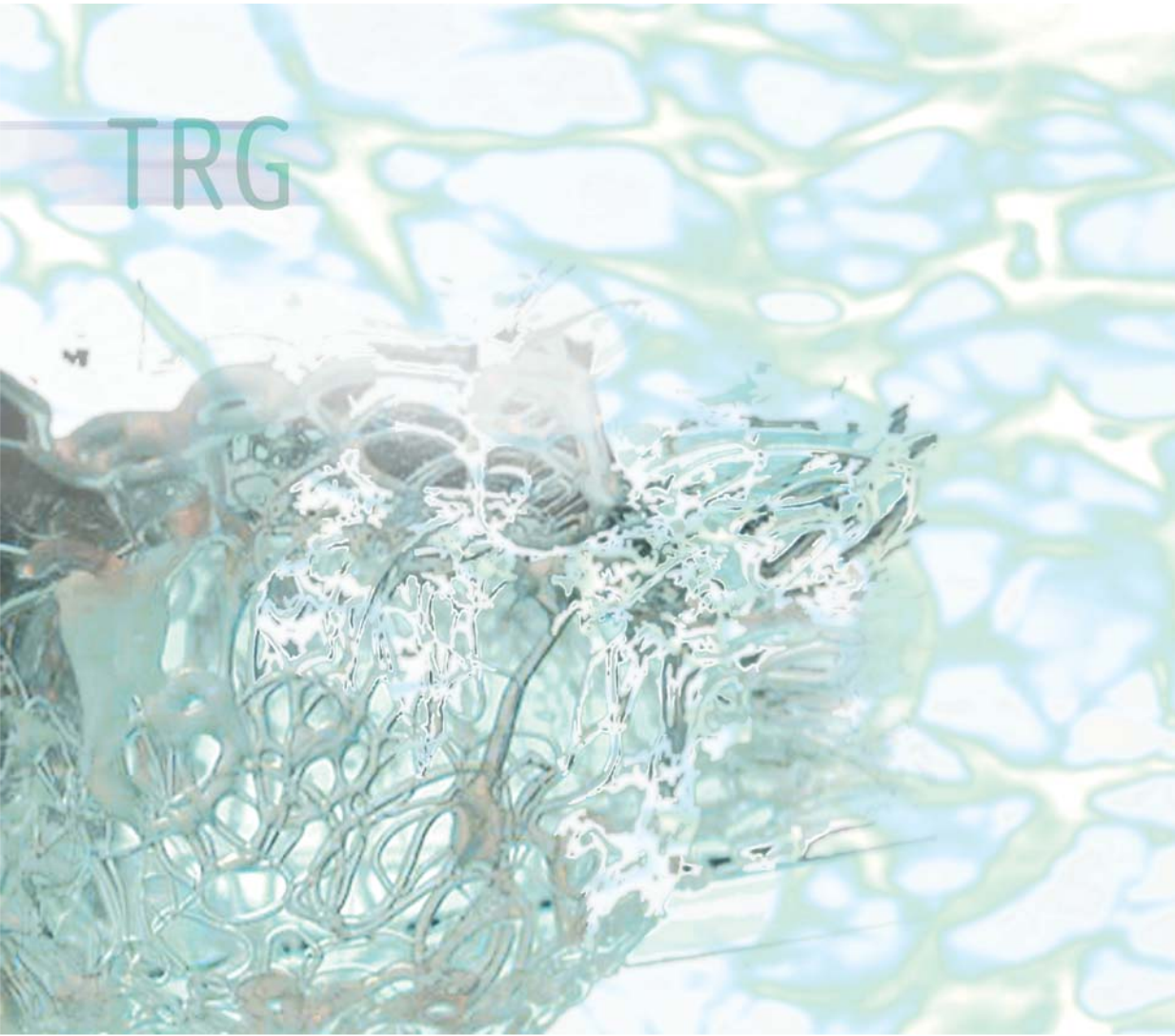
TRG

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TRG: On Transient Realities and their Generators

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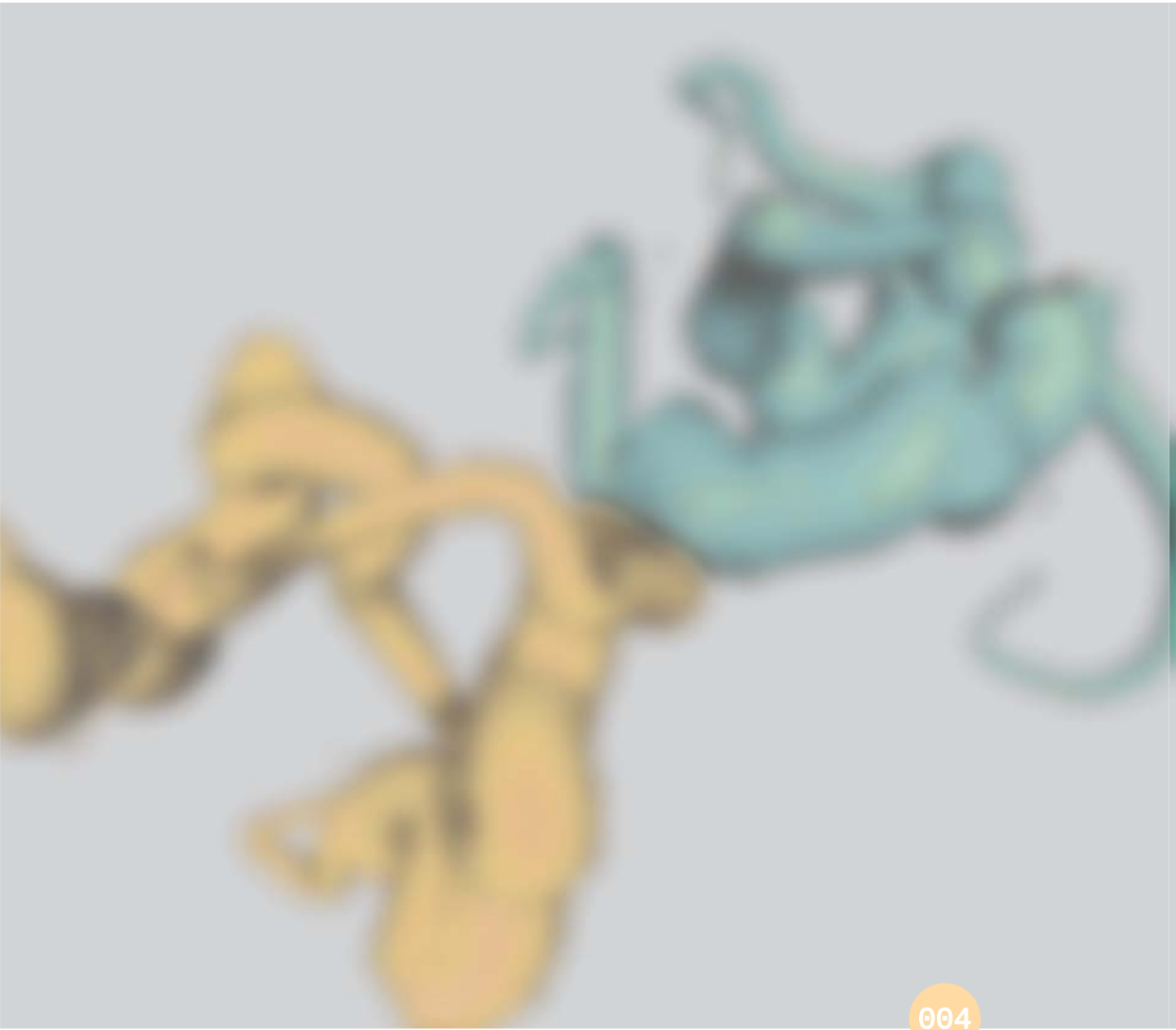

INTRODUCTION

INTRODUCTION

You are holding in your hands the distillation of one intensive year's work on the Transient Reality Generators project. This distillation is built of several angled slices through the events, projects and inspirations that made this project possible. From philosophical underpinnings to anthropological analysis, from recipes for good food through to abstracted ponderings of the fundamental structure of the universe, all these aspects and many more made this project interesting and valuable.

The Transient Reality Generators project grew from several parallel discussions about short-, middle- and long-term, lived-in, reactive, co-structured real world environments, story telling and game playing, perception, action and fantasy. By no means have all these ideas and inspirations, thoughts and conclusions made it into this volume. But a number of them have, and it can only be hoped that the repercussions will continue to reverberate in a number of other places for quite some time to come. The two main results that arose in this project are the Sensory Circus from Time's Up and trg (from the Slovenian word "trg" meaning public plaza or square) from FoAM. We hope that the double usage of the term TRG does not cause too much confusion.

The texts in this book fall into several groups. One of the surprising aspects for us has been the unexpected connections that arise, not just between those texts written by people who collaborate and thus share significant common ground, but also echoes between distinct areas. For instance the repeated ideas of play and storytelling that arise in the discussion of interactive spaces, their design and implementation, inspiration and interpretation. Then one reads Tom Toffoli's text about science: he is saying the exact same thing! Science is telling stories about games that scientists play. Inasmuch as the stories say something about our physical world, they are real, but no more and no less than the tales of any other storyteller might tell, where the stories speak to us about our emotional or cultural world. Most of these introductory notes will attempt to draw out some of these parallels and connections, perhaps this will make the hopping and skipping in the texts somewhat less confusing, or at least less daunting, and help the reader see that we are con-fused. Note that, to follow Neal Stephenson's example, the word "confusion" is actually to be interpreted as "con-fusion" - the fusing together of several elements, multiple stories or threads drawn together. Thus this entire volume, in fact the creation of transient realities, is always a con-fusion and that is a good thing.

One significant slice through the collections of inspiration and information that form the basis for TRG is the article "Transient Realities or Verges of Con-fusion" by Maja Kuzmanovic and Nik Gaffney. A technically grounded fanciful gedankenexperiment, "Verges of Con-fusion" begins to sound like a manifesto for transient realities, then shifts sideways to allow a few more interpretations and motivations into the pool. A rolling mixture of inspiration and analysis, the article reflects to a great extent the structure, or

at least the interests of this entire volume. FoAM's spaces are complex multimodal systems within which a player continually re-negotiates their relationship with and their understanding the space. The spaces are consciously nonsymbolic, a strong position that resonates with the abstractness of the universe models that they incorporate into their environments. Highly theoretical physics informing cutting edge interactive installations. That they make strong use of pataphysics, the science of imaginary solutions (to imaginary or other problems) is indicative of the mixture of playfulness and seriousness with which they make their way forward. The article demonstrates the process that allows the construction of imaginary universes: a process that is as vital as the perceptual theories upon which it is based. FoAM's work is informed by all the strangeness of the world, but people are the core reason for all this work. It is not only their relationship with the space, but also with their cohabitants in the space and thus also their relationship with themselves that is being continually re-negotiated. "People's actions and reactions never cease to surprise" brings the article, and one dares to say the entire motivation for the work, to a final statement.

One significant part of this volume is dedicated to the Data Ecologies Workshop held in May 2005. We were surprised that so many aspects of interest to physicists and other scientists were of relevance to the construction of temporary realities. Many of the inspirations for the interactive pieces developed come from physics - however the flipside, that physicists would be interested in the ideas of artificial world-building as a way of understanding how our world might be built, is a bit surprising. Of course there is a long history here; clockwork led to a mechanical universe, the theory of electromagnetics gave us a field-theory universe. Given our computational society, a computational universe is the natural option today, along with computational theories of cognition, economics and emotion. A lot of discussion in the workshop centered around the theories of intrinsic and extrinsic observers and the possible connections this has to the theory of endophysics (a closely related theory of action and observation in closed systems pushed by the chaos theorist Otto Rössler). That these concerns remain relevant almost 30 years after the first papers on the intrinsic observer was published is a credit to their value and relevance. An introductory paper "Data Ecologies Report" by the organiser of the meeting, Tim Boykett, tries to describe many of the threads and tangents that appeared in the discussion within the workshop. Tom Toffoli's paper "Computation: our theoretical physics kit" builds a bridge between the theory and practice of physics and the outside world. Toffoli is arguing that not only can physics, like all other sciences, be made clear, approachable and comprehensible for the average person, but that computation offers such a simple inroad and that the ideas conveyed do not become diluted or misrepresented in the process. His concentration on play and story-telling is not only reminiscent of the ideas that inspire the building of large scale interactive environments, but also reminds us of the simple experiments that can be undertaken by children in the kitchen in order to better understand those more "human" of sciences: biology and (to a lesser degree) chemistry. The story-telling of a tadpole growing into a frog, the narrative details of where it was found, how it acts, the observations of what it likes to do and how it reacts to various changes in its environment, are closely related to the ideas that Toffoli is conveying when he tells the stories of how the deepest level of physics is carried out. Reg Cahill's paper "Engineering the Quantum Foam" might appeal to another sort of story - a discussion of the ways in which understanding the strange properties of modern physics might lead us to be able to engineer strange forms of matter in order to build warp drives or somesuch. Cahill was unable to make it to the workshop, but sent us this text as a kind of apology and an inspiration that the stories of physics are still quite open. He has applied his theory of a process physics, developed over the last decade with several collaborators, to some ideas that were raised in connection to a Warp Drive (a well-known idea from science fiction, enabling faster-than-light travel). However Cahill is not falling into some fantasy world, rather he is taking the idea, as developed by Alcubierre, and showing that it is not impossible, pushing the envelope of allowable physics. Karl Svozil's paper "Aesthetics and Scarcity" is only one small part of the ideas that he brought into the workshop. Giving a physicist's perspective on some aspects of aesthetics he treads the difficult line between falling into romantic ideals of beauty and falling into overcomplex information theoretical interpretations of perception. His other contributions to the meeting were also vital and invigorating, ranging from the theories of the intrinsic observers and their investigations of their spaces to the reminder that physics, art, games, play and all the other areas of human activity where the humanity of the actors and players and their inviolate locality are principal. His closing cry for more nature in the cities echoes the seed-bombing practices undertaken by New York City's Green Guerillas, Kathryn Miller and FoAM amongst many others. Physics, the arts and activism meet in a seed bomb.

Physics as perceived by physicists and computer scientists was not the only point of view taken into account. Early in the TRG project FoAM organised a workshop to investigate the problems of physics and the strategies and tactics that could be used to get around them. The "Defying Physics" article from the collective heads and hearts of FoAM underlines the fact that a workshop - a meeting of several interested parties in order to transfer information, experience, wisdom and learning - is a transient reality per excellence, where a continual process of negotiation between the parties is primary. The article investigates various experiences in several workshop situations and attempts to talk about them. At the point that learning about a subject (Transient Realities) becomes the subject itself, recursion has been finalised and, for all we know, Gödel is waiting on the sidelines.

Several papers discuss the theory and practice of transient realities. It is a pleasure to be able to have Andreas Broeckmann's text "The Festival" translated into English. That a festival, in particular a media art festival, is a transient reality, one that shares a lot in common with the kind of responsive environments that we talk about in the rest of the book, is somehow clear, yet somehow surprising. The realisation that perhaps some of

the problems we are dealing with in the construction of temporary realities are the same as the problems confronting the curators and organisers of media art festivals, is perhaps somewhat comforting: festivals are well-known to be hard to organise, plan, set up and keep moving. Perhaps this explains some of the problems we have in creating large scale, mid-term transient realities of our own. On the other hand, S. Pearl Andrews' nineteenth century micro essay "The Dinner Party" echoes many of Broeckmann's interests yet shows that the most interesting parts of modern society are to be found in the playful, rule-less space of the dinner party, another form of transient reality.

Maja Kuzmanovic and Nik Gaffney give an introduction to the field of mixing realities for artists and by artists in their article "Interfacing Realities." It situates TRG in a wider context of Mixed Reality artworks, as a homage to our fellow reality generators. Trying to categorise the tools and techniques for reality mixing, there seem to be certain concentrations at the points of Augmented (or Mixed) Reality and Augmented Virtuality. They want to investigate, however, the in-between position of Hybrid Reality and do so by investigating certain elements that make up the environments in this class. They divide the class into three levels of scale and formulate descriptions of the parts of reality that fall into that scale. We see that at the smaller scales, a lot of work is being done on smart materials and tangible interfaces, with well funded large projects around the world investigating these smaller items in detail. These items, small objects or localised interfaces, are also an important part of the field of augmented reality. The larger scale, where (physical) reality becomes not just augmented but begins to take on new properties as a result of (for instance) architectural scale integration of smart materials and their interaction with the behaviour of the participants in that environment, is the scale of hybrid reality where the TRG projects and a handful of others are making headway.

Sha Xin Wei has been has been mixing realities for many years. In his paper "Ethico-aesthetics in t* performative spaces" he outlines his history of theoretical and critical discussions, that are enlightening and contextualising in many ways. Coming from a mathematics background, his take on the use of scientific ideas and technology in the arts is somewhat distinct yet related to the papers in this volume. He uses the term "media choreography" as a term that attempts to describe MR environments not as databases and rule systems, but rather as dynamics and quasiphysics. This ties in nicely with some of the concepts thrown around in the discussions of Digital Physics in the Data Ecologies Workshop: attempting to build quasi- or pseudophysical environments. Sha concentrates mainly upon (approximations of) continuous systems rather than accepting / working with / exploiting discrete systems. He is, however, aware of the differences between these things, which not all practitioners in these fields are. One language point that remains pertinent is the use of the expression "co-structure" rather than "interact" when referring to the behaviour of visitors and systems in complex MR environments. There is no turn taking involved, it is much more a case of the visitors and the environment taking part in a collaborative structuring of the media architecture in an intertwined and simultaneous collection of actions. His closing comments, where he forcefully holds the term "play" to be distinctly different from the ideas of ("the carcass of") "game" are a rallying call to all those who continue to believe that there is and should be an important difference between the two.

Alkan Chipperfield comes to the field of Mixed Reality with very few preconceptions. His background in anthropology has led him to this field, and he is in the midst of a year-long study of the behaviour of artists and technologists involved in developing MR environments. The article "Towards an Anthropology of Mixed Reality Phenomena" is a collection of the various starting points from which he intends to build a framework inside of which an analysis might be possible. One of the core motives in his paper is the use of "hermeneutics" - the study on interpretations - which is a concept that has arisen repeatedly in the work of Hans Diebner, one of the more active up-takers of the Endophysics ideas of Rössler and his collaborators. Endophysics is the somewhat more populistic side of the field of Intrinsic Observers which formed a main thread in the discussions during the Data Ecologies Workshop. This focus upon the study of interpretation, closely related to the problematics of what a player can know in a MR environment and how they can go about using that knowledge, is an element of anthropological and cognitive interest. Another element that is raised in the collage of elements that forms a basis for Chipperfield's work is Handelman's suggestion that "we view public events as discrete and distinctive" which ties in not only to Sha's claim that MR environments are or should be a form of alchemical theatre where neither the system nor the public make models of one another, but also Just Merit's idea of the "public individual", the person in public space who cannot be modelled as the sum of experiences and psychological parts, rather only as the collection of public behaviours. Merit was always insistent that the interpretation of actions, the psychologizing of the public person, was in error, that for interactive spaces the individual could only be regarded as that which they (consciously or not) chose to display; i.e. their behaviour.

