that every new technological system bears the possibility of accident within it. Every new system that is invented opens up a new domain of potential accident: "to invent the sailing vessel or the steam ship is to *invent the shipwreck*."^{vii} The risk, according to Virilio is that each new capability is also a new capacity for accident, and the more far-reaching the capability, the more extensive is the capacity:

"The old techniques of the transportation revolution provoked accidents that were specific, local. Invent the luxury liner, and you invent the 'Titanic'... On the other hand, by virtue of cybernetic technologies, the accident is total. It simultaneously concerns the entire world at the same instant."^{viii}

Virilio urges us to conceive of the accidental domains that we have opened up with new technologies, but which we have not yet experienced. The accident does not intervene from outside the system, but derives from the internal functioning of the system. An accident does not arbitrarily enter the domain of normal, systematised conditions, to be either defended against or generously accommodated. The accident is part of the conditions that define the domain of system from the outset. Virilio quotes Freud: "Accumulation puts an end to the impression of chance."^{ix} Through iteration, the exceptional event becomes inevitable. This inherent relationship between systems and accidents is not counter-intuitive in light of emergence theory: accidents, mishaps and catastrophes could be considered emergent possibilities of systems.

It would be misleading, however, simply to describe Virilio as an emergentist. In his own studio teaching, he stressed the one-to-one correspondence of intention and action in design.^x His writing about accidents is an explicit critique of some of the very technologies and processes that are central to emergent design practice. But perhaps the most significant impediment to mapping Virilio's accident directly onto emergence theory is that it requires positing that accidents are an instance of a system's self-ordering. Virilio himself provides no argument to this effect.

Virilio's accident and Emergence theory are directly equivalent
But a tentative alignment could potentially be productive for thinking critically about accidents in designing.

Two lines of thought presented for testing to two studio groups:
What is the connection between accidents and emergence?

To what extent are accidents emergent, or emergence catastrophic?
How can a consideration of the unintentional enrich studio design practice?

Accident and Emergency

Papers organised around group discussions

Design as research - production of illustrated and referenced design report.

'Accident' (4th yr): theoretical position on accidents.
vehicle depot as a site for meetings and failures to connect.

'Emergency' (3rd yr): employing emergent systems to find
unexpected architectural outcomes.
emergency facility.

Look at some student work. Mention final outcomes, but focus
mostly on process.

Both projects began with individual students identifying an accident (train derailments, nuclear containment failures, volcanic eruptions, accidental survivals, things becoming lost, coincidences) and describing the various systems it involved. In discussion, it became clear that the students understood accidents as exceptions. Almost exclusively they described their selected accident as the failure or limit state of a system. A train derailment was the failure of the system of controls and mechanisms of a rail network. A survivor of the Holocaust was a failure of the system of extermination represented by the camps. An earthquake was caused by tectonic plates failing to move smoothly along their course. These discussions polarised around the opposition of the systematic (which was seen as deterministic and predictable) and the accidental (which was seen as arbitrary and chaotic).

Students were asked to use these analyses to inform a generative process. These processes included mapping movements in simulated networks, converting safety procedures at nuclear power plants into drawing methods, experimenting with spray-paint and stencils, carrying out particle-based collision simulations, photographing water, and experimenting with toffee production. In refining their

processes conceptually and technically, students were asked to postpone judgements on use-value.

A common experience in the studio during this period was concern over the value of accidental work. One student commented that she didn't feel like she was designing. Did something carried out accidentally even constitute 'work'? A number of students held to the view that accidents represented a failure of designerly discipline, and were to be excluded. They saw design as a conscious process of control and consequently, as their project developed, they downplayed the significance of intuitive movements and chance discoveries.

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One such student, SB, developed a broad typology of disasters, based on a formal mapping of historical events. Accidents were placed into a governing systematic framework. Her analysis assimilated accidents as classifiable events, as an insurance assessor might. SB was interested in architecture as the restoration of a disrupted order. She set herself the task of designing a rail terminal for Ports of Auckland, arguing that the atrophy of Auckland's rail network constituted a disastrous event for the city. The human-scale spaces of her proposal were marked by a series of knowingly nostalgic gestures to a 'golden age' of NZ rail: slightly vaulted ceilings like those in train carriages, brass fittings, overhead storage nets, walls of railway sleepers.