Public space is also the main theme of Andreas Mayrhofer's "Remoted through audio," an article that attempts to bring together a feeling of defenselessness against the invasive behaviour of acoustic pollution in our world. A large portion of public space is controlled. Where musique concrete started working with the ambient sounds that arise around us, and contemporary sound artists such as Bruce Odland or Sam Auinger continue to use this inadvertantly generated soundscape as raw material, a vast proportion of the sound in our environment is consciously constructed. When Negativland released their infamous "U2" album and incurred the wrath of Island, U2's record label, they argued that the sounds of U2 and similar artists had gone beyond being music in some traditional sense and had become background noise. In a public space such as a mall, popular music is played into the space in much the same way that bird tweets, automobile sounds and conversations fill

traditional public spaces. Thus, goes one argument, the reuse of this sound is akin to the recording and reusing of other ambient sounds, and is a valid artistic pursuit. This corporate use of acoustic environment construction, of which Muzak is perhaps the most insidious form, is widespread. Thus Mayrhofer attempts to set up some parameters and frameworks within which one might hope to build ideas of how a transient reality can be supported, or even built entirely of sound. The pervasive nature of acoustics, the multiplicity of acoustic perception, lead to effects in spaces that are unable to be obtained with other, direct techniques of architecture or visual ornamentation. That such acoustic construction is important is outlined in his text. However, the means for its construction, in particular the evaluation of its effectiveness in a noncommercial setting, is hard. The overload character of sensory input, whether the perception of "free" architectural styles, odours or sounds, is a repeating theme in the essay. His final call for the conscious construction of temporary acoustic realities is a cry to all those who assemble public spaces to attempt something more than just "more" - to attempt spaces that do not just reflect the perfect taste of the designer or performer, but allow and even encourage the integration of the listener/viewer/audience in a nontrivial fashion.

Tim Boykett's "The Care and Feeding of Transient Realities" is an attempt to distill some of the hopes and dreams, self-doubts and worries, and other highs and lows of designing, building, setting up and maintaining Transient Realities. In the same way that Chipperfield talks about the thickening of the interface so that the hermeneutic relationship of learned interpretation becomes an 'alterity relationship' and the interface somehow becomes relevant in its own right, one main thread of this text is attempting to explain the way in which a complex MR environment begins to become complex and "thick" to the point of having its own dynamics that are related to, yet distinct from the dynamics that take place within its perceptual field (the actions of the players) and its action field (its media and mechanical output). These dynamics, perceptual and actional as they are, begin to become protocognitive and the act of manipulating them becomes perhaps akin to the process of psychoanalysis or neurosurgery. This curve begins to delineate what perhaps will be a further development in such transient reality spaces: away from the general situation as "weather" to a general situation as "mood" and a Damasio-inspired model of body and perception and emotional effects as self-describing, self-representing machines. At this point we will cease talking about transient realities and rather about temporary consciousneses, at which point the restrictions of short term (transient) installations will begin to raise their head. Permanent Reality Generation, anyone?

These two authors, Boykett and Mayrhofer are two people heavily involved in Time's Up, one of the partners in the TRG project. From their harbourside laboratories, Time's Up has a well established tradition of experimenting with spaces composed of one or more games in which the players get thrown off-balance and into a disorienting experience. A place where a deactivated fun-fair becomes reanimated and recycled into a proto-scientific playground.

Many people experienced the power-cycling in the 'Hyper-fitness Studio' and biometrically driven spherical projection interface (SPIN), the precedents of the multi-facetted un/balancing playful spaces of the Sensory Circus. Time's Up's work has been termed protoscientific by the late anthropologist Robert A. Fischer and as Toffoli has already made clear, science and games and play and storytelling are all part of the same field of activity.

It might seem that this entire project was the result of technological playing with scientific theories of mind and matter. This, however, would be a vast simplification of the situation. With respect to the swathe of fiction that inspired all the participants, Maja Kuzmanovic's "World Story" is a sketch of the trg world in words and images, a poetic vignette of the Transient Reality that kept us all engaged for many months. The stories that we and the players in transient realities tell one another, the tales of explanation and (de)construction, the metaphors and parallels with some consensual reality, these are the aspects that remain with us, long after the seams are torn, the computers obsolete and the steel rusted.

The final article, the Epilogue, sets up some directions for further development - this captures many of the tangents flowing in the TRG complex and sends them off as some kind of bundled manifesto, ready to explode as soon as it leaves the confines of these pages, somewhere an inch or two from your left eye.

We hope that the collection of recipes spread throughout this volume entice you to apply the ideas here outside the dry confines of theoretical discourse - invite some friends for dinner, create your own transient reality. It really can be that easy.

Literature of Possible Relevance

Hans Diebner, Timothy Druckrey, Peter Weibel (eds) "Sciences of the Interface" Genista-Verlag, Tübingen, 2001.
Uziel Awret "Art, Science and Consciousness" Editions questions 3, Salon Verlag, 2000.
Just Merit, Tim Boykett (eds) "Closing the Loop '98" edition Time's Up, 1999.
Neal Stephenson, "The Confusion (The Baroque Cyle, Vol 2)" William Morrow and Company, 2004.
Antonio Damasio, "The Feeling of What Happens" Vintage, 2000.

PS: As you read through the articles, you will notice subtle and not so subtle differences in layout, style of footnotes and references, language usage and other details. We have decided not to attempt to press all the disparate authors into one format, deciding to respect their differences as far as is reasonable. Once again, a Con-fusion. Enjoy the buffet!

From the Time's Up Strudelfabrik

The correct way to say strudel is, in fact, "Schtroodel." A strudel is a rather old fashioned Austrian way of wrapping stuff up in goopy flour before cooking it. Traditionally, the snobby things like eggs weren't included. But we will look at posh strudel - it tastes better.

Sift the flour and salt into a pile, make a hole and crack the eggs into it. Start by mixing the flower into the eggs. Add the water and oil slowly, forming a good paste. Once all the ingredients are mixed, then start to knead the dough on a surface. You will usually need more flour. Be brutal! Slapping the dough onto the counter seems to help. Keep doing this until the dough seems quite stretchy. Then cover the ball of dough in oil and put it on a plate under a warmed bowl for half an hour to rest.

While the dough is resting you can prepare the filling. Note that the amounts used here for the dough are enough for two strudels. And the whole process is easier if the strudels are not too big. So make one for the main course and one for desert. Be greedy.

Take the dough out and use a rolling pin (or a wine bottle) to flatten it out into a rough rectangle, quite thin. Then take the rectangle on the backs of your hands and spread it out more. The goal is to get the dough so thin that you could read a newspaper through it - it should be like skin. Once the dough is quite thin, lay it out on a floured cloth. Use something like a white tablecloth so it is easy to wash afterwards. Keep stretching the pastry until you have a strangely textured large, slightly rounded rectangle.

Spread the filling out on three quarters of the surface, paint the rest with melted butter, then roll the whole dough/filling mixture up using the cloth. This is the strudelling process. The buttered section should be the outside layer. The outside of the strudel should then be painted with more melted butter, milk or egg to help it not dry out. Then the strudel is popped in an oiled baking dish and is baked at 180-200 degrees centigrade for around half an hour. When you cut the strudel, you will see a spiral shaped form. This is the "strudel" as it is known along the Danube.

STRUDEL

Basics.
The essentially strudelly thing is the pastry.
The "normal" style is as follows.

250 g flour plus some more for kneading.
2 eggs
1/8 l warm water
1/16 l oil
1 tsp salt

SPECIAL CASES:

The classic: Apple Strudel

Filling:
5-10 middle-sized Apples
Raisins (optional)
Finely ground Cinnamon
Sugar
Pine nuts (ad libitum)
Breadcrumbs

Dough preparation as above. Bedabble dough with hot, liquid butter all over coat it with breadcrumbs. Evenly spread out the apple-raisins-cinnamon-sugar (...) mixture. _Strudel_ it up and put it in a high-sided baking dish. Flood the baking tin with milk - until app. 2 cm of the Strudel are covered bake it for 30-40 min at 180 degrees centigrade.

The Easy Schwammerlig

500g-1kg Mushrooms ("Schwammerln" if possible)
Butter
Garlic

Chop up the mushrooms, fry them in butter, add some sliced garlic. Spread the mushrooms ("Schwammerln") over the dough, strudel it up and coat with some oil.

A more complex version can be made with a creamy sauce.

Green Strudel

500g Spinach or more
One block Feta cheese
Garlic
Spring onions
Salt, pepper, nutmeg, etcetera

Finely chop the onions, fry them up in butter. Add the spinach, salt, pepper, nutmeg and garlic. Spread it over 2/3 to 3/4 of the strudel, paint the outside with oil. Serve with a creamy sauce made from sour cream and fresh herbs.

Interfacing realities:
On blending worlds with contemporary technologies

Maja Kuzmanovic and Nik Gaffney

Making worlds can be an exciting game for most children and many adults. You collect the raw materials, as sand and water. You design and define more or less flexible rules. You populate the world with real and fictional characters, including you, possibly your siblings and your real or imagined friends, and importantly also people and beings native to this world. The worlds unfold through their histories, myths, relationships and inventions. They expand and collapse, influenced by the weather (usually external to the world) or the changing mood of its makers. The games of making and breaking intermingle. Destroying the world when its time has come can be great fun as well.

Making, playing and breaking computational worlds requires additional skills. The raw materials have to be created before being collected. The algorithms have to follow a particular logic that your world-making machines can understand. The world is sometimes shared with remote players, and it becomes your main frame of reference, means of communication and contact. Your characters can take a life of their own, if so designed. Laws of physics, social adequacy or motor skill can be extended, defied or bent by the world's makers and inhabitants. Sometimes, the consequences of your actions can be undone, mistakes corrected and the game restarted. Destruction is rarely permanent.

The next step in world-building is to combine the two - the tactility and closeness of a physical sand-castle, with the elusiveness and magic of the digital one. Your game-world becomes a make-believe reality in which metaphors melt into tangible matter. The stories and myths penetrate the rigid walls of the sand-castle which can begin to swarm with holographic dragons. We can try grabbing their tails and letting them pull us under water, steering through the virtual world with our limbs, breath or even eye-lids. We can sprout strange universes by tapping our fingers, as if casting spells. Destruction in such mixed worlds becomes more intricate. Physical breaks are irreversible; a collapse of a physical portal forever buries the access to a part of the virtual world. A computer crash leaves the physical castle looking like an empty shell, devoid of magic. The more compelling the connections between the two parts of the world, the more dependent on each other they become. Can they continue functioning separately, or are the edges between them what makes this world so special? The making and breaking of such a mixed reality becomes a subtle balancing act.

Mix and match

The TRG project was an exercise in world-building. We constructed worlds that you could see, hear, touch and be absorbed in. Worlds aware of your caressing, stepping, talking, twisting or simply moving through. The worlds that would engage with you, as animals would - mimicking your actions, translating them into something that made sense to their internal logic. They were worlds where skin-tight clothing and voluminous architectures communicated with abstract creatures in digital landscapes, in an attempt to stretch your perception of reality. Questioning your certainty of what is commonly understood as 'real'.

For something to be considered real, a continuum of space and time is implied. When blending computational realities with the corporeal one, another continuum should be added to the equation: the continuum of transition between the physical and the digital. If such a continuum existed, we could seamlessly, gradually, pass through a diversity of technologically extended reality mixtures, deciding which ratio is comfortable or interesting for us, rather than 'switching' virtuality on or off. Although theoretically compelling, this continuum can not be easily explored using currently available technologies.

FIGURE 1:
Mixed Reality
Continuum

The contemporary technologically 'mixed reality continuum' is shaped in a less continuous fashion. There are separate fields of inquiry that distinguish themselves based on the amount of 'leakage' of the physical into the virtual and vice versa. Each field is developing particular methods and technologies to interface between the physical and the virtual and can be grouped into three main categories: Augmented Reality (AR), Hybrid Reality (HR) and Augmented Virtuality (AV). The following paragraphs are an attempt to summarise and highlight different approaches to mixing realities, with examples of works developed by our colleagues and peers working in this still fragile field.

Augmented Reality

In augmented reality (AR) situations, the world around its inhabitants is mainly physical, with some digital additions, such as context- or location specific graphical or sonic overlays (so the physical space becomes augmented with digital imagery or sound). A practical example of augmented reality is a navigation system to help you locate your position in a foreign city or guiding you towards your destination. The same technology can also be used as a storytelling device; an imaginary extension of a city could emerge in the gaps between physical buildings, overgrowing empty lots with angular computational flora, fertilised by the motion of people crossing the street. AR often uses mobile, portable or wearable devices that don't necessarily

alter physical matter, but are capable of adding new meanings to the public spaces of everyday life. Well-known artistic examples in this field include the works of Blast Theory, PLAN (Pervasive and Locative Arts Network), Katherine Moriwaki and Jonah Brucker-Cohen.

FIGURE 2:
Katherine Moriwaki and Jonah Brucker-Cohen: Umbrella.net

Augmented Virtuality

Augmented virtuality (AV) consists of digital, simulated worlds that change and adapt based on inputs from the physical world. For example, a distributed online game-world could be changing shape, (or any number of graphical and sonic properties) based on the position of the players in the physical grid of a city. The AV scene is either completely digital, or can have (real-time) video and audio signals incorporated in the virtual environment. The AV works can be screen-based, presented through websites (on desktop or mobile devices) and media performances, or can be used in augmented and virtual reality settings using more high-end interfaces and display devices such as head-mounted-displays (HMDs), collaborative-augmented-virtual-environments (CAVEs) and others. Artistic works augmenting virtuality have been developed by Project Atol, Alok Nandi, Esther Polak & Ieva Auzina (the MILK Project), Rixc, The Interactive Institute and others.

Hybrid Reality

In the centre of the mixed reality continuum is the place where physical matter becomes infused with digital media, often referred to as 'hybrid reality' (HR). In hybrid reality, scientists and artists are developing new materials, objects and spaces that are responsive to their surroundings, allowing the physical reality to appear more malleable and aware of our actions.

On the smallest scale, in the realm of atoms and molecules, active materials are being engineered to make our garments, furniture and architecture into dynamic, compliant surfaces. New electronically-, chemically- or physically-enhanced materials that change their appearance and behaviour (colour, luminescence, density, volume) in response to external stimuli. Active materials can assume a dual role: on one hand, they can sense changes in pressure, temperature, humidity and a range of other impulses; on the other hand, some of these materials can respond to the perceived changes by altering their physical or chemical properties, thereby assuming the role of an 'actuator'. Well-known artistic endeavours using active materials include, Loop.ph, Joey Berzowska's XS-Labs, Hussein Chalayan, Elise Co and others.

FIGURE 3:
Loop.ph,
reactive window-blind

A step higher in the spatial scale, hybrid reality consists of tangible or physical interfaces, where the sensing and actuating apparatus becomes embedded in common objects and structures (such as fashion accessories, furniture or buildings). These interfaces are not necessarily made from active materials, but have at least some of their parts able to function as input and/or output interfaces to a digital system. Habitual gestures (say yawning, or walking), or explicit bodily actions (touch, speech) can be used to

FIGURE 4:
Laurie Anderson and
Michel Waisvisz

influence the behaviour of the computational world. For example, tangible interfaces can function as physical manifestations of digital information, so that for example, when modelling a virtual character, instead of directing a mouse-pointer over a screen, the artist could mould a physical interface with the consistency of a lump of clay. On the other hand, tangible interfaces can function as ambient displays, diffusing digital information to make it less intrusive, but still noticeable on the periphery of our perception. For example, an ambient display can make a remote person feel present in the same room - a fan in a room in Rome can change its direction and airflow based on the movement of a person in a room in New Delhi.

Artists involved in experimental electronic music were early adopters and developers of tangible interfaces. Musical compositions are traditionally tightly coupled to the gestural virtuosity of the players, to which electronic musicians added the practice of designing and making hybrid instruments. Blends between acoustic, analogue and digital devices emerged from musicians and engineers such as like Laurie Anderson, Die Audiogruppe, Michel Waisvisz, Laetitia Sonami, The Sensorband and Atau Tanaka. In visual arts and design, there is a growing awareness of these developments, with the Tangible media group at the MIT Media Lab, HITLab, RCA, Interactive Institute, Haque design, Natalie Jeremijenko and Kristina Andersen as a few well known operators in this field.

On the scale of rooms in hybrid realities, interiors of built spaces are transformed to become networks of interfaces to media worlds. These responsive environments often incorporate both active materials and tangible interfaces within the architecture of immersive spaces (which can be site-specific or self-contained). The digital reality becomes a fully integrated element of the physical space, while the media worlds evolve, or change their form, structure and/or mood, based on the full-body and social interactions of their (temporary) inhabitants. These environments can feel as if the stable and unchangeable parts of the architecture are gradually becoming more aware of our presence and are willing to adapt their shapes and responses to a human scale. We can perceive our influence on the scale that our bodies associate with the immediate physical world around us. The media and their responses feel more 'real' and tactile, while the physical structures in which they are embedded can feel more unstable, malleable, or even elusive.

FoAM and Time's Up have been developing responsive environments for several years. TRG is one in a longer sequence of experiments, which includes the TGarden, txOom, SPIN and Sensory Circus as the most publicly exhibited examples. Other works in this genre, developed around the same period include environments such as Gravicells, Trajet and Whisper.

Then we reach the scale of cities and eco-systems. The mixes on this scale will have a large impact on our urban and biological habitats in the coming years. Origami-like foldable houses for nomadic youth. Buildings with walls acting as cellular membranes. Zoo-morphic subways to make Calabi and Yau

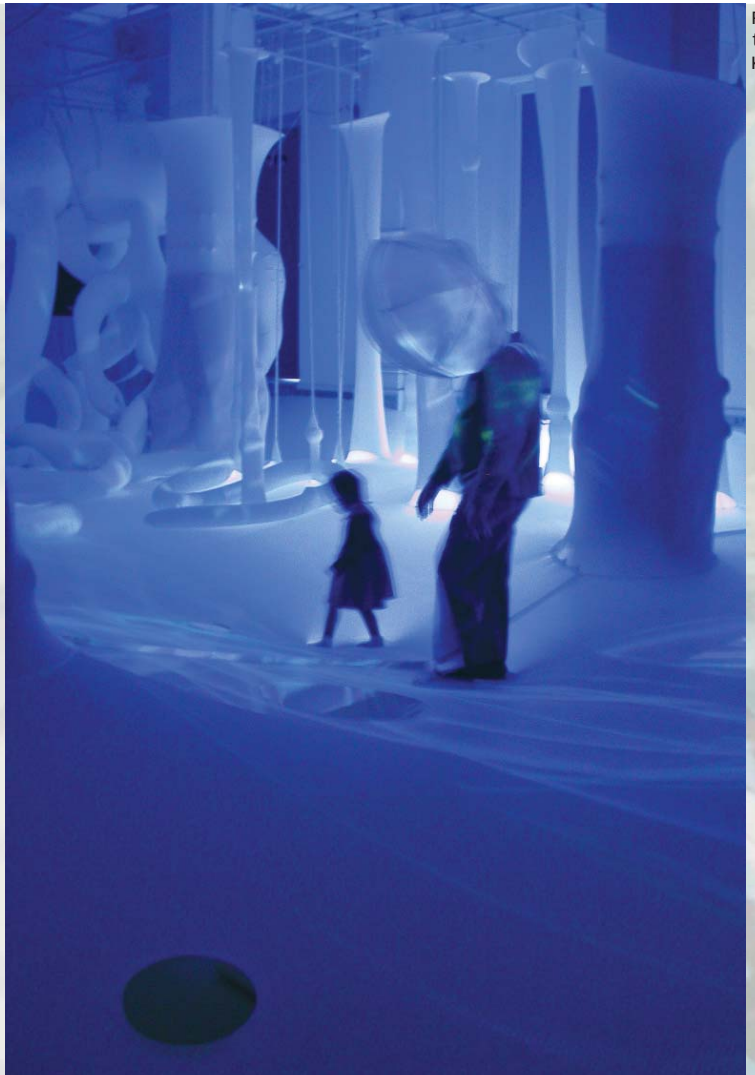

FIGURE 5:
trg environment in Kibla

smile. Such visions continue to entice us from the periphery and will certainly become a part of our future endeavours. Before these plans float much closer towards the centre of our attention, with this book we wanted to reflect on TRG as a solid foundation for a myriad of imminent world-building exercises on a range of spatial scales.

Alongside TRG several other contemporary endeavours will continue to inspire and inform our work. To end this brief summary, here is an extract from the bestiary of the great Transient Realities and their generators of our times:

Aether Architects: http://www.aether.hu/
Alok Nandi: http://www.transfiction.net/txt/
Atau Tanaka: http://www.sensorband.com/atau/
Audiogruppe: http://home.snafu.de/maubrey/
Blast Theory: http://www.blasttheory.co.uk/
BodySPIN project: http://www.timesup.org/spin/
Elise Co: http://www.mintymonkey.com/
GPSter: http://www.gpster.net/
Gravicells project: http://www.g--r.com/
Haque Design: http://www.haque.co.uk/
HITLab: http://www.hitl.washington.edu/
Interactive Institute: http://www.tii.se/
Joanna Berzowska: http://www.berzowska.com/
Jonah Brucker-Cohen: http://www.coin-operated.com/
Katherine Moriwaki: http://www.kakirine.com/
Kristina Andersen: http://www.lockergirl.com/
Laetitia Sonami: http://www.sonami.net/
Laurie Anderson: http://www.laurieanderson.com/
Loop.ph: Rachel Wingfield and Hiaz Gmachl: http://loop.ph/
Makrolab / Project Atol: http://makrolab.ljudmila.org/atol/
MR Lab Singapore: http://mixedrealitylab.org/
MR Lab Norwich: http://www.mrl.nott.ac.uk/
Michel Waisvisz: http://www.crackle.org/
Natalie Jeremijenko and xdesign: http://xdesign.ucsd.edu/
PLAN Network: http://www.open-plan.org/
Royal College of Art: http://www.rca.ac.uk/
Sensorband: http://www.sensorband.com/
Sensory Circus: http://www.timesup.org/sc/
Tangible Media Group at MIT: http://tangible.media.mit.edu/
TGarden project: http://fo.am/tgarden/
TRG project: http://fo.am/trg/
TxOom project: http://fo.am/txoom/
Viridian Design: http://www.viridiandesign.org/
Whisper project: http://whisper.surrey.sfu.ca/
XS Labs: www.xslabs.net/intro.html
Zoomorphic Architecture:
http://www.vam.ac.uk/vastatic/microsites/1269_zoomorphic/homepage.htm

ETHICO-AESTHETICS IN T* PERFORMATIVE SPACES

Sha Xin Wei

Introduction

trg is a member of a branching family of responsive playspace events and installations, with curious relatives and ancestors, such as TGarden (including tg2000 and tg2001), txOom, tgvu and tmtl.

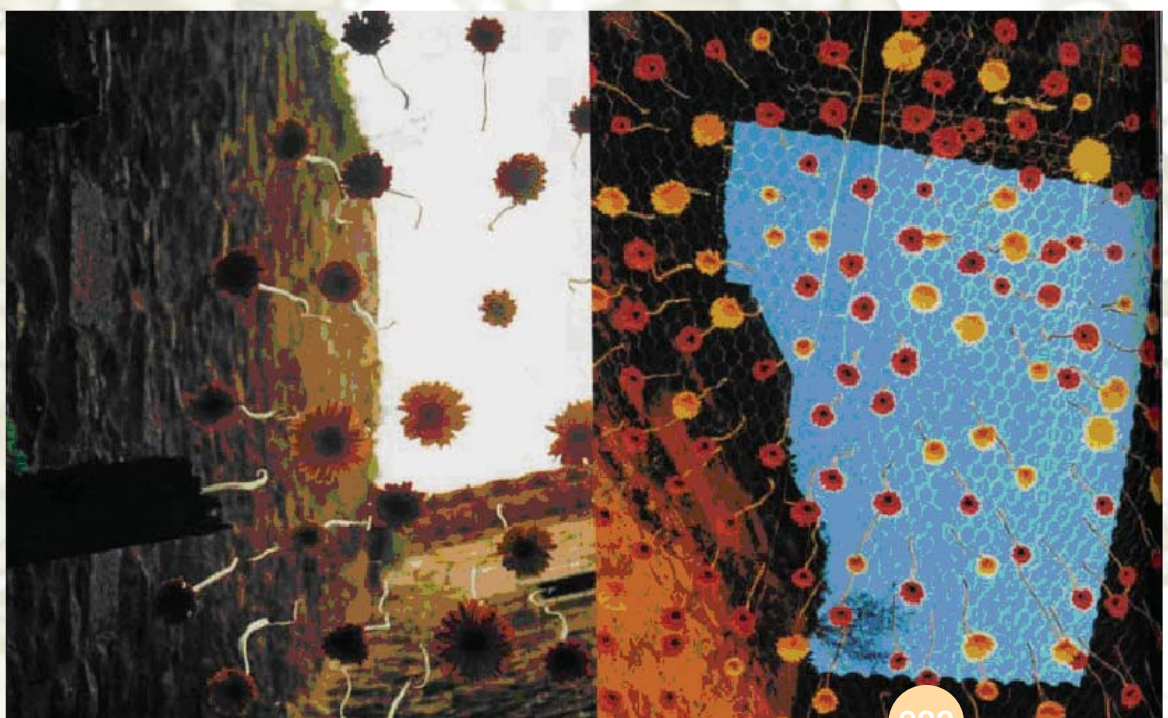

FIGURE 1:
Sostre de Flors
installation

[Peter Brook,
The Empty Space.]

What I discuss in this essay are not particular playspace installations and events like trg or tg2001, but some of the passionate critiques and questions motivating TGarden, and the desired qualities of experimental experience that make some of the background and potential for such playspaces still so compelling with respect to that pre-history. Given all the heart, craft, knowledge and energy that have been poured into making and presenting these installation-events, it's natural to ask what's at stake? Why should we creators and participant players care about making these playspaces? I hope this essay will tickle some of you into, as Maja Kuzmanovic put it, growing your own worlds, weedily and wildly.

Starting Questions

Most critically, how can we make events that are as compelling for the people who encounter them, as theater ever was in the most powerful of events by Brecht, Müller, Bausch, Sankai Juku, Dumb Type in their day and for their audiences? In a sense, this is a technical challenge, in other words it is a challenge to the practice and craft of experimental performance (to what Peter Brook called Holy Theater, as opposed to Dead Theater of typical rote and commercial performance, and different from the Rough Theater of the street and Commedia dell'arte.) One of the questions I refined from this very broad challenge was: How can we make a responsive space and event within which initially accidental, unmarked, unrehearsed, ordinary gestures can acquire great symbolic charge? These questions are practical questions of craft, and could only be answered or explored materially, bodily, in physical built spaces and peopled events. The way in which we explored them was not by making commercial shows, but by doing performance research. We made installation-events that straddled the border between closed shop studio improvisation-experiments with special audiences, and open performances with a public. As it turns out, these questions, though they were forged in a precise context of experimental performance research, resonate far outside the world of digital media art and performance. They are informed by dance, movement, textiles, fabric, musical performance, and visual art, but they also are impelled by a desire to embed such work into public space and everyday space. This is part of the ethico-aesthetic adventure of the work that appeals so much to me.

Now the same questions about the event also have a radical, micro-textural inflection. Could technologies like computational media, realtime sound and video (re-)synthesis, cheap hobbyist sensors, and the like, be added to the mise en scene of theater as Antonin Artaud dreamed to extend the theater of cruelty in a way that is relevant to us today? This theater of cruelty would create a theater that would not drop out of our consciousness as soon as we've finished consuming it but would transform those who encounter it as utterly as the plague. By cruelty, Artaud explicitly did not intend the meanness of human hurting human or animal, but the implacability and indifference of matter to our human ego. Stone resists, and a tree greens, and software breaks regardless of what we say.

If we desire matter to perform differently, we cannot simply legislate or script it by brandishing a pen alone, we must also manufacture a symbolic material substrate that behaves differently from ordinary matter.

Spiraling Concepts

The rest of this essay will spiral up through a set of concepts: the basic kind of events that I'm considering, a discussion about "representation", a question of performance, then the technologies of performance, then concepts embedded in those technologies, and finally a return of sorts to a transformed notion of event and representation (language).

Some people say that ideas are cheap, that making is hard. But we know very well that humans create and rework concepts with just as much effort and rigor and material discipline as the making of a physical installation. It's just that the young domain of media arts and sciences has not enjoyed the luxury of alloying and hammering out concepts as thoroughly as say biotechnology or history of Renaissance Italian literature. Domains of practice that benefit from billions of dollars or centuries of investment can elaborate practices that exploit the making and composition of concepts based on antecedent literatures, intricate dependencies and interrelationships of publication and citation, the social networks that give meaning to concepts, and procedures of evidence and argument and generative logics indigenous to the epistemic culture.

Events

The kind of events I'm talking about, the kind I'm interested in making are collective, co-present, embodied, and a-linguistic. These are situations to which people are invited to be physically together, face-to-face, in short, co-present. This is a basic condition of theater too, and distinguishes theater from for example cinema or photography, in that the performer-actor-artist is in the same physical place as the spectator-visitor, so that the spectator can get up and physically lay a hand on the actor to interfere with the action if she or he wants to. This potential for physical contact is a condition for the collective embodied experiences needed to conduct experimental phenomenology. These situations are collective, with three or more participants, three to destabilize dyadic pairing, with an eye to lower the threshold to improvisation of being in that space. I say embodied to mark that the fleshy bodies of the participants essentially move and act together in the co-construction of the event. The line between actor and spectator is dissolved, so any body may adopt the disposition of an actor as an agent of change in the event, or equally a spectator as a witness of the event.

The ambient environment will be thick with media, filled with thick sound, thick video, dense physical materials, so that people will live in a dense matter that responds and evolves in the course of their activity. All of this activity can be conducted a-linguistically without necessity for spoken language. On the other hand, speech is not prohibited; it's just dethroned with respect to the other modalities of coordination among the bodies and media in the space, again as way to estrange the speaking subject, and render more prominent the material dynamics of the lifeworld on the other side of the veil of the technologies of language.

[I find it helpful to think in terms of inequality rather than equality or definition: concept ≠ representation ≠ abstraction ≠ concept. Also, theory ≠ philosophy ≠ model ≠ procedure (problem solving) ≠ poetry ≠ rhetoric ≠ theory. I would shy away from abstraction, model, sophist rhetoric, and art "theory"'s word salad, but affirm that we need philosophy, poetry, and concepts if we want a life worth living. See Gilles Deleuze and Felix Guattari, What Is Philosophy?]

[Saussure, Course In General Linguistics.]

By thickness, I refer not only to perceptual thickness -- density of video and sound textures, but also to the rich magma of social, imaginative, erotic fields within which people play even in ordinary situations, situations in which we perform without first analyzing, and cutting up our experiences in to analytic layers: how did I smile? How did I rest my feet on the floor? Did my voice carry or resonate well? Did I stand too close or too far to other people? Did I interrupt or listen or talk over or under other speakers? Is the light too bright? I borrow the term from Clifford Geertz's notion of a sociologist/anthropological responsibility to study culture in all of its rich social patterns and dynamics without orthogonalizing it a priori into categories that we would bring to bear on that culture. So this experience should be designed in a pre-orthogonalized way by the designers, and enjoyed by the participants without requiring that they make any cognitive model of their world in order to perform in it. Why? Engineering's power derives from the portability and extensibility of standardized schemas and methods that apply globally over phenomena and life. Our engineered systems are already built on taxonomies that must be navigated by grammars and operated according to rules that discipline our thought and action -- the action of power to discipline humans into docile bodies has radically evolved under the impact not only of the informatic technology but the epistemic matrix that encases our imaginary. These taxonomies rest on fundamentalist distinctions such as signal vs. noise, functional versus aesthetic, and syntactical vs. non-syntactical (relative to a grammar). It's not enough to side with noise as the opposite of signal, or idleness (the vacation) as the opposite of wage-slavery because that still leaves in force the distinction made by the relevant schema in power.

[Representations of] lifeworld

Perhaps the principal (and only?) loci at which power grips us and with which we grip the world are the patterns and forms of the world. These regularized and normalized systematized patterns are what we call representations. And our most highly developed form of representation is language, which since Ferdinand de Saussure's semiotics has been axiomatically susceptible to regularization (and subsequent normalization) by linguistics. It is language to which most of us have been disciplined since childhood, thanks to the modern democratic impulse. That this generative power can use turn to the benefit of non-elite agents is recognized as a threat by the counter-democratic forces that are trying to dismantle the systems of public and higher education in the western nations.

It's for this reason that so much critical energy (Plato, Kant, Foucault, Deleuze, Derrida, Haraway, and so many others) has concentrated on the power of representation to constrain us to think and act in the world in certain ways but not others. I use "power" mindful of Foucault's studies of the genealogy of "madness," the "prisoner," and "sexuality" that put those categories back into play in the contingent currents of history. What's at stake is whether we can create conditions for events in which power is put in play, and its categorical fingers can be unclamped, if only provisionally from their grip upon our bodies. Power, as Foucault reminds us, is not always signed with the mark of evil (or good for that matter), it's the generative force, "the force that through the green fuse drives the flower" (to borrow from Dylan Thomas) as well as the blasting cap. To put power in play also means to unclamp the hands and collectivities that wield it against life. And if representation is the grit and grip of power, then one core way to put power in play would be to test the limits of language.

Now, mistrusting, examining, and interrogating the limits of language in fact has been one of Modernism's central concerns, so we are walking a path well trodden by many, which should assure us that this concern is not peripheral or hermetic, but vital to people whenever they wonder how life is worth living.

When Ludwig Wittgenstein wrote at the end of the Tractatus Logico Philosophicus, "Wovon man nicht sprechen kann, darüber muß man schweigen," (Whereof one cannot speak, thereof one must be silent), he was acknowledging the limits of what could be expressed by propositional language, of the machinery of statements with truth value that could be built with logic into the vast edifice of knowledge that could be articulated in statements like: "Creon, ruler of Thebes, forbids on pain of death anyone to bury Polyneices, who was a traitor to Thebes. Antigone has covered her brother Polyneices' corpse. Therefore Antigone's life is forfeit." or "When the appropriate conditions are satisfied, power must be exercised. Iraq has been tyrannized by a dictator. My nation is founded on principles of self-determination and autonomy. Given the preeminent power of my nation, it follows that, in the name of freedom, it is imperative that my nation liberate Iraq from its dictatorship." -- complexes of statements that are supposed to have the same epistemic weight as: "Suppose there are only a finite number of prime integers, p1 < p2 < ... < pn, where pn is the largest prime. Then consider the integer Z = 1 + p1 * p2 * ... * pn, 1 added to the presumably enormous but finite product of all the prime integers. Z is not divisible by any of the primes, p1, ..., pn, yet Z is bigger than pn. But it is a prime bigger than pn, which contradicts the assumption that pn was the largest prime integer. Therefore there cannot be a largest prime integer, i.e. therefore, there are an infinite number of prime integers."

It would be disingenuous of me to dismiss the tremendous constructive power of propositional knowledge. Propositional knowledge is in fact part of the social/legal/economic infrastructure that makes it possible for me to walk out of this door and down the street to buy a copy of the Economist or Libération. It is part of the technoscientific apparatus that allows me to type this essay without thinking about the galaxy of electronic and logical procedures that are being performed to stabilize and transmit my words to you. My purpose is not to diminish the scope and depth of propositional knowledge, which in effect is all we can state about ourselves and our experience, but to play at the limits of propositional language, of language, of sign in general, in fact at the meeting place of sign and matter, which is the symbolic. That is what led me to consider creating playspaces of responsive media saturated with symbolic potential in distributions of desiring matter. That is why I thought of the TGarden and its precursor installation-events as phenomenological experiments.

[One modern root would be Saussure's canonical Course in General Linguistics, but of course we find antecedents in Leibniz's search for a language of mathesis universalis, and Athanasius Kircher's cabalistic formal languages.]

[I thank Patrice Maniglier for teaching me this concept of the symbol.]

Wittgenstein, who like A.N. Whitehead cut his teeth on logic and the foundations of mathematics, so he knew profoundly what he was talking about, also wrote in the Tractatus: "Die Ethik nicht aussprechen lasst. (Die Ethik und Ästhetik sind Eins.)" (Ethics cannot be expressed. (Ethics and aesthetics are one.)). With this, Wittgenstein expressed several deep insights with characteristic compactness. Even given the rich and ever more complex web of knowledge that can be expressed in propositional language, such as law and morality -- social norms -- and computer science, matters of ethics and aesthetics cannot be expressed in propositional language because such language cannot express value. Recognizing this, Wittgenstein closed his project on the logical foundation of knowledge, and wrote the Philosophical Investigations, surgically deflating the illusions of the conventional theories of meaning one by one until we are left standing at the door to the only source of meaning, which is life, practice, the lifeworld. Meaning, Wittgenstein observed, cannot come from any set of rules, from correspondence to the world, or from appeal to transcendental objects (that last observation is pretty obvious after Descartes and Kant). Meaning comes from contingent use, meaning comes from practice in life. But the lifeworld is external to the span of what language can contain in itself.

Jacques Derrida wrote, in Of Grammatology: "Il n'y a pas de hors-texte" (There is no outside-text), meaning not that the world is entirely contained inside the semiotic, but that we cannot ground language's meaning by having it represent faithfully something in a transcendental or exterior world. Context determining the meaning of a text can only be expressed in language itself, so it would be delusional to attempt to ground meaning by believing language homologously represents or faithfully points to some ultimate reality, whether that be the Bible, genes, memes, or bits.
So, after Wittgenstein and Derrida, it would be quixotic to try to simplify our lifeworld by reducing how we make meaning and symbolic charge to one thin layer of the world or another, so let's skip by the monuments of cognitivism, and move into the lifeworld, the other to language.