Each design decision, for SB, was a conscious movement that needed to be explained. When she was unable to justify a decision she had made, SB would pause until she had established a plausible chain of cause-and-effect reasoning. SB saw the role of the studio tutor as pointing out causes that had not yet found their expression in effects, or effects that needed to be justified with respect to a cause. Maintaining the proper relationship of cause and effect was central to SB's design practice.

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Another student, JW, was interested in involuntary physiological responses to film. He described these responses as accidental, because they were not the product of direct intention. Even though his project concerned unintentional actions, JW's architecture was itself the effect of the designer's conscious intentions. In the same way that a filmmaker could produce a physiological response in the viewer by means of the film, an architect could control the responses of occupants by means of the architecture. There was a clear chain of causality that passed through the building. Architecture was the effect of the designer's intentions, and in turn subjected the occupants to those intentions.

SB and JW successfully addressed accident as a theme, but they excluded it as a design strategy. By restricting accidents to the status of theme, they could be classified and guidelines for response drawn, while the designer retained a traditional position of external control.

Risky Intervals

Other students deliberately pried open what could be called a 'risky interval' between cause and effect. The precise nature of these risky intervals varied by student, but they can be characterised as spaces where loss of control was permitted.

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AG for example, was interested in sleep and dreaming as examples of the loss of conscious control. Of particular interest was the idea that dreaming was how the brain processed memory. From her research, AG identified four processes which occurred in sleep: the reconstruction of cells and tissue, preservation of energy, compression of memories, and the development of the brain, understood as a kind of unfolding. These conceptual processes were turned to a method of making fabric castings by wrapping familiar

objects in fabric saturated with glue, and then binding them. When the glue was dry and the object freed, a flexible cast remained.

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In this way, AG devised an abstract machine, which she then fed with a range of inputs (household objects). The ability of the objects to speak about sleep and dreaming did not reside in the objects themselves, but in the processes. We might suggest the objects were performative, rather than constative. They did not represent ideas about sleep and dreaming; rather, those ideas were enacted in the production of the objects. By 'automating' a part of her design process, she established her project in terms of a phase-space rather than a single significant object. Within this space of possibilities, all possible objects met the criteria for being read in terms of sleep and dreaming. In the language of emergence theory, AG operated algorithmically. As she tested her algorithm by varying the inputs, she was able to refine it technically and conceptually.

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A project by JT worked with refining a kit of bamboo and cardboard parts for use in rapid-response disaster relief. [slide] By designing the individual parts and connections, JT was manipulating a phase space. She developed her components through manufacturing them in large numbers and testing their flexibility for producing a range of spaces. Early versions of the components lead to a phase space sharply divided into horizontal constructions and vertical constructions. This observation was fed back into the process by making subtle modifications to the components so that vertical and horizontal could be mixed, producing a smoother phase space and a more flexible system. [slide] At another point, the phase-space organised itself around small spaces, which JT identified as unsatisfactory and addressed by further subtle modifications of her components. Although at all times during the process JT was working with specific architectural details, the object of her design was actually the

phase-space itself. Observations at a large scale fed back into operations at a small scale. [slide]

Neither AG nor JT operated in a traditional mode where intention orchestrates and validates action. Instead algorithmic operation allowed for unexpected outcomes which still fitted within conceptual and technical parameters. Rules were not constraints on production but a means to open up a field of potential accidents. In both cases feedback was introduced to the system as the students manually evaluated their productions. The possibility that feedback might be integrated algorithmically is demonstrated in a project by PN.

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PN began by looking at human interactions at traffic lights and tried to describe through drawing the way that two individuals simultaneously respond to each other as they try to determine the other's intentions. As she moved on to consider larger groups, individuals became jittering particles in a field of dynamic interaction (Figure 1). PN proposed an Accident and Emergency Clinic for Grafton Gully. She established a diagram of site and function, which was then deformed by the 'material' properties of dynamically interacting occupants. Hesitation and ambivalence, which appeared in her drawings as irregular, unsteady lines, became roughness of surfaces: gravel underfoot or roughcast concrete. Sudden decisive movements became sweeping corridors or moments of wayfinding clarity. PN's proposal was conceived as emerging from a dynamic simulation. The programmatic diagram is modified by the simulated behaviour of occupants, and is responded to in turn until a relatively stable state is reached.