Reality and the Imaginary

What can we do in the lifeworld, then? And what would it take to unmoor power-that-controls and put it in ethico-aesthetic play?

One of the basic distinctions we have to address here is the issue of Reality. There's much talk about reality as if it were something pure that we could contaminate, and therefore save. But even if corporate and state power require the conceit that reality is pure and must be protected by opposing it to the virtual, we do not. As Jean Baudrillard observed in Simulation and Simulacra, it is exactly at the moment that our symbolic machines have become so powerful as to threaten to destabilize capitalistic power, that power tries to distinguish reality from virtuality, and re-inscribe reality so ferociously. Why? The virtual is that which is not actual, but could be, and understood this way is identical to the potential, a mortal threat to the power that would control. In fact, reality, as Bruno Latour so thoroughly and persuasively argued in We Have Never Been Modern, is always and everywhere radically, inextricably mixed between society and nature, word and thing, symbol and substance. In fact, it's useful to think of reality as everything that is not logically self-contradictory, like a 4-sided triangle, and include the virtual as part of this reality.

So, Reality = Potential + Actual. The actual is what is in the here and now, what is the case, whether as configurations of physical matter, or as symbolic patterns like law, business, or systems of value like emotional relations, fashion and aesthetic tastes. The potential is what is not the case, but could be, and the imaginary is the collective or individual envisioning of that which is not the case, and of transforming the potential into the actual. So, reality is always already mixed. The challenge is not to define, brand, or package mixed reality, but to mix reality, just as the deepest challenge is not to define the human, or the citizen or the psychological or cognitive subject (as AI aspires to do), but to human (adapting from Ann Weinstone).

Therefore, what I'll do is not just putter around synchronic representations of mixed reality which can be much more than written language, of course, including any map, diagram, schema or any sign system whatsoever, but bracket the operation of [Representation of], and move to the arena of improvising, performing, practicing in symbolic, desiring, embodying matter. What in the world could that possibly be like? How can we work not instrumentally but poetically with such material magmas and stay clear of formalizing, disembodying, and dessicating reductions to the informatic or cognitivist abstractions of the lifeworld?

Felix Guattari's decades of work with schizophrenics in his clinic La Borde, while deeply informed by the tradition of psychoanalysis of Freud and Lacan, parted from psychoanalysis in a most radical way. Guattari left behind psychoanalysis' aspiration to scientificity, to discovering the truth about the

[The standard reference of psychiatric disorders.]

[http://topologicalmedia.concordia.ca]

[http://sponge.org]

subject's world, and recognized instead that all forms of expression are actually also simultaneously forms of content, that every one of us co-creates the world and co-adapts to the world. Guattari recognized that the schizophrenic is as much a co-structuring agent as the doctors and nurses who ostensibly run the clinic. One of most illuminating examples in Chaosmosis tells about families who come as a group to sessions in which actors introduce extra characters in filmed events. The participants must revise, improvise, enact and re-enact their relations for each other and for later viewers. There are vocal and manual gestures or movements whose meanings are not pre-defined or evident but arise organically from being exfoliating in the world in a signifying process that Guattari (and Deleuze) called pathic subjectivation. The subjects later reviewed these events, and narrated for themselves what they saw themselves doing. This is radically different from the subjectivation imposed according to schema by an analyst who announces to his patient: "By the power invested in me from my training as an analyzed Analyst and interpreter of the DSM, I declare, 'You are schizophrenic.'" It's one of Guattari's clearest examples of ethico-aesthetic play in the magma of a-signifying semiologies, and of improvisation over rehearsal and experience sedimented over the lifetime and (acknowledging Lacan) beyond the lifetime of the ego. This is not theatrical role-playing, nor everyday activity observed in the wild behind a screen, nor purified laboratory interrogation. There are no blueprints or recipes for any of this kind of playful, rigorous work, and in fact it would be a terrible betrayal to make a method out of this.

Much of this articulation has come to me only after many years of working dumbly, so to speak, so I've enjoyed the pleasure of traces of recognition in these writers who wrote incandescently out of the crucible of their own experiences. Guattari and Artaud resonate well with how I've tried, in very preliminary and partial ways, working with autonomous people and the means at hand, to nurse art research in a studio-lab I established, called the Topological Media Lab (TML).

Responsive Media Research at the TML

Given these concerns, as I've described them, what's interesting is not so much a matter of taxonomy, and schemas and classifications or standards and protocols, although those are necessarily part of the robust construction and operation of our playspaces, but the dynamics of processes that stir, up, shape and unshape the material patterns that constitute the lifeworld. The early exercises, studies, and installation-events by Sponge dealt with particular questions in performance research: How to make events that were experientially as powerful as works of avant-garde theater but without resorting to verbal/written language, erasing the distinction between actor and spectator, and relying on thick, physical/computational ambient media. TGarden: tg2000 and tg2001 as built by FoAM and Sponge was an installation-event that marked a transition and a bifurcation from performance research into a strand

of public installation-events and a strand of studio-laboratory research in the Topological Media Lab. I started the TML after leaving Stanford for Georgia Tech in 2001 to take stock of, and strategically extend some of the technologies of performance according to a particular set of ethical-aesthetic heuristics inspired by continuity, human performance (e.g. the violin), human play (e.g. in water and sand), and non-electronic matter like clay, smoke, or rain. I wanted to make responsive media synthesis engines, gestural instruments, and choreography systems that would allow participants to experimentally co-structure, not interact (!), with co-evolving ambient life in the "real-time" of perceptually concurrent action and the specious present. The media engines and instruments that we've developed fall naturally into the areas of calligraphic video, gestural sound, softwear or active materials, and audio-visual (DMX) instruments.

[Regarding the specious present, see William James, Principles of Psychology, p.573 in the Harvard edition; see discussion in Steven J. Meyer, Irresistible Dictation,]

FIGURE 2
Softwear: sensate, luminous, body-based soft materials, TML 2003-2004

Media Choreography

Media Choreography names how, in the approach taken by the Topological Media Lab, the creators of a playspace put all the media together using continuous dynamics and quasi-physics, rather than rules, databases and procedural logic. This is both an aesthetic and an operational heuristic. Media choreography is a way to relate the synthesis of all the different streams of media in concert with the activities of the people in the common playspace, such that the behaviors (to use an overly anthropocentric term) of the media and the people co-structure one another, and evolve over time according to pre-arranged strategies and latent predilections, contingent activity, and memory of past activity. I appealed to continuous dynamical systems on several grounds:

<1> People's experience of the world is continuous.
<2> People have sedimented huge amount of experience with the physical world, so we should leverage it by using quasi-physics models.
<3> I wished to see how we could move away from the Judeo-Christian technology of ego-centrism and anthropocentrism.

The most important common feature of the media choreography of playspaces, such as tg2001 (TGarden), trg, or Time's Up's A Balanced Act, is that the creators specified not a fixed, discrete set or sequence of media triggered

by discrete visitor/player actions, but rather a potential range -- a field -- of possible responses to continuous ranges of player actions. Behavioral tempers, or to use less animistic terms, climates of response evolve over macroscopic periods of time (minutes), according to the history of continuous player activity.

A subtle difference between an information theoretic approach to scripting the behavior of a system and the quasi-physical approach is that the latter bets on a radically modest approach to computational media as dumb matter. By dumb I mean (1) free of language, even the formal procedural programming languages that are operationalizations of the logic that I relinquished early in this essay; (2) free of intelligence, the cognitivist approaches of symbolic artificial intelligence; and also (3) free of representations of abstract structures like hidden Markov statistical models or 3D polyhedral geometry.

One particular research strategy I'm exploring in the TML is to use continuous dynamics to sustain superposition of contingent and composed potential behavior, and expose these intertwined dynamic processes to the players not through words or discrete tokens, props, or characters, but via the richest possible temporal textures of sound and visual imagery. The research heuristic is that this way we can leverage people's bodily intuition by having them play in the media, rather than look at representations of some squiggly shapes projected at some remove from their own flesh.

(Representation would rear its head.) To let people play immersed in media, we could have them step into a warm pool of water laced with honey, so why use computational media? Computing the quasi-physics allows the creators to inject a physics that changes according to activity and local history, and respond in ways that resemble but are eerily unlike any ordinary matter. This is analogous to the alienation effect of theater but not at the level of whole bodies: characters, actors, spectators, plot. Instead, what continuous, dense, topological dynamical systems afford is a micro-fine alienation effect at the level of substrate media such as calligraphic video, gestural sound, and kinetic fabrics imbued with uncanny physics.

A word on method, design heuristic

Indeed it would take a lot of work to build up to macroscopic objects and actions from relatively homogeneous textures and simple dynamics. But I would say that it is not "hard" (the adjective used by Tim Boykett in Riga), but strange and un-idiomatic for all of us who have been trained to the aesthetics and logic of whole bodies and macroscopic human-scale objects like words, props, characters and conventional game action. After all, to render a character in a novel or play from the raw material of alphabetic text and grammar, takes an enormous amount of hard-earned psycho-social knowledge, literary apparatus and wordcraft.

In TGarden and tgvu, the metaphorical behavioral state topology is independent of media state topology. TGarden's state engine evolves through a rather sparse topological landscape with few valleys and peaks, whereas the visual and sound fields are synthesized as densely and temporally finely as possible and as necessary to sustain a rich experience, with micro-dynamics of response that we do not attempt to trace using the state engine.

The reason for decoupling the dynamical metaphorical state engine from the media engines was in fact to decouple the evolution of the behavioral response "climate" from the dynamics of the visual and sonic textures, which has to be as rich and tangibly responsive to the players' actions as possible. It seems artistically and compositionally useful to keep these dynamics decoupled from one another.

My concern at least in the context of this essay is precisely with what possibilities a micro-phenomenology, free of ego and anthropocentrism and indeed of any fixed, a priori objects, can offer toward fresh and refreshing improvised play. Aesthetically, at least for TGarden, this play should take place immanently in as dense an ambient medium as that of ordinary life. So the best approach would be to start with ordinary matter and real fleshy people in common space, and judiciously augment the everyday matter with just enough computational matter to give the event a strange and marvelous cast. This approach, which I nickname "minimax" design: maximum experiential impact for minimum computational technology, resonates with the poor theater's choice of a minimalist technology of mise en scene relative to cinema, a minimalism which in fact is constitutive of its magic.

However, this apparent inefficiency is in fact endemic not only to "bottom-up" simulations but to all simulations and simulacra. As Humberto Maturana and Francisco Varela pointed out, to be as dense as life, a simulation of an autopoietic system can never operate any faster than that autopoietic system, and can at best run at the speed of life -- so much for the cybernetic fantasy of mastering and replacing the lifeworld by a transcendental, superior simulation of life.

As for theoretical approach, my long term interest in the TGarden and its sibling responsive playspaces extends beyond the actual events themselves to the mixing of ideas and conflicting ideological commitments from different epistemic cultures. I won't take the space here to pursue this sociologically or anthropologically, but it would be liberating to practice our arts and sciences in a more reflexive way.

The week after the 'Space and Perception' conference at RIXC in Riga, I participated in a symposium focused on Deleuze, Whitehead and the Transformations of Metaphysics. There I realized how to articulate that one could use mathematics as poetry rather than as instrument or measure, or a replacement for God, or an intellectual battering ram. (I must confess, however, to deriving some pleasure from reading Alain Badiou's fearless and fierce polemic about

[For more on this, see Jerzy Grotowski's Towards a Poor Theater.]

[Isabelle Stengers has retold the stories of seven scientific disciplines in a way that presents the partial and provisional messiness of science as it is actually practiced. Telling science in this way has both cosmological and political implications, hence the title of her books: Cosmopolitiques.]

[With Isabelle Stengers, James Williams, Mick Halewood, Steven Meyer and about 20 other philosophers, Proceedings of the Royal Flemish Academy.]

mathematics = ontology.) I agree with Badiou that mathematics is substance, and not merely a description of substance. Shaping mathematics as poietic material in fact differs in kind from using mathematics to describe the universe as physicists see it. Part of trg's charm is its attempt to make palpable a concept of the world (recent quantum field theoretic cosmology) by forcibly identifying it with the perceptual field -- a cosmic ambition. The artists could only begin to approximate this by restricting trg to a very compact physical duration and place in Kibla, and by making allegorical simulations in software. Allegory makes the world of difference between depiction and enaction, perception and phenomenology.

As for experimental phenomenology, I'm trying to discover and mix together mathematics as materials that are adequate to life. It could be sharply different sorts of poetic matter: continuous topological dynamics, geometric measure theory, or even fancier stuff like non-commutative algebra and etale cohomology. But I choose to start with the simplest symbolic substances that respect the lifeworld's continuous dynamism, change, temporality, infinite transformation, morphogenesis, superposability, continuity, density, and value, and is free of or at least agnostic with respect to measure, metric, counting, finitude, formal logic, linguistics, (syntax, grammar), digitality, and computability, in short of all formal structures that would put a cage over all of the lifeworld. I call these substances topological media. Simplicity here is not a requirement of the theory (no Occam's razor here) but merely an acknowledgement that I do not understand enough about the lifeworld to bring out fancier stuff yet, of which there is so much more up the wizard sleeves.

The fundamental difference in this approach is to use mathematics as substance in a workmanlike way, patching here and there to see what values ensue, as a trellis for play, rather than a carapace, but always sensitive to whether the poetic material accommodates transfinite, incommensurable, immanent passion. Totalizing carapaces like Wolfram's computational equivalence principle, which at bottom is a transcendental atomic metaphysics founded on making counting sacred, would hammer us into a very sparse ontology. And to a hammer everything is a nail.

What's at stake?

I approached the branching family of playspaces represented by tgarden, txoom, tgvu, and trg as phenomenological experiments of a certain kind, as events based on gesture and movement, rather than language, for people face-to-face in a common place, playing and improvising meaningful micro-relations without language, in thick responsive media. I see these as opportunities for ethico-aesthetic play, to borrow and adapt Guattari's concept of the coming into formation of subjectivity, to engage in biopolitics, radically dispersed into tissue and molecular strata, and reaching far beyond the computational media arts, meeting with experimental impulses in dance,

movement, textiles, musical performance, experimental theater, but also the most speculative initiatives in urban design, science studies, and philosophy. But the ambition here is to conduct even the most philosophical speculation by articulating matter in poetic motion, whose aesthetic meaning and symbolic power are felt as much as perceived. I shift the emphasis from spaces of representation to spaces of experience, hence the Topological Media Lab's emphasis on technologies of performance, and on live event.

If we grant ourselves the power and opportunity to experiment with the world at all scales, in all strata, and relinquishing all schemas for an object-oriented ontology, to what extent can the blackboxed modes of work, operation, representation themselves be continuous and transformable sans metric, i.e. topological?

Art all the way down?

If art puts the world in play, puts questions in motion via human and material experience, then art practice could be a mode of material and speculative philosophy. But working in a plenist, unbifurcated world (working with Whitehead's concept of nature recovered whole from the many dualist knives of modernism and postmodernism), I wonder to what extent we can truly suspend, float, and dissolve all distinctions that fracture our being in the world, including the distinction between art and craft. Under capitalism, modern art practice is well served by a distinction between the artist and the executant, the director and the designer, art and craft, theory and practice, and in exchange much commodity art pretends to nothing more than a clever permutation or anamorphic mirror of the actual. But art all the way down could put all relations in play, which implies that how it is produced is as important as what is produced. Therefore it must risk dissolving those distinctions of modern art. FoAM is a good example of an a-modern art organization that tries to work this way with limited access to financial capital. However, with the rising star of engineering buoyed by a particularly crude version of pragmatism, there's been of course the counter-cultural revolution aimed to turn the tables on high art, but very often this threatens to merely flip the duality upside down, and manacle art to the categories and norms of engineering and design. Given that one of engineering's norms is modularity, I ask, can we alchemically open and critically transform all theses blackboxes: "interaction," "program," "information," "bit," "sensor," "cpu," "linguistics," "market," "design," "industry," "body," "ego," "citizen," "machine," "human." …? Art all the way down means there is no layer below which the socio-technical magma becomes mere machine and craft, the level of the technician who executes the artist's desire. But on the other hand, this means also that we do not reduce conceptual rigor and passionate dreams to a willfully dematerialized, a-historical, anti-intellectual naiveté. It means, for example, to explore the erotics of the formation and dissolution of object from field, has consequences not only at the level of co-present bodies but also at the level of programming language, drawing model, and graphics and dynamics engines.

[See Eugene Gendlin on felt meaning.]

[There's a profound difference between discrete approximations to continuous things and things that are discrete from the get go. One example is the definition of flow by mean curvature, a project that Ken Brakke tried to carry out but could not complete due to deep technical lacunae that could not be patched until Tom Ilmanen's work 20 years later. Elevating the discrete and the computable to universality, via for example Wolfram's principle of computational equivalence or Newell and Simon's symbol processing hypothesis excludes more life than it includes.]

[Tom Standage, The Mechanical Turk]

Can the material process of making things collectively be radically non-denumerable, countless, non-computable, non-dimensional, infinite, and yet remain also immanent, embodied and continuous? Can we make playspaces that evoke not puzzle-solving behavior, but ethico-aesthetic-erotic play, and marvel, or vertigo, or elation? To respect the open, unbounded lifeworld, such a space should not be useful or therapeutic. In fact, that was Guattari's point about psychoanalysis, too. The point would not be to help the participant construct a narrative analogous to the hermeneutic objective of classical psychoanalysis -- "This is what the patient's phobias / psychoses / dreams mean," nor to effect a cure -- therapy's arrogant stance with respect to its patient: "You are sick. We will fix you." In a playspace, a participant would not read, interpret or recount a dream -- a participant would be a dream.

Why not just enclose a volume of ordinary space and repeat some experiments like the action art of 40 years ago? With our techniques, a playspace could be charged with latent magic, a heightened potential for charging gestures with symbolic power. A playspace could become a theater for the alchemical transformation of hybrid matter, but not a space for cognitive games, inducing puzzle-solving behavior, nor a bath of raw qualia. An alchemical theater would avoid having "users" and "system" building models of each other. (In the human, such models would be cognitive models.)

Our typical model of interaction has been of humans and their proxies engaging in an action-reaction ping-pong. And interaction design, even in its most enlightened mood has been centered on the human (viz. human-centered design), as if we knew what a human was, and where a human being ends and the rest of the world begins.

Since the beginning of the Enlightenment, the automaton has fascinated those members of our species who cannot themselves bear children. One of the most celebrated such automata was the Turk, a chess playing machine unveiled by Wolfgang von Kempelen in 1770, and toured through the courts of Europe. In fact, this chess playing automaton turned out to be powered by a human dwarf hidden inside the box. This piece of automata history is in fact emblematic of the genealogy of the concept of the software agent as a homunculus, from the ENIAC to the fictive Hal 9000 in "2001," to the agents of Sim City and the customer call center program that can interpret telephoned speech as well as John Searle's Chinese Box.