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This is how PN's project outlined the possibility for a sophisticated emergent system. But rather than actually simulating the movements of people through the diagram and allowing moments of hesitation or clarity to emerge, PN intuited where these

moments would occur, based on her assumptions about how people might act in various circumstances. She opened up a risky interval by siting some decision-making externally, but then managed that risk by annexing that decision-making to herself.

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The question of decision-making becomes particularly pressing in the case of intuitive action. WW made a series of elegant, complex pencil drawings as an intuitive response to the idea of material transformations that occur in accidents. Her drawings were puzzling for her, because she was not immediately able to articulate what qualities of accident they expressed, or how. Her intuitive drawing drew on her unconscious resources: the assumptions, preferences and concepts that she was not consciously aware of having. Most of her designing from this point consisted in re-interpreting her own drawings in order to disclose these unconscious conditions. At the end of her project, WW described architects as working with reference to this subconscious pool, as "symbol collectors and ideas alchemists".

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Intuition is often taken as arbitrary or uncritical action.^{xi} In PN's case, intuition thwarted a properly generative process. However, WW's work suggests that, properly framed, intuitive action can become an opportunity for reflexive disclosure. While other students adopted processes that were external to themselves, WW treated her own subconscious as an emergent field that she traversed quasi-psychoanalytically. Intuitive action is problematic for a discourse of intention because it is neither the act of an intending subject, nor a external imposition on the subject. In considering intuition in emergent terms, there may be no simple inside and outside. Virilio suggests, quoting Hugo, that "it is inside of ourselves that we have to see the outside - a terrible admission of asphyxia"^{xii} Instead of a distinctly separated interior and exterior, we find a risky continuum.

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Soliciting Accident

All designing incorporates intention and unintentionation.

Designer is not an agent of pure, unconstrained intention.

Trying to articulate this relationship more precisely.

The accidental is not an exception to an established order.

Propose the concept of a 'risky interval' as a useful alternative.

The risky interval is the space which is opened up by a shift from direct intentional control to an algorithmic or rule-based process (whether it be digital or analog). It is what I have described above as a phase-space, or a domain of accident. The risky interval is not intended as a concept which sums up all the issues of accident or emergence, but as a technique for foregrounding these issues in the design studio. By encouraging and assisting students to establish and explore a risky interval an intensive and reflexive engagement with accident, emergence, and other forms of unintentionation becomes possible.

Conclude with Lebbeus Woods, from Virilio's *Unknown Quantity*:

"Paul Virilio's insight that the accidents occurring within a system are as designed as its intended results corresponds closely with the dynamics of unpredictability characteristic of a culture based on innovation and technological process. As this implies, determinism by itself is no longer an adequate framework for understanding contemporary life or spaces designed for it, yet we cannot dispense with it. Instead we should seek to enlarge its scope and deepen its implications."

ⁱ Lynn, 2003, p1

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ⁱⁱⁱ A phase space is an abstract, multidimensional space in which each axis corresponds to one variable of a system. Every possible state of the system is thus represented by a single point in phase-space.

^{iv} Lynn, 2003, p1

^v In its most abstract sense, emergence is nearly equivalent to the philosophical concept of supervenience. Supervenience first developed into emergence in the work of British philosophers examining the relationship between consciousness and causality. See Horgan (1993), and O'Connor and Wong (2006).

^{vi} Hensel, Menges and Weinstock, p14

^{vii} Virilio, 2002, p24 (*italics are Virilio's*).

^{viii} Virilio and Lotringer, 2002, p160

^{ix} Virilio and Lotringer, 2002, p25

^x "Virilio would constantly push us to expose ourselves, to adopt points of view, and would force us to make them stronger and more personal. For him there was only one type of architect: author. He would tell the students: 'Author or unemployed - you must choose.'" (Bessard, 2004, p44)

^{xi} Christian Norberg-Schulz proclaims: "One of the important insights offered by architectural theory is that a building task cannot be solved through intuitive improvisation." (Norberg-Schulz, 1965, p217) According to Norberg-Schulz, intuitive action is untheoretical, and therefore unjustified.

^{xii} Virilio and Lotringer, 2002, p129