But this anthropocentrism is not confined to engineering, of course. Look at Bill Viola's beautiful series of video works, The Passions. If we really take seriously the challenge to pursue art all the way down, and if we are willing to put in play, in suspension, all the putative atoms, objects, and subjects of the world, then I ask you this question: to whom do you owe allegiance: Homo Sapiens Rex, or the world?

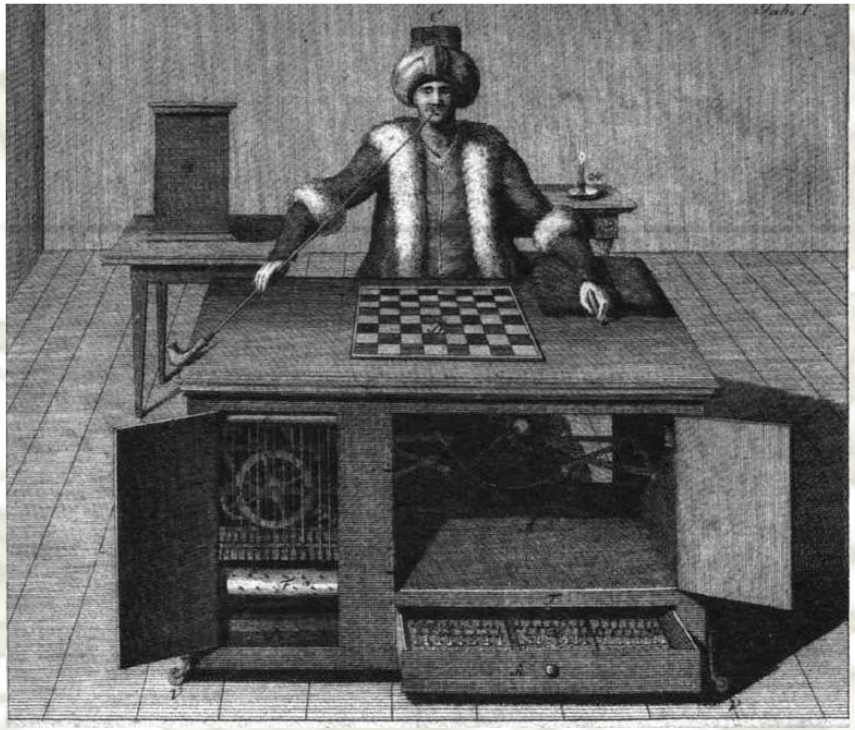

FIGURE 3
The Mechanical Turk,
1770

Apart from the the totalizing and dematerializing power of the Judeo-Christian God, and of informatic and logico-linguistic schemas, essentially the only ethico-aesthetic choice in the West is to start with the self, with Homo Sapiens. We witness the disastrous global ecological and economic consequences of this choice. However, given topology as a way, even a rigorous and precise way, to articulate living, non-denumerable, dense, non-dimensional, open, infinite, and continuous matter, one has the option of choosing the world instead. I use these adjectives precisely for their interwined technical and poetic values. But this is not going to be a cure-all, a recipe for success. It's an approach to design, a way to think about living in the world, how to shape experience, a disposition with respect to the world, rather than a methodology or a technology.

[This will be the subject of a book on the genealogy of topological media. For a spirited and beautifully motivated introduction to the mathematical study of proto-metric substance, see Klaus Jänich's Topology.]

[Hardt and Negri, Empire, and Multitude]

Enactment and Enchantment in Living Matter

Dylan Thomas wrote (in 1938):

> The force that through the green fuse drives the flower
> Drives my green age; that blasts the roots of trees
> Is my destroyer.
> And I am dumb to tell the crooked rose
> My youth is bent by the same wintry fever.
>
> The force that drives the water through the rocks
> Drives my red blood; that dries the mouthing streams
> Turns mine to wax.
> And I am dumb to mouth unto my veins
> How at the mountain spring the same mouth sucks.
>
> The hand that whirls the water in the pool
> Stirs the quicksand; that ropes the blowing wind
> Hauls my shroud sail.
> And I am dumb to tell the hanging man
> How of my clay is made the hangman's lime....

Allow me to suggest a reverse-allegory and use a piece of the world to stand in for some concepts. This is a patch of sod that I cut out of the earth under a tree outside the RIXC building. Representations, words, are like the blades of grass, individually well formed, discrete. I can pull up this piece of sod and turn it over to reveal the root structure underneath. Yes, there is a network of roots as we can plainly feel running our fingers through the dirt. However, I draw attention past the blades of grass and their contingently formed roots to the dirt and the moisture in between the roots. It's the continuous, nourishing, dark, loamy stuff in between the discrete structures that materially constitutes the Earth. This moist earth is always and everywhere in continuous transformation. Our discrete structures, our words, syntax, grammars and schemas and methodologies are the blades and at best the roots. And yes, they are our best ways to grip the earth. But though they are a common supra-individual resource, they are not transcendental. They can only take form in and draw meaning from the earth, and become earth when their life cycle is finished.

Archimedes said, "Give me a place to stand, and I shall move the World." But what if there is no place to stand inside a bubbling chaosmotic soup of infinite inflation? To what extent can we alchemically open and critically transform all of modernity's blackboxes such as market, machine, or human if we do not have a place to stand in this age of globalized empire and permanent war? Is there any possibility for an immanent resistance for us not as non-docile bodies, but as resistive and desiring flesh? Yes, I believe, yes, if we take reality already as an amalgam of the potential and the actual, dematerializing, for example by becoming fictive, and rematerializing

under the incessant quickening action of our imagination. This affords openings for life in the mud-filled interstices of our technology.

A most immanent mode of resistance and weedy generation in those muddy interstices of our technologies of representation is play. Play could be the make-belief, the as if, making fictive, becoming other than what is the case, the art that drives the green fuse all the way down and up again. But in recent years, play has been harried by many who would classify it, barely escaping the nets of those taxidermists who would like to stuff play into the carcass of game. What our playspaces could offer us are not allegories of other worlds, whether cosmological, or political, or religious, or psycho-fictive, but events affording playful processes that open life up to more life. Let me close by suggesting a few senses of play that may merit more careful consideration. There's the play of water lapping against the side of the boat, making the lazy slapping sound that evokes sunlight and fish in the clear water just beyond the reach of your fingers. There's the play, the empty space, between the teeth of interlocking gearwheels, without which the entire assembly of gears would lock up; the teeth guarantee discrete synchrony, but it's the gap that allows movement to be born. And yet, that gap is never a vacuum because the world's structures are always and everywhere part of the substrate magma of the world. There's play in the sense of continuous, infinite dimensional variation from any given trajectory, that invites arbitrary degrees of novelty. And there's play as the infinite deferral of definition, a passionate sense-making that develops ever more virtuosity re-enchanting the world.

FIGURE 4
soft-wear
2003-2004 GVU

Figure 1, 2 and 4
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Figure 3 from Wolfgang von Kempelen - The Turkish Chess Player. Copper engraving from the book: Karl Gottlieb von Windisch, Briefe über den Schachspieler des Hrn. von Kempelen, nebst drei Kupferstichen die diese berühmte Maschine vorstellen. 1783. Public Domain.

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Mushroom Zapekanka

MUSHROOM ZAPEKANKA

Ingredients

dough
2 cups of baking flour
100g margarine
170ml sour cream

filling
200g grated gouda (or similar yellow cheese)
500g mixed mushrooms
170ml sour cream
3 eggs
1/4 teaspoon of grated nutmeg
salt and black pepper to taste

Preparation

Mix the flour, margarine and sour cream to a smooth dough. Leave in the fridge for 30 minutes. Preheat the oven to 250°C. Mix the cheese, sliced mushrooms, sour cream, eggs and nutmeg for the filling. Take the dough out of the fridge and transfer it to an deep oven dish that you have previously covered with baking paper. Pour in the filling and bake it for 45 - 50 min. Serve hot.

Mushroom Patties

ČUFTE OF GLJIVA

Ingredients

1/2 litre of olive oil
1 onion
3-4 cloves of garlic
500 grams of assorted mushrooms (depending on season and availability)
1 egg
3 handfulls of breadcrumbs
1 handfull of wild thyme
1 handfull of parsley
1 splash of red wine
Pinch of salt and pepper

Preparation

Finely chop the onion, garlic and mushrooms. Heat 2-3 tablespoons of olive oil in a deep frying pan and add the chopped ingredients when the oil is hot. Stir fry the mixture for a few minutes. Chop the parsley and transfer to the frying pan. Add a splash of wine, lower the fire and sautè the mixture until the mushrooms are soft. Take the pan off the heat and leave it to cool down for about 15 minutes. Add the egg, 1 handfull of breadcrumbs, thyme, salt and pepper and mix thoroughly until the mixture becomes a sticky paste. Form the paste into balls or flat disks (čufte) then roll the 'čufte' in the remaining breadcrumbs. Heat the remaining olive oil in the frying pan until sizzling hot and fry the čufte until golden brown on all sides. Serve with a fresh green salad and/or oven baked potatoes.

REMOTED THROUGH AUDIO

Andreas Mayrhofer

Abstract

The ears are a fundamental perceptual organ. That much is clear. However, it is not the case that we can always control what we are forced to tolerate. Environments create and define their own acoustic situation; many environments are in fact defined by their acoustic properties. We venture into these spaces as some kind of experimental subjects, unaware of the effects that are being tested upon us - no constructed space is truly silent. One might refer to this as a musical effusion, the "pouring on" of acoustics in the same way that a baptism takes place. This process of acoustic sprinkling - for the acoustic sources are often low level - is vitally important for the feeling of a given space. This article investigates various aspects of these themes, from shopping center harmonies through acoustic weapon systems, before coming around to briefly outline some small experiments undertaken as a part of the TRG series of environments and elsewhere.

Introduction

A permanent but subconscious shaping of the senses goes on continuously. You prick up your ears intuitively when you enter a new zone, it's just what you do. The power of habit is ubiquitous. We can all imagine and describe the sound of an airport, a train station, or a bar, when we have had this experience. It is less so with the zeitgeist adaptations, the long-term changes such as the dynamic pitches on the radio and the fact that classical music is now played faster than years ago when originally composed, that make us sit up and take notice. An audio panorama remodeled in its integrative social structure, or whose original nature seems completely removed, is more likely to force its way to the foreground.

This development is subject to a continuous process; it can be interpreted as insidious and thereby usually escapes our perception. While traveling through new territories, we can probably defragment individually probed "real patterns" most clearly. Even a simple stroll can sometimes do the trick. Upon reintegrating back into customary everyday life, our senses differentiate more. They seem sharpened, the auto-focus switched off; we consciously question things for a while, then glide with apparent ease back into a well-balanced state of inattentiveness.

Noise, muzak, disturbances and suchlike, are subject to individual perception. Along with its scientific use (e.g., in zoology), in many places the term "noise pollution" serves to provide legal legitimacy. Here we mention as the most recent example, the discussion in the Free State of Bavaria over a legal ban on the Islamic public call to worship. Who determines what is socially intolerable and where?

The spearheads of acoustic distractions can be measured in decibels. Yet nearly everywhere, apart from this quantitative method, the steady, subliminal drone beyond public sources of noise remains largely unknown territory. The fact of private displeasure with permanent acoustic irradiation is obvious but sustains a meagre, socially marginal presence in public perception.

Various types of muzak and the permanent acoustic irradiation outdoors, shopping and waiting zones, supermarkets, workplaces, cafés, concourses and elevators, unconsciously attract attention. What lasting social effects can we detect? What counter-measures can be taken? To what extent is it possible/allowable to intervene? Is it possible to heighten individual awareness of acoustic manipulation in (public) living spaces; is it possible to take clear steps to break open the spatial structures and arrangements that have been created?

In the following text "noise pollution" is understood as a permanent acoustic irradiation - whether from muzak, radio, television or other sources. The observations are contextualized with regard to the creation of temporary spaces within the field of public and social systems. This would naturally apply to every source of sound on the part of individual persons, whereby these will not be included in the present article, as the core content of the discussion primarily maneuvers along the motivational logic of monetary growth and the capillaries of its networked mechanisms.

The following lines are not dedicated to a comprehensive explanation of the tactics of acoustic sprinkling (as there is no accepted term for continous drizzle of sound, let us use this only slightly unwieldy expression for now), but instead are conceived as a loose chain of emergent manipulative processes, which are based on the arbitrariness of unsustainable situations.

Bewilder my senses

Just follow your nose, or have a sixth sense for something - as the proverbs say. Whereas decades ago, the shabby odors wafting from a sausage stand could move slowly along the paths of the nasal septum and the information that had yet to be analyzed could be transported further, "today's" noses sometimes stick at the end of their stuffed up wisdom. Overload. Fast food odors creep gradually through the alleyways and - between cotton candy and perfume - bring the joyful message of diverse lifestyle drugs. Those places that are of no economic interest are forced to settle for the biting stink of urine. In between are perspiring persons, strolling along with their personal fumes and those caused by the traffic. To smell "the winter" or "the rain"; these are rudimentary, existing, primal instincts that can still be put to the test in some places. In principle, however, we can subsume the scenario of civilized urbanity under the term "olfactory cacophony" as a special form of "sense cacophony."

The sense of hearing, although apparently even more intensely courted than smell, experiences similar mistreatment. The most frightening thing that can occur - because it is the rarest - is silence. No sound, no nothing. Everything is calm. A person with extreme visual impairment knows the extent of the problems caused by audio-sensitive over-stimulation. Escaping acoustic harassment is impossible, except of course by cutting the connection and donning headphones or attempting to partially block off one's ears through concentrated, selective listening. There is no end to the terror; yet the actual fun has merely just begun. Situations such as those on the streets of Tokyo, like living in a pachinko machine, already offer a taste of future scenarios.

Whereas visual over-stimulation seems to be an abstract theme seething in the corner for the esoterically-oriented and media scholars, enlightenment in terms of noise pollution seems to stop at an awareness of public sources of noise from construction sites and the various means of transportation and transport, unless perhaps it becomes a legal theme in confrontations between industrial firms and private residents. Audio scenarios are being created incessantly in all of society's public spaces. The starting situation is as unfavorable as could be, although fascinating, since the legal discretionary powers emit political signals, which, if the occasion arises, must be accounted for in an argument.

Where "hot air" is afforded more added value than the craftsperson's creation, then something is wrong all over. Yet, marketing mixer sounds better than carpenter.

Where are the problems? "Money makes the world go round" and here, the plight can most certainly be attributed to the domesticated economic system and the busy little ants that execute it. Money is the motivation behind death and spoilage. But wait: the core of the problem is naturally to be found in the details. That means that when plants and animals react to an appropriate musical accompaniment with a greater output rate, then the instrument of acoustic irradiation is economically legitimate. Additionally, humans can be relieved of their greatest torment - being alone - by the constant presence of melodies and voices from the radio or the tube. It is considered better yet if the human being reacts thankfully or effusively, creating additional benefits, like the dairy cow producing more milk when stimulated.

Mechanisms to rev the economic motor are subject to the simple rule: "what does it cost and how much profit is expected?" Watching television ads with the sound switched off offers a vague idea of the extent of the suggestive power that is being staged there with great effort. Clearly, it is not due to sheer coincidence that unrestrained media consumption is caught in the crossfire of untraceable criticism. Three TVs and an equal number of radios can be found in quite a few households. What is important is to always keep at least one source of acoustic sprinkling flowing. The thesis - all of life is noise - floats about as a subsidiary, side issue of social interest in the gray era of material excess.

Various views on content-based criteria determine the character of quality. Market analysis and trend research occupy a central role with regard to social transformation. Anyway, it is hard to believe that the use of space is still able to escape monetary enforcement. "Business is busy," whereby in the best case scenario, the fate of each and every blade of grass is preprogrammed. An ecological terrorist operation of random-seeming destructive potential has become flesh and blood. Nature is hippy-like or boring, or at least it is a space that must still be conquered. Things that a few years ago didn't seem to be considered as possible are, for example, pumping a steady stream of sound onto a ski piste. Trees, heavily laden with loudspeakers vomiting ghastly music(k) replete with sexist lyrics. A jingle in the ear, a sentence on the lips; there is no end to the madness. The pictures have long become established in our minds, whereby our ears seem to be a territory that still lies fallow.

Increasingly, the wooed human falls victim to audio-branding. It is difficult to avoid the trend at work in the background; the louder, the harder and more simplistic we perceive an audio event, the greater the certainty that it will enter our receptors. The effect can therefore not be judged on the basis of whether it is a positive or negative incident for each individual person. What appears important is absolute presence in the sense of an unavoidable confrontation with the message, rather than with the mechanisms that lie behind it. This functions, on the one hand, through the conquest of the market-defined space, which according to its own symbols is the child of opportunistic and money-oriented machinations; on the other hand, the carrier of information defined as public space is also a desirable site of malleable options. At the same time the perfect control of the human senses becomes increasingly important. Although, this sweeping blow occurs under the premises of competitive ways of thinking and acting, which likewise means obeying the respective genre-specific superlatives of better, stronger and faster.

For example, when the thought of a supermarket still elicited a joyous expression, probably only very few were capable of estimating the market directives. John Lennon could not even be remotely traced as the musical accompaniment to the monotonous scenario of pulling bar-coded packages from store shelves. Communication required an interpersonal situation. In the meantime, however, human labor has become too expensive. Yet the human element, per se, must still be there in the transaction. We have to be able to pull emotions, packed up tightly, across the cash register. It's Whitney Houston's turn since the butcher's services have become too expensive.

Bonjour Tristesse

The radio, too, conquers and designs spaces, yet currently it is less of an informational instrument and instead, is, in the broadest sense, a climate control unit for human temperament. Mainstream radio, for example, as an accompaniment to breakfast, functions as a type of soundtrack or accompanying measure for the classical versions of regulated work and social scenarios. One can

imagine the acoustic resolution as something like a split screen TV, where above and below, the roll bar flickers with the "hot air stock market numbers," one sensory stimulation following the next with no perceivable pause.

The traditional content of radio can be considered as regulating or as a type of social engineering. As an instrument of collective conformity it requires a lowest common denominator. This appears each season, for example, in the summer hits of one-hit wonders whose relevant content-based criteria are oriented towards hedonistic attitudes. The principles for realization of hits are fully fitting with market interests; a stylistic catchy tune and lack of message. The best hits, contests and funny jokes create an apocalyptic mixture of permanent cheerfulness, youthful dynamics and aggressive blubbering. Is stopping the torture of the steady drone possible for those who are not in the fortunate situation of being able to design their workplace according to their own discretion, but instead are at the mercy of all the colleagues with whom they share the space in an open-plan office?

The more often the occasional idea to insert music as a positive parameter for emotions becomes flipped over into a counter-model, the more incessant appear the responses. A prime example is the catchy tune, to which a sufferer dedicates the following report:

"The competition to set the others into the most awful hip-swinging went on for months. Whether it meant the repetition of a gruesome 1980s hit or the playing of a nauseating riff from some terrible metal band, nothing was absurd enough. A mass heavy enough to cut of intensified acoustic dust hung in the air. Intros that had embedded themselves like the 'amen' in church danced around in our minds. The methods employed for this ear candy competition were also enraging. A simple, casual whistle, a lilted 'we built this city…' or the abstracted war tool, the mobile phone; all means appeared to apply here. Despite vehemently practiced abstinence from commercial radio, the rhythms and battle songs sit deeply rooted. Naturally, the drama is also found in that there is no song that can't be remixed yet again. Even without the market's hoopla, it is impossible to escape the lunacy; traces of the moans for attention are left behind everywhere. Whether muzak in the department store or Mozart in the queue, acoustic irradiation is a wooed, hegemonic realm."[1]

"Pay no attention to the man behind the curtain"

All means appear legitimate in the battle for attention. The catchy tune is the euphemistic version of gaining someone´s attention in a situation in which dissatisfaction reigns; yet it is still possible to recognize this situation and react to it in a clear and unmistakable way. Even without a full awareness of the manipulative powers of noise pollution and even with shifting them exclusively into the context of socio-political confrontations, it is still possible to locate the decisive mechanisms for the future execution of collective bondage.

[1] Description of a year-long competition / harassment project between the author and Gerd Trautner.

[2] O.Arndt, Die Korrektur - Richtschallstrahler, Elektroschocker und andere Methoden zur Begütigung unzufriedener Massen, p. 195ff in "Gendertronics: Der Körper in der elektronischen Musik" ed Club Transmediale and Meike Jansen, Suhrkamp, 2005.

[3] Ibid., p. 200.

In the meantime, the military deployment of acoustic weapons for the creation of public order has already occurred. Infrasonic devices belong to the standard repertoire of every termination of demonstrations. Remember the BATF disk jockey at Koresh´s last stand. Nowadays different types of "non-lethal weapons" are being developed and tested. These can be described as military and police weapons below the threshold of war. Psychological attack is only an indirect front runner. Currently under development, for example, is the cultivation of bacteria or fungi to affect opponents' fighting ability by destroying their equipment or infrastructure (traffic networks, air fields, public squares). Under development for direct deployment against humans are non-lethal weapons such as psychoactive substances, sterilizing flies, stink bombs, and electromagnetic irradiation fields.

Essentially, the total control of space is desired, although this is actually not the arena where the battle is being fought. Instead, it is at the level of the individual microcosm, where the aim is to remove every potentially deviant behavior. This has the advantage of silently emphasizing the desired goals and at the same time, eliminating the development of public resistance. "So-called high-technology takes care of 'mood management,' it organizes the mood of the masses."[2] Directed noise is a currently executed tactic to prepare impartial information for the test subjects. The intensified version of ultrasound emitters is a probable indicator of the way of the future. In this way, news can be addressed specifically to individual persons in the form of high frequencies. A simple way to set free paranoid dispositions, it will soon probably involve being diametrically opposed to the mainstream, without knowing that this deviant reaction has already been programmed "from above." The goal, along with the control of the scattered masses, is to ensure a "technically moderated guarantee of the market."[3]

Amazing is the accomplished technological leap, which manifests on the one hand as the huge gap in capabilities between mismatched opponents and on the other, in the lack of awareness that the motivation for the deployment of non-lethal weapons stands under the patronage of those who rule in the economic war that is currently being fought. Since that which is mentioned above clearly shows that acoustic sprinkling mechanisms, as minute and minor as they are, support the design and construction of a social layout, then it is obvious that deviant behavior, such as making a fist in front of the big shots or composing polemical treatises, must be ruled out in the future.

A generative processed audio-conglomerate as mood barometer

The attempt to define one or more spaces as audio-responsive and to start the practical field test, requires a quasi audio-semantic supra-structure. Appropriate, that is, for a semi-public site, for example, such as a bar or a club. There, it is possible to stomp on some toes if one is intent on unhinging normal arrangements, for instance playing folk music in a techno

club. This risk is taken quickly and often unawares. Not as a cry for help or a wake-up call, but rather as an incontrovertible statement. Yes, it is the point where a dethroned audio environment is perceived as a bitter loss by the "resident acoustic-architects". It leads to the moment where discussion about acoustic territory seems to be inevitable.

At first, the idea that "a responsive space" could be set up in such a way that it is capable of sorting out the existential states of individual persons and tossing these back into the space, might sound frightening. Can you just imagine… that could cause waves. Architecture has made apparent how fatal it can be if everyone is allowed to just build what they want and then present their dream plot for general viewing, especially some one-family houses are perfect examples that shed light on different types of comprehension of landscape architecture and city planning. If we could co-form the audio landscape in a bar through our state of being and our facial expressions, for example, then that would, first of all, certainly have more appeal than checking one's ears at the cloakroom and letting the rest just happen. This was the motivation for a series of experimental situations, field studies of a sort.

The first primitive attempts at small field studies have left an impression on the test subjects. Some of the people who were guinea pigs in our tests in public areas (mainly bars) offered direct reactions. Either they got excited about the loss of "their" audio-scenario and demanded back the old conditions; this happened, for instance, in constructed scenarios based on very minimal music with hardly noticeable rhythmical changes. On the other hand more difficult musical structures seemed to offer a kind of audible security and also the certainty of embedding the test person’s own acoustic output in a complex meta-audio-environment. Silence worries people if it occurs in situations where they do not expect it.

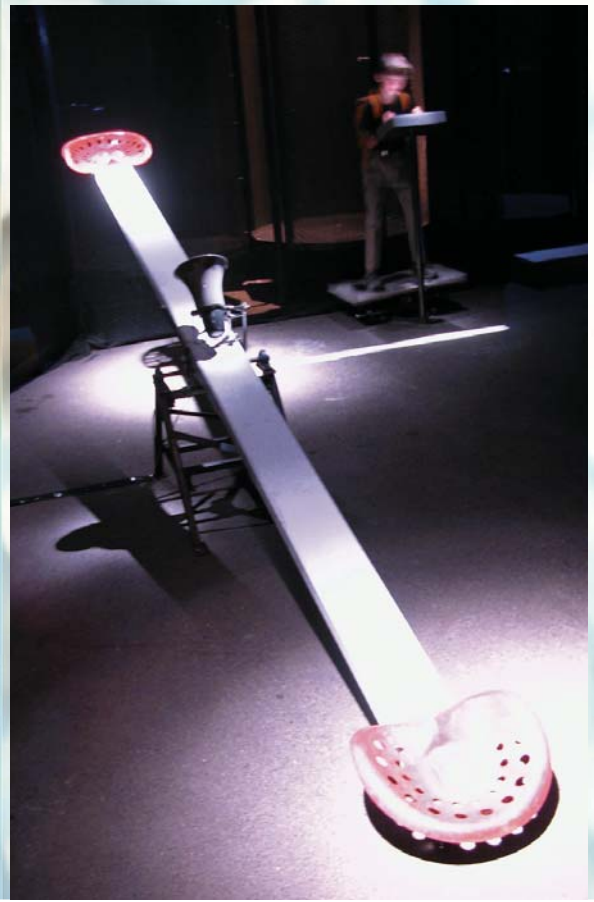
The very minimalistic style kept people’s attention busy as the line between the feeling that something was going completely wrong, boredom and anger seemed to be very thin. The whole attraction in the room was focused on acoustical peaks. This clearly disturbed some people’s privacy as a result of too much exposure. An acoustically more busy environment, on the other hand, allows place for concealment and camouflage. It was also found to be possible and interesting to introduce direct visitor actions into the acoustic environment, actions that were perceivable for the visitor acting but which were not disturbing for the other visitors.

An environment, that has its typical "audio-order" in the sense of stylistic conditioning, is hard to redefine. People expect "their environment". Therefore it seems to be more comfortable to create a whole new architectural scenario that has no specific implemented social order. A thing that defines itself within the process. There are no expectations to be usurped or contrasted with: the constructed acoustic situation is coherent and constructed ex nihilo. Conclusion: Interventions most certainly make sense and fun. We keep up the good work and come back to you as long as "they" let us.

‘Lyrics: Comic series: "Es war einmal der Mensch." Orig. Title: Il était une fois... L'homme (F/J, 1978) director/screenplay: Albert Barillé.

Summary

In a narrow sense, in terms of content, we have gone beyond the problem zones of noise pollution. The race is over anyway. On the one hand, the misery cannot be revealed as threatening (most people do not notice, or care). On the other hand, a much profounder power of imminent consumption will be established by force, if other means are not possible.



The acoustic positioning of each and every person as architectural components depends greatly on the individual relation to the respective, audible state. The noise pollution described above is a non-existent public theme, only perceived as such by a minority. It is probably necessary to preserve a passionate connection to music in order to even first notice the scenarios to which one is used to / willing to be subjected. When this is present, then experimental phases can be introduced and therefore a discussion about the redefinition of quality is inevitable. "But what is time? A moment, the stroke of the clock … a thousand years are a day."‘

MUSHROOM/ PORCINI SAUCE

Mushroom / Porcini Sauce

Original recipe yield: 4 servings.

Ingredients

1 onion
olive oil
100g dried porcini / or other mushroom (if fresh, use 500g)
400ml milk
250ml sour cream
250ml sweet cream
4 bay leaves
1 clove garlic, minced
parsley
basil
salt and pepper

Directions

Soak the dried mushrooms in milk for 30 min or until soft. Chop the onion and fry in hot oil until translucent. Pour the mushrooms and milk into the pot and bring to the boil. Pour both creams into the pot and stir until smooth. Add the bay leaves, garlic, parsley, basil and salt and pepper to taste.

Serve with gnocchi or tagliatelle and green salad with olive oil as a side dish.

Bon apetit!

6 FUNGUS CURRY

6 fungus curry

Ingredients

a handful each of dried:
> black Chinese fungus
> lotus fungus
> white fungus
> shiitake mushrooms
250g small champignons
250g oyster mushrooms
250ml coconut cream
a handful each of:
> (smoked) garlic
> spring onions
> grated ginger
> sesame seeds
> fresh coriander

spices:
handful of curry leaves
or 1 table spoon of
yellow curry powder
3-4 bay leaves (laurel)
1 teaspoon each of:
> cumin seeds
> ground cardamon seeds
> (wild) thyme
> black-bean paste
1/2 teaspoon of cinnamon

1 tablespoon of palm oil
(or other available oil)
1 teaspoon of sesame oil
dark soy sauce or salt +
fresh chillies to taste
(wild) rice or oriental
style noodles
(rice or egg)

Preparation

Soak the dried fungus in warm water for 10-20 minutes.

If you are using rice as an accompaniment, this would be a good time to wash it, leave about 2cm of water above the rice and let it boil. Once the rice is almost 'al-dente' and there is still a bit of water left in the pan, take it off the fire and keep it warm under a towel or a blanket until the rest of the meal is ready. The water will evaporate and leave the rice dry and ready to serve, without burning or being too soggy.

In the mean time, chop the oyster mushrooms, champignons, garlic, spring onion, coriander and grate the ginger.

Roast the cumin, cardamon, cinnamon and curry in a dry pan, to allow the aromas to be released.

In a wok (or deep frying pan) heat up the oils and quickly stir-fry the oyster mushrooms and champignons with garlic, ginger, sesame-seeds and spring onions. Add all the spices and coconut cream. Lower the flame and tend to the fungus by squeezing out the water and chopping into bite size chunks. Carefully fold the fungi into the mixture of mushrooms and spices. Leave to stew for about 10 minutes, while occasionally stirring. If the mixture is too thick, add a bit of water. Add fresh coriander just before serving.

If you use noodles as accompaniment, boil them while the curry is stewing.

If the sauce is served with rice, garnish with coriander stalks, curry and thyme leaves and/or black sesame seeds. If served with noodles, mix them with the sauce in a large pot before garnishing.

If you happen to have leftovers, this curry can be kept refrigerated for several days, and becomes tastier (and spicier) each day.

ON FEASTS AND FESTIVALS:
WHY THE FESTIVAL IS A TRANSIENT REALITY

Tim Boykett

The Transmediale Festival 2004, "Fly Utopia," was a feast for the senses; from Heidi Mortenson and Kevin Blechdom through Ghassan Hage and Geert Lovink, it was wonderful. "Bandbreite", which wasn't a book for the festival, but somehow was the book of the festival, is a collection of articles and interviews about where new media festivals are now, and why, and from where, and what they might be, or should be, or could be. Reading Andreas Broeckmann's text "Über das Festival" I was captured by the following passage about the festival as a "Hybrid aus elektronisch erzeugten Bildern, Klängen, Maschinenprozessen und Interaktionsmöglichkeiten...zeitlich begrenzt...räumlichen und zeitlichen Konzentration...über Erlebtes, Gesehenes sprechen...es konstruiert sich - öffentlichkeit. Vielfalt und Fülle...zwingen den Besucher zu einer Mischung aus eigenständigem Auswählen und Sich-treiben-lassen." [Hybrid of electronically produced images, tones, machine processes and interaction possibilities...limited in duration...concentrated in time and space...to speak about the seen and experienced...public space (is) constructed. Multiplicity and fullness...lead the visitor to a mixture of independent selection and simply following the flow].

I am sure it is not normal for festival organisers to explicitly state their requirements, expectations, hopes and ambitions so explicitly and publicly. Nevertheless, the fact that such a statement was made and that the expectations were achieved, speaks volumes of such an open approach. Open Source festival directorship, anyone?

The text resonated well with the talks of Lovink and Hage, where the festival becomes a temporary zone of action, where certain standards of behaviour and action become suspended, where a visitor becomes a participant in the spaces that extend the visitor's actuality, where potentials become possible. The restriction in space and time - these few days, in these few places - allows for a heightened sense of attention, where the concentration upon "the passage of a few persons through a rather brief period of time" is normal and even natural.

Thus we see that this text is not just about festivals. It is about the construction and composition of public spaces and the initiation of possibilities within them. It is about the construction of (experimental) situations, enhanced environments, and properly augmented realities. Such spaces need not be media related, but let's remain focussed on such environments. The enhancement of possibilities of "speak[ing] about the seen and the heard," to bring the public individuals into an environment that departs from their known actual, where the standard rules of action and reaction become flexible, is fundamental in public spaces. The space needs to be full and the experiences need to be multiple and coherent. The space needs to be unifying without becoming one-dimensional, the entirety of the system in which the public individuals find themselves must be apparent. It must allow and encourage, even demand, exploration, whether active or passive, whether directed towards certain goals or simply the exploration of wandering, of following a flow, combined with the temptations and nigh upon demands to actually use and interact with the space and its objects. That such a text grabbed my eyes, with its strong correlation to the methods and goals of our developments at Time's Up, should come as no surprise. These requirements and the formulation of them in such a coherent fashion leads to a fear that what we aim at is somehow not much less than a complete media art festival, yet not much more than a good dinner party (in the sense of S. Pearl Andrews). And these two things are perhaps not that far apart, yet there is a world between them. A very interesting world.

It is a pleasure to be able to present an English translation of this text, as I feel that the ideas involved show that The Festival is one of many forms of Transient Reality.

THE FESTIVAL

Andreas Broeckmann

(originally appeared in German as "Über das Festival" in "Bandbreite - Medien zwischen Kunst und Politik", edited by A. Broeckmann and R. Frieling. Kulturverlag Kadmos, Berlin 2004)

1. For media art it seems that the festival is indisputably the most prominent event form. Visual art presents itself to the public primarily in the form of exhibitions, theory in texts and lectures, music in concerts. Yet when disciplinary boundaries are crossed and the work characteristic of art is superceded, as in media art, then an open, hybrid form like the festival is needed. The festival not only tolerates diversity, inconsistency and excess, but actually raises them to a principle. With an exhibition of interactive installations and video projections, a conference, an international competition, a public media lounge for comfortably viewing Internet, software and CD-Rom projects, artist workshops and club events with electronic music and live video performances taking place alongside and sometimes parallel to one another, the festival not only offers a wealth of possibilities for finding things that are unexpected and raw, but also opportunities for making surprising connections. What is already familiar is a necessary redundancy, the noise that makes the signal transfer possible.
It is one of the characteristics of the festival that it supplies an overabundance of possibilities and opportunities. It is intended to be a low-threshold presentation platform and specialized media workshop, seeking simply to show art and to convey it theoretically in context as well as to have fun, to arouse curiosity, to make young artists famous and the audience hungry and sated at the same time. It draws from a huge reservoir of artistic productions of very different quality, which must be selected in such a way that a whole range of artistic practices is visible. Concentration upon this hybrid and not on a few undisputed positions, this is the programmatic. Inherent to this openness is the necessary risk of giving the audience something to see and to hear, where perhaps the quality may be questionable, but which also might simply not be understood yet.
The diversity and abundance of the program compel the visitor to oscillate between making independent selections, and just letting go and drifting. Program elements interfere with one another, intersect, block, distract from and reinforce one another. Offers have to be made available that allow the less daring to find a point of access, experience something new and perhaps become immersed. This requires attractively arranged and clearly identified channels, through which the visitor can be steered into the manifold alternatives. Not everyone will accept, but everyone should be invited.
The festival is not an exclusive alternative to other cultural institutions. The unnecessary concentration of numerous cultural events into an overflowing festival framework is, in many cases, not an enhancement of art or the enjoyment of it. Where festivals tend to weaken rather than strengthen sustainable artistic work, and where they only offer a homogeneous distillation of the conventional cloaked as concentration, they are certainly to be questioned. However, the festival offers an opportunity to excessively experience culture in a concentrated and pleasurable manner. This is not to be missed in the same way that a banquet with good food and drink in congenial company is not to be missed.

2. In its entire scope, media art, in other words art through and with electronic and digital media, is a hybrid of electronically generated images, sounds, machine processes and possibilities for interaction. For a long time the "art of new media" had and cultivated a pariah status with respect to contemporary fine art. The value of the latter is often determined by the usability of its products in the art market, which media art just as frequently deliberately eludes. To the same extent, however, that electronic and digital media are no longer solely the domain of obsessive tinkerers, but are instead becoming generally available as a possibility for creative expression just like other materials and methods that can be used for art, the distinguishability of media art as a separate genre will disappear. Of course a vital artistic practice will remain, which not only makes use of digital media, but also seeks to understand and reflect on them and their cultural significance, whether as interactive art, net art or software art. It is to be expected that this avant-gardist work, which specifically seeks to appropriate new technologies (and old technologies in a new way), will operate pragmatically and heuristically under the name media art for some time.
A media art festival can bask in the diversity of this field. It can follow the hybrid and mixed forms, occasionally allowing itself to be seduced by the sirens of new technological developments. In its early days video technology offered a range of instruments for image creation that still continues to fascinate artists trained in more traditional image media again and again - just think of the never-ending series of experiments with feedback effects with a video camera focused on the monitor. Sometimes elaborate arrangements or series of works are developed from these kinds of obvious experiments, which investigate the features of the technical medium and the perceptional effects that it triggers, which trace an aesthetic impact inherent to the machines, which urgently seek to tell necessary stories in new ways, which attempt to expand the scope of action for interactions between humans and machines. All of this needs to be shown, played with and discussed, whether it is finished or in progress.
The festival is thus, in the best case, a banquet buffet dinner where a well-balanced prepared combination of food and drink is served. Those who have had enough for the moment can withdraw with old or new friends, with the cooks and gourmets to the smokers' corner, or they can return to the buffet to select the portions they desire according to their own taste. In the exhibition, visitors are left in peace to discover and view the works at their own pace, but in the media workshop they may well be entreated to join in. The cinema remains the cave of dreams where video artists can present and comment on their works, and artists, theorists and curators introduce their latest work on the open stage, partly to promote it, partly to find sharp critics or future collaborators. And at night in the club the

mixture of music, images, voices, movement and conversations is intended to blur boundaries but not traces. A certain degree of recklessness is part of the job of the curators in making the selections for this program. Themes and theses have to be taken to a climax in individual, radical artistic positions. That requires courage - and an audience ready to take the leap.

3. The festival lives from the fact that it lasts only for a limited period of time and that it brings its visitors together in a space and time that are as concentrated as possible. Its success largely depends on the presence of participants and visitors, who sit together during the breaks in the cafe, in hallways and in the lounge, talking about old and new plans, what they have seen and experienced, friends in common and popular enemies, thinking up new projects and making use of the concentration of interesting people. Art and social function are in a symbiosis here - a public sphere is constituted. If the festival succeeds in carrying itself and its themes over into the local surroundings, mass media and the global networks in actions and partner events, then we experience media culture in its native context, namely fragmented, translocal urban space ranging beyond the boundaries of the respective individual city.
The festival offers program formats that make it possible for the general public to see and experience artistic works. Exhibition, video presentation, performance evening and conference follow more or less familiar patterns, which are intended to make it easier for those interested to take the step into the festival. With some luck these visitors may find their way into the media lounge, the salon or the open workshop to come in contact with those for whom dealing with digital media and its creative means have become everyday culture. The media art festival is thus a meeting point that becomes a stage for an intensive engagement with current developments in digital culture, not only for the producers, but also for a curious public. One of the curatorial challenges is to arrange flexible intersections in the program and in the arrangement of the space, so that they are open in all directions for these unpredictable encounters.
For the "digital generation" of youngsters who have grown up with computer games, mobile telephones and the Internet, the festival offers a copious everyday environment, more diverse and varied than a LAN party and so well equipped with artistic content and questions that what has long been familiar is no longer taken for granted. Those who know that a computer is more than just a console for playing predetermined games can delve into the appropriation and reworking of the media apparatuses and their applications together with others. For this generation, at least in the places in the world where computers are readily available, media competency is less of a problem than an awareness of the individual and collective scopes of action that these apparatuses offer. And this scope can best be represented with practical examples of the work of invited guests on site. Here the smooth transitions between play, art, programming, consumption and critical reflection also become clearly evident.
Digital image media, electronic music and mobile communication devices are increasingly at the disposal of a broad international artist scene newly negotiating the significance of art in the age of digital media. New forms

of cooperation and globally networked resistance against the consequences of globalization, the perceptibility of ecological disasters, the emergence of new styles and identities under the influence of migration and a cultural industry that operates worldwide - all of this marks a society that creates forums in its cultural events, where these changes can be expressed and subjected to a critical evaluation. Although the optimistic and also cynical promises of technology developers occasionally take center stage in media art, they are certainly no longer considered in isolation, but rather embedded in an understanding of social processes that artistic action seeks to influence or undermine.
Yet the focus always remains on the artistic discussion of digital media and the aesthetic and thus also ethical formulations of a digital culture. To this end, a scene of artists, curators and cultural producers can meet at the media art festival and investigate the status quo locally, nationally and internationally, depending on the size and range of the festival, over the course of several days on the basis of the presented program and the ideas and experiences they bring with them. This lives on in journalists' descriptions, sound and image documentation and retrospective publications, but also in subsequent and competing events, which pick up the same threads and continue or unravel them, and in individual, curatorial and culture-political projects resulting from the events of the festival. And when the requisite, open discursive platforms are available in and beyond the actual program, these more professional debates can intermingle with the valid questions of non-professionals into a real symposium on media art.

4. The culinary metaphors of the banquet and its program, the tastes and preparations, the seasoning and combining, simmering and frying, what is sweet, tangy and spicy, the conviviality and shared enjoyment - these are not to be taken only metaphorically. The festival should be a feast - for the palate and the eyes, for the ears and the hands to the same extent. Long evenings with friends in the bar, interrupted by a concert or a film screening supplying new food for thought and discussion, meeting new acquaintances, discovering the unknown and daring to try something entirely different: the festival is capable of making all of this possible, if it is successful. A festival is a place, a moment, an occasion of hopes and projections, an in-between space in which something can arise that cannot arise in everyday life. It is a secret, a surprise, a carnival - when it goes well.

Mushy Herring

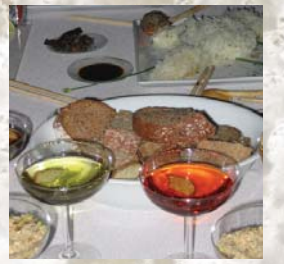
MUSHY HERRING

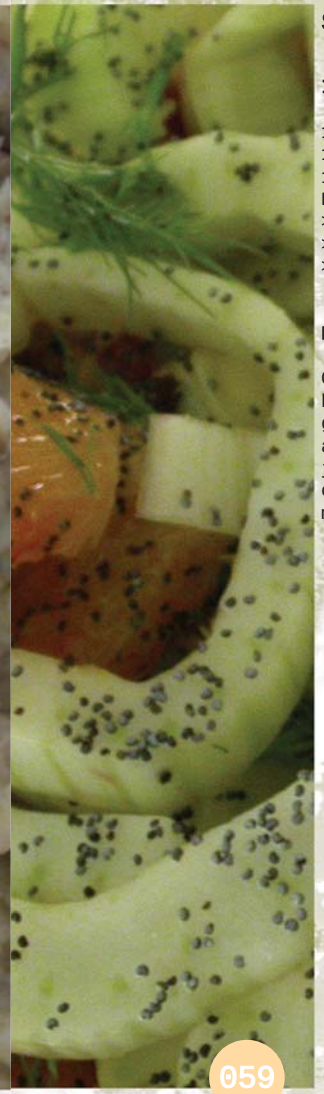
Ingredients

1 herring
1 boiled egg
1 sour apple
1 small onion
1 pinch of sugar
1 pinch of cinnamon
bit of lemon juice

Preparation

Place the herring into a bowl filled with water and soak it until it becomes less salty. Chop the herring into very small pieces. Grate the boiled egg, apple and onion (grate as finely as possible). Add sugar, cinnamon and lemon juice, mix the paste and mash thoroughly. Enjoy either by itself or on thin slices of toast.





Sweet radish salad

SWEET RADISH SALAD

Ingredients

1 white or black radish
125g grated dark chocolate
1-2 stalks of fresh mint
Dressing:
> 1 lemon (or lemon juice)
> 1 teaspoon of sugar
> 1-2 teaspoons of black pepper

Preparation

Grate the radish and chocolate (the radish should be in larger pieces, with the chocolate being grated into fine powder). Make the dressing by adding sugar and pepper to the squeezed lemon juice. Pour the dressing over the radish and chocolate and mix thoroughly. Garnish with fresh mint leaves.

TRANSIENT REALITIES OR VERGES OF CON-FUSION

By Maja Kuzmanovic and Nik Gaffney

Abstract
Development of responsive environments is often described in terms of how they are made, which technologies they use and what the experience should be. With this text, we wanted to look back at the ideas behind the 'how', looking at the theories, inspirations and thoughts, as well as their process of becoming embodied as the design for the trg environment. This text draws on the many discussions (on-line and on-site) between the people involved in developing and experiencing trg, from June 2004 until June 2005. It is a small window into the heads of the people involved in this small-scale, short-term Transient Reality Generation. We touch upon ideas of multiple realities, multiple universes and multiplicities of forms, incorporating theories from Calvino, Wilson, Bey, Merleau-Ponty, Witten, Sterling and others. We talk about sensual and synaesthetic perception through which such intricate ideas can be grasped intuitively. We briefly look at play as a way to release these intuitions from fixed perceptual pathways and to open up new experiences. We briefly describe our process of moving from concept to the design for the trg environment (from Slovenian 'trg', public plaza, square). To conclude, we describe various experiences during FoAM's public experiment presented in Kibla.

FIGURE 1
trg environment: detail

Entangled Tunnels

Could it be that each of us lives in our own reality, one which never completely coincides with anyone else's? That we do not share a single universe? Our experience of the world is mediated by a tangle of senses; dominated by sight and skin, tuned by sound and enhanced by taste and smell. Skin stretches over the thin extremities of the nervous system, forming a localised interface to the environment. Our sight articulates distinct shapes from a continuous field of reality. The hearing ranges from the low and tactile vibrations to squealing pulses at higher frequencies. We can smell and taste the world in illusive nuances. The synaesthetic manifold that we learned to call 'world' seeps into our bodies through an intricate sensual network. Once internalised, the world is analysed, modulated and adjusted continuously so we perceive ourselves immersed in it. We have learned to live and act in this world since our childhood. We are able to intuitively grasp the mutual impact between the world and our existence in it. However, considering the amount of processing done by our sensory organs and nervous system, it is unlikely that any of us perceive the world in the same way. Hence, our realities can never fully coincide. Robert Anton Wilson described this situation using the metaphor of a 'reality tunnel' in which each of us live. A tunnel that is shaped through our experiences of the world, our memories and our expectations. As moles digging through the stuff of the world, we make space for ourselves, while simultaneously shaping the world as we go along.

From our early years of consciousness, we begin to learn how to influence these reality tunnels. We can act to change them, bend them into shapes which we imagine would be most suitable for us to inhabit. In doing so, we inevitably intersect other realities. Sometimes our interference is welcome, often it is seen as disruptive. Occasionally two or more realities may seem to merge. While actions might have particular effects in one tunnel, they may be perceived differently from various others.

It is possible to imagine that not only living things exist in their own 'reality tunnels'. Geological or climatologic tunnels perhaps. Natural, constructed or maybe even supernatural realities. Worlds woven through the intersections of an infinite number of such realities, on a range of spatial, temporal and perceptual scales. Realities that die off, becoming sediment for those newly born..

What happens when our 'reality tunnel' intersects another? Temporary intrusions, blends and mutations of different realities occur quite commonly in everyday life. How frequently do unconscious worlds bubble to the surface of conscious situations, in each daydream, speculation or "what if.."? How often do we experience phase changes of physical matter, moving from solid to liquid to gaseous? How many of us have discovered microscopic and macroscopic universes, being able to scratch the surface of a molecule, or feel the simulated heat of a remote star? Have our nervous systems ever tricked us into temporarily experiencing events and spaces that people assure us don't exist? The more dissimilar the intersecting tunnel is, the more likely it is for us to notice our passage through it. The more familiar the intersection, the more real it will seem to us. Interfering with other realities and leaving our traces in them is unavoidable, sometimes involuntary and often unnoticed. Instantaneous or timeless, the intersections are never permanent.

There are times in our lives when we deliberately want to intersect or even generate a different reality tunnel. Moments when we want to share particular experiences with other people, moments in which we want to be elevated from our daily routine, or when we are in need of another perspective. In such moments there are different techniques we can use to alter perception of reality.

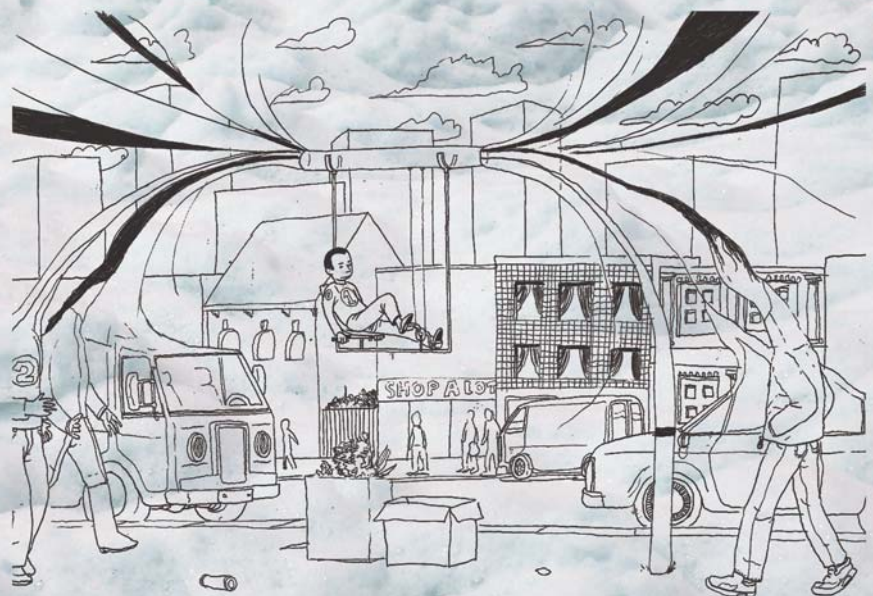
We can instantiate physiological changes within our bodies; through a range of means, including extreme bodily endurance, such as sleep deprivation; by prolonged, intense physical or mental activity; or simply by consuming various foods, drugs or medicines. Alternatively, we can make changes in the environment. We can modify sensory input and alter what we see/hear/touch. We can destabilise the sense of balance, by removing the frame of reference - such as the horizon. We can restrict or alter motor functions, by wearing specific clothing or building architecture in which gravity becomes unpredictable. We can play with different scales of permanence and impermanence, where something that usually appears permanent and static, such as a building for example, can become mobile and pliant.

Exploring which reality tunnels to intersect and which techniques to apply are the first steps in most reality generating exercises. Determining what happens on the intersections and how much of the world should be modified gives context and shape to the new reality. At this stage some aspects may appear as an indeterminate, amorphous sludge, until people passing through begin paying attention and their senses begin differentiating shapes, structures and relationships between them. Once this happens, this reality can become incorporated into pre-existing reality tunnels, with inhabitants learning how to influence and shape it. Temporarily, a new hybrid reality flourishes at the edges. Once the reality tunnels peel off each other (as these intersections are rarely permanent), their traces may exist in both. These traces may have either long or short term effects on perception. Knowing how significant or irreversible the effects of experiencing a transient reality can be, the process of generating them becomes a creative act in which ethics and aesthetics continuously intermingle.

"Think what it would be to have a work conceived from outside the self. A work that would let us escape the limited perspective of the individual ego, not only to enter into selves like our own, but to give speech to that which has no language, to the bird perching on the edge of the gutter, to the tree in spring and the tree in fall, to stone, to cement, to plastic. Was this not perhaps what Ovid was aiming at when he wrote about the continuity of forms? And what Lucretius was aiming at when he identified himself with that nature common to each and every thing?" Italo Calvino

If we can consider generating realities as a creative process, transient realities are art-works that tend to be conceived from outside the self. They are shaped through constant balancing between artistic intention of the makers and the expectation of the temporary inhabitants, both of whom tangle their individual reality tunnels through them. Transient realities present significant expressive potential, where the line between 'those who make' and 'those who experience' warps and sometimes even disappears. No one can pass through a transient reality without influencing it. The strength of the impact depends on the level of attention and effort the passers-by contribute to the reality. However slight, the impact will remain inscribed in the reality's evolving dynamics.

FIGURE 2
A transient reality generator



As if following the Irrealist Manifesto, transient realities feed on the tension between the dynamics of the physical world and that of simulated, fictional ones. They are familiar, but strangely alien. They allow an easy entrance, encouraging us to shape them, but are dissimilar enough for us to notice and remember that we have mated our reality tunnel with them. They question our ideas of what is considered real. They can give voice to gestures, colour to motion, rhythm to vibration. They can make our daily reality more explicitly responsive. Or they can simply be silly and make us laugh.

How does one design such realities? What concepts, shapes and motions can bring forth these 'universes of the irreal', in which reality and fiction become con-fused and actuated?

Multiplicity, lightness, visibility, exactitude, quickness and consistency

Calvino presents these six characteristics as imperatives for the evolution of literature in his essay "Six memos for the next millennium". We found these characteristics to resonate strongly with qualities we wanted to encourage in TRG. A multiplicity of forms, media and materials is needed to construct a rich reality. Playful behaviour emerges from a lightness and simplicity in the designs. The visibility, or clarity of signals dispersed through different media allows reality to appear coherent and synaesthetic. Negotiable exactitute and vagueness of forms can become a part of a game where people unveil the intricate nature of the world. The quickness and consistency of sonic and visual phrases enable realities to unfold through different timescales, both discrete and continuous.

When the transient reality generators involved in trg first sat down to think about the 'what', 'why' and 'how' of the project, we began to collectively dream up transient realities that we would like to dwell in. After several weeks of squiggling drawings and words, a transient reality, or TAZ (temporary autonomous zone, to borrow the term from Hakim Bey) began to take shape. We approached the task of reality generation with the intention of illustrating that all things are inevitably entangled with each other, and that every action influences not just our individual reality tunnel, but others as well - although perhaps not on a human scale.

Following the environmentalist slogan "think globally, act locally" we wanted to design a world able to encourage the participants to engage with it on both micro and macro levels. On a micro level, immediate effects would become understandable. The players engage in discrete, local interactions with different elements of the world, which provide direct responses. The macro level of engagement would involve grasping the collective influence the players have on the slower, more continuous transformations of the environment. Through both levels of engagement, the dynamics of the reality would evolve. However, the transient reality would not exist exclusively for the human participants. These environments should be aware of themselves, and aware of the presence of others within them. While each individual or collective always has an effect, there is never a centralisation of control.

As with the "Six memos..." (a work that was never completed) we expected the realities of trg to remain ineffable and incomplete, leaving a broad terrain for interpretation and speculation for everyone involved. As such, a transient reality becomes the result of many acts of co-creation. Through a dialogue (polylogue) with each of the players (human and non-human), a transient reality comes into existence, being continually shaped and transformed. The creative and expressive power of a transient reality exists in the 'conversation' between the players and the environment. In order for this conversation to happen, players should be attentive to the intricacies of their sensory (and sensual) experiences. Co-creation in the trg environment could occur through movement, gesturing and social play on the part of the

FIGURE 3
Conceptual diagrams
for trg

human participants, while the environment would respond through atmospheric changes in sound, graphics and softness of its architecture. The reality generators had to be careful not to burden this activity with explicitly symbolic or figurative content. We aimed to inspire interesting gestures and playful interaction, with the ability to turn the rigid boundaries between people, spaces and imaginations into impermanent, semi-permeable membranes.

We wanted the experience of our transient reality to feel both strange and comforting at the same time. Situations in which the participants could get

lost if they wanted to. If they preferred, they could investigate specific regions and responses of the world with determination and purpose (such as finding repeatable responses). They could choose to be alone or explore with others. It would be designed as a place for the making of meaning through improvised play. A place where the players' attention and motion would entice the environment to cringe or unfold. Rather than having a specific aim (for example a puzzle that once solved it would reward the players), all actions would be rewarding in various ways, with the experience always being different. The trg environments, we decided, should accommodate a variety of behaviours and should always be able to respond in rich and compelling ways. We were interested in designing an environment which could sense (rather than detect) not just presence or absence, but the wide range and subtlety of human gestures and interactions.

Generating a reality able to be experienced as a shared, social space gave rise to an interesting question - how can a continuum of events in a given space be perceived as an immersive, rich reality? Our hypothesis used synaesthetic and sensual experiences as a starting point. Simultaneous stimulation of all senses, while keeping the connections between the sensations consistent, would at least hint that the discrete signals combine to form an articulate reality. Following Merleau-Ponty's writings about perception being a physical, bodily contact with the world, we decided to rely on people's perceptual abilities to experience different sensory stimuli as a coherent whole. We were particularly interested in attempting to disrupt visual perception, which tends to create distance between the observer and the object of observation. To achieve this disruption, we decided to obscure or disorient the visual field, and amplify the importance of the players' sense of touch, sensory experience which is inherently responsive. When we touch something, it necessarily, simultaneously touches us back.

This lead to the question - what would the players be touching and be touched by? We examined situations occurring on the periphery of perception, in which our normalised behaviour becomes unbalanced and our sense of reality tricked by mixtures of tangible and intangible phenomena. We visualised continuous passages through layers, or membranes between spaces of varying density (gaseous/liquid, solid/malleable etc.). Membranes as worlds in between worlds, continuously intersecting reality tunnels. Fragile edges and verges of con-fusion, overflowing springs of diversity and strangeness...

FIGURE 4
Membranes

Irreal Universes

Our quest for art-forms which express visions, ideas and sensations of quirky universes, inspired by both scientific interpretations and fictional universes is a parallel shared between Calvino's work and TRG. Early in our brainstorming sessions speculating on the substance of our transient reality, we became interested in various scientific attempts to probe the fundaments of life. Attempting to uncover its inherently wondrous, sometimes bizarre structures, hidden within physical, biological and chemical processes.

As part of our initial designs for a transient reality able can make explicit the entanglement between ourselves and everything else, we looked at the various contemporary "theories of everything". One of the theories often mentioned as the contemporary 'System of the World' is the speculative M-theory as proposed by Witten, Horava, Lukas, Ovrut, Waldram and others. In order to grasp these complex theories, we scavenged amongst them for concepts and worldviews that most tickled our imagination. We sought inspiration in the rich ideas within this theory, in order to create a transient reality possibly resembling some of Calvino's Cosmicomics - imaginary universes, built upon a more-or-less scientific foundation.

We looked for ideas that resonated with our aim of making an adaptive environment. We found many resonances in the hypothesis that the universe is continuously shaped by minuscule fluctuations of energy (referred to as strings), whose actions through time form into 'world-sheets', realities drawn through motion. According to this theory, the motion of the strings creates worlds on a tiny scale, which unfold through (at least) eleven dimensions - four conventional dimensions (three spatial dimensions and time) and seven curled up and thus invisible to the human eye. Furthermore, the theory suggests existence of many parallel universes (or 'branes') - universes in which reality might be shaped by sets of utterly different physical forces. There is also speculation concerning occasions in which two or more branes collide, causing massive reality shifts, in which whole universes may cease to exist, while new, mutant child-branes begin their expansion. Such an ekpyrotic universe (From Greek 'ekpyrosis', conflagration) is often visualised as a pliant, knotted dough, an image that resembled our early sketches for the trg environment.

We tried to make sense of these concepts for each other, by translating some of the more speculative ideas for each other into forms which could be touched, heard, seen, tasted and smelt. Inspired by M-theory, we imagined a world as malleable and oscillating as that proposed, but on a human scale. What would that do to our reality-tunnels? What would it feel like to be immersed in such an elastic universe, being able to perceive its impermanence with our ordinary five (or six) senses? These disparate theories and strange dreams formed into a tangled system of possible worlds. Charts were sketched and stories were written, illustrated with comic strips, drawings and photographs. Slowly, this tangled mess of ideas pro-

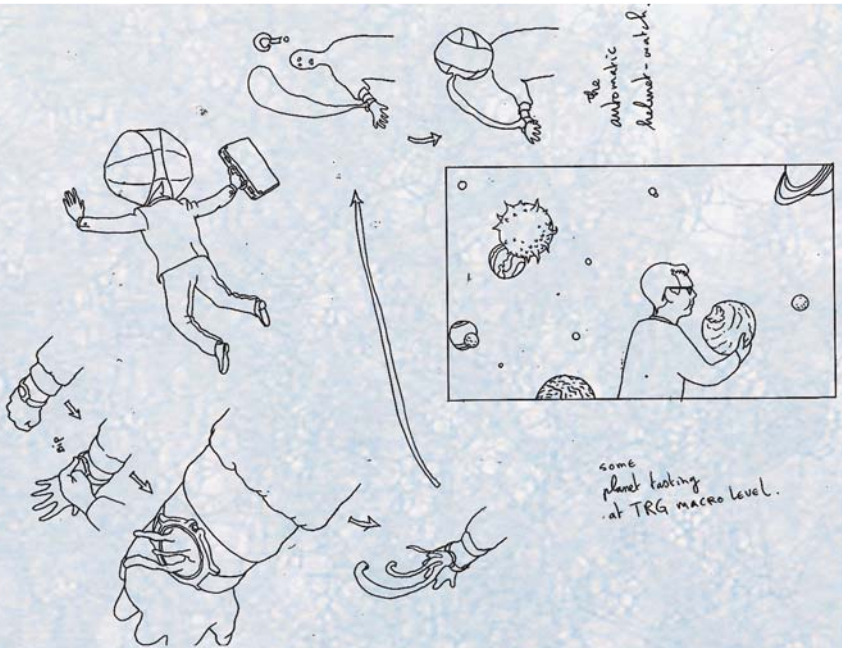


FIGURE 5
TRG universes

vided glimpses into an irreal and imaginary universe that would be possible to make on the scale of a room. We proceeded to develop the dynamics of a transient reality based on a simple, physical force model, borrowing from Newtonian, Quantum and String theories. What resulted was far from scientific, it was a universe fitting better in the realm of Pataphysics, the science of imaginary solutions.

In our heads and on the blackboard the trg world began taking shape. It was a world shaped by four fundamental forces; the fictional equivalent of gravity, electromagnetism, strong and weak nuclear interaction. It would unfold, expand and curl based on the energy levels within its perimeters. On one hand, kinetic energy generated through fast, dramatic movement would cause the world's spatial scale to increase, and it's dimensionality to decrease - becoming a colossal two-dimensional sheet stretching towards infinity. On the other hand, potential energy instigated by the subtle movements, touches, iteration and repetition of gestures would make the universe unfold in more intricate dimensions, increasing in richness and decreasing in scale (similar to discovering the porous structure of a seemingly smooth rock under a microscope).

FIGURE 6
Orbifolds and
multiple dimensions

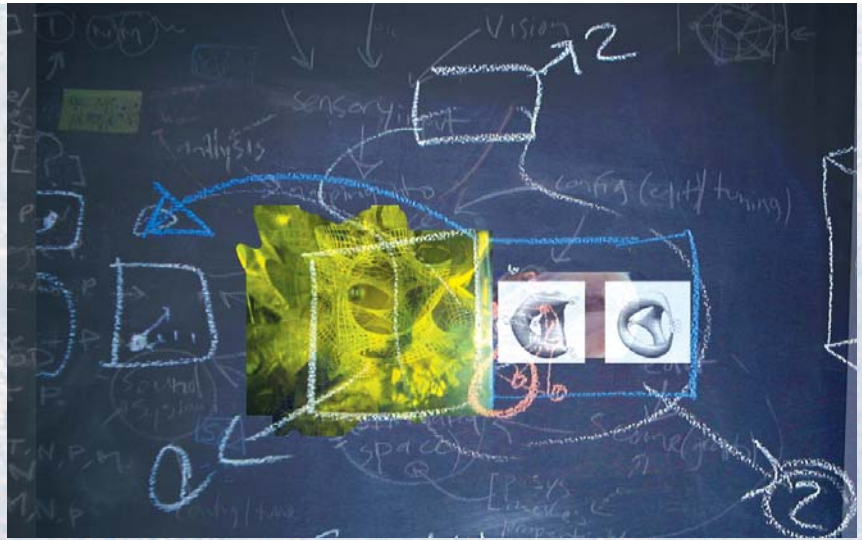
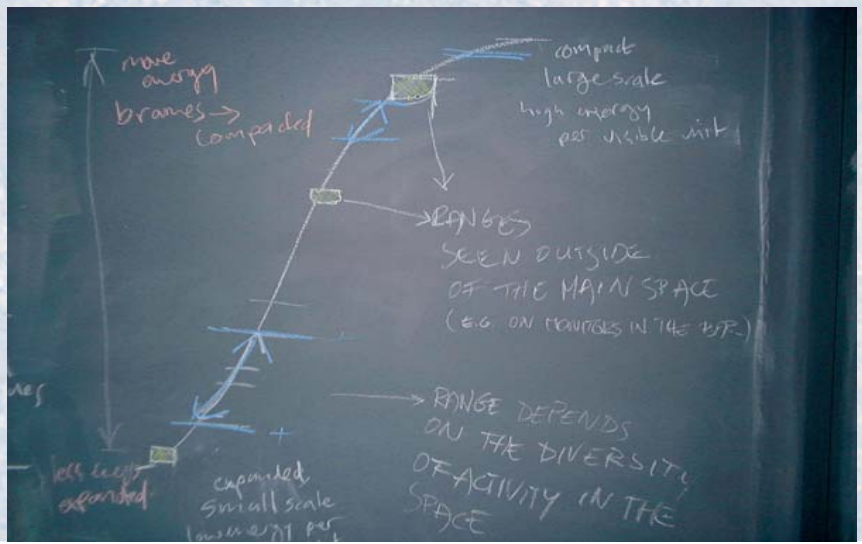


FIGURE 7
Energy model for
dynamics of trg



The dynamics of this world would lay in the continuous transformation between different scales and dimensions. On the largest scale, smooth reality skins slowly undulate through vast emptiness. On this scale the simulated world appears much larger than the human players, their influence disappearing as quickly as a veil of smoke. Within these thin translucent worlds the players can encounter a tangled and tentacled landscape, which sways and knots, repulsed by, or attracted to the players' movements. Further unfolding reveals a frothing, electrified system, pulsing to reflect the energy of a universe becoming denser or sparser, responding to the play occurring within it.

"Not a dense, opaque melancholy, but a veil of minute particles of humours and sensations, a fine dust of atoms, like everything else that goes to make up the ultimate substance of the multiplicity of things." Italo Calvino

The translation

The world that would be touched, tasted, seen and heard in our transient reality would be of both physical and digital nature, both actual materials and virtual spaces; an amalgam of soft architecture, graphics, sound, performance, costumes, food and drinks. The process of amalgamation would be guided by a consistent logic, that enables connections to be formed between the disparate media, materials and events that made up the trg environment. This logic, primarily informed by touch became the glue that made it possible to stick the separate components together into a coherent reality-field. The physical elements (such as costumes, stretchable and inflatable architecture, varied tactile forms and textures) were to be shaped to amplify their tactile qualities (smooth, wet, pocky, solid or unbalanced). The soundscapes would echo as a multitude of atmospheric vibrations propagating through different volumes and surfaces (as a wind passing through tensed silk, or as a swarm of sonic grains bouncing within the vacuous chambers of a dirigible). The graphics would change the lightness and density of the space, making the air appear thicker or sparser. In the process of massaging the concepts into the essences of the design, glimpses of a possible experience were formed:

Imagine your movement extending into ruptured surfaces and relentless, tentacled curvature. Sonic fields splattering into (re)modulated and (un)structured light. Strange shapes brushing against your skin, destabilizing your motion. You feel your limbs slowing down, until you carefully crawl on a smooth surface of a large pliant membrane and dare to touch the fickle world around you. Through the bumps and craters, pocky skin and viscous liquids, you can feel it touching back, becoming aware of your intentions, opening up its secrets and allowing you to affect its power. Attracting, repulsing, binding and transforming the fundaments of the world, you gradually grasp the dialogue forming through its stormy fingers. You feel a nauseating disruption of your visual perception, as the empty space in between physical objects begins filling up with elusive imagery of bubbling, luminescent surfaces, whispering in deep tectonic voices. Unable to orient yourself using your eyes and ears, you rely on your sense of touch to begin traversing the space.

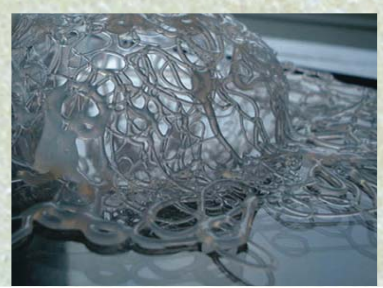
FIGURE 8 betwixt physical and digital

We worked together for several months translating these fragile dreams into designs for a responsive environment. Our most challenging undertaking was the distillation of conceptual worlds into feasible experiments on a corporeal scale. We chose the media, materials and technologies which we anticipated would bring us closest to our visions. We designed a system that could provide such an experience. We moulded sound, image and the tactile textures of fabrics, food and dialogue - the multiplicity of forms that Calvino talks about in his "Six memos..". We set processes in motion that would allow these forms to be brought together to create a 'total' experience, stretching through and between the senses. In a way, we began to create a "spime":

"With a pressing need for a neologism, to describe the next logical development in the historical arc of "artifacts," "machines," "products," and "gizmos," I spontaneously invented the word "spime" (...) "The most important thing to know about Spimes is that they are precisely located in space and time. They have histories. They are recorded, tracked, inventoried, and always associated with a story. Spimes have identities, they are protagonists of a documented process. (...) The upshot is that the object's nature has become transparent. It is an opened object." Bruce Sterling

For our transient reality to become "spime"-like, we required modular, persistent and easily reconfigurable protocols and systems, which can unobtrusively adapt to a wide variety of environments and social situations. Ordinary gestures and actions should be adopted as interaction modalities, appealing to multiple senses, encouraging us to re/discover our bodies as constantly expressive instruments. Cumbersome hardware should be melted into the fabric of the architecture, furniture, clothing, or even skin, allowing for the reality around us to become more active and adaptive. Media in these spaces should be used as a means to knead physical reality into new shapes that can be created and shared through play. The whole environment should be able to support playful behaviour, in which the duality of right and wrong dissolves into the magma of intentional exploration. We knew that it was impossible to make such systems within the timeframe of TRG, but we had a vision to strive towards and hopefully took a few steps in the right direction...

The team divided the tasks and set to design the different components. Physical structures and media worlds were developed in parallel, making sure that the consistency of the world would be preserved. More and more of the ideal design was shaved off by the constraints of time, space and finances. At the same time, material experiments led the group towards new and unexpected solutions. The details of the world were continually readjusted and redesigned, while keeping their essence intact. Many experiments were conducted. Small pieces of strange-smelling materials, a couple of seconds of obscure graphics, psychotic audio-visual particles swarming and disappearing off the screen.



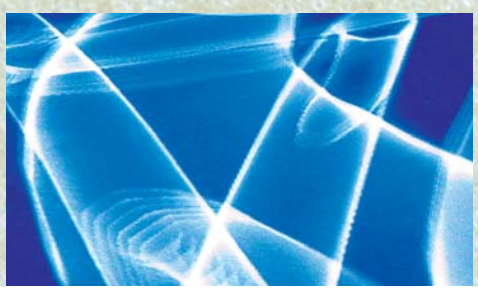


FIGURE 9
Physical and
digital textures

In the course of a few months, the experiments began increasing in size and strangeness. Metres and metres of white tentacles were sewn. At the same time, a simulated tentacled forest began swaying its translucent limbs. A black rubber blob was inflated. The knotted textures found their way onto still immobile membranes. The particles decided to remain on screen and even mimic smoke, with hundreds of tiny oscillators sonifying their movement.

From the earliest experiments, we tested the designs ourselves and with other willing subjects. Sometimes the results would make us nauseous, other times make us burst in hysteric laughter. Other times again, we would try not to offend our fellow generators while voicing our disappointments and trying to help them find alternatives. The most thrilling tests were those examining the consistency between the physical designs and the digital media. While testing the designs, we would open the passages linking the separate sensory experiences, while carefully exploring the space. Slowly, the more detailed and subtle qualities of the reality began to unfold. We became intoxicated with silicone fumes and numbed by numbers scrolling on screens. Reappearing behind our eyelids whenever we would get a chance to close them.

FIGURE 10
Inflation/Deflation

Tired but excited, we squeezed the makeshift transient reality and ourselves into a van, and drove across Europe in a blizzard. Hours later, we unpacked the van, ready to adapt our transient reality to Kibla's freshly renovated gallery in Maribor, Slovenia. In the winter coloured town and smoke veiled cyber-cafe, we worked on moulding the still unformed reality into a site-specific experiment. This development required additional 'reality-checks'. Assumptions were put through severe tests, improvisation and adaptation becoming crucial skills. Concepts were stretched and designs thrown out of the window. Technical challenges became important features incorporated into the environment, propagating changes and adjustments through all its components. Almost every day felt like we were starting at the beginning again...

FIGURE 11
trg environment

In spite of being partially held upright by invisible strings and improvised procedures, we managed to set up an environment that came closer to our visions than any previous experiments. Perpetually on the verge of descending into chaos and noise, demanding of our constant attention, it was time for trg to be put through the first public experiments.

Public experiments

Becoming acquainted with the trg environment demanded a particular flow, designed to allow people to relax and open their senses to an unknown experience. We provided no recipes nor instructions telling the players what to do once they entered the space. There were no rules determining the right nor wrong in trg, only a constant influence, more or less obvious, more or less discrete.

FIGURE 12
Entrance

It began in the bar, with a few drinks, specially designed snacks and cocktails, flooded with sonic echoes from the depths of the transient reality and illuminated by a window into the visual melange of the trg atmosphere. We would invite several players at a time to join us behind a stretched fabric wall. Sometimes we would blindfold them. They would be guided to a seat where they could submerge their feet in warm water, bubbled up by foot-jacuzzies.

After having their legs dried and massaged, stories would be woven from the lines on their feet, and socks stretched over their tingling toes. We would equip them with a new 'head', through which they could see selectively focused aspects of the environment. We would lead them during their first steps in the environment and then leave them to explore.

Once in the space, people danced, slept, jumped, crawled, got lost, listened, watched, played, touched and laughed (a lot!), while being sensed by

FIGURE 13
Initiation

FIGURE 14
Wearable projection surfaces ('heads')

the computational system guiding the dynamics of the space. Their actions were translated into perturbations of the sonic and visual fields that surrounded them. The fabric architecture was similarly elastic and compliant to every movement. Moving around, they would begin exploring the space by connecting their disparate sensory experiences. They would learn where the material was rough, where it stretched into a thick tube higher than themselves, or where it became too unstable to walk. They would find their ways through different visual pools, playing with the abstract shapes generated by their movement. They would tug on the fibres of the space and hear it scream. Together they would modulate a deep hum that vibrated through the hollows of the space and of their organs.

FIGURE 15
From concept to reality

Sometimes, players would take off their 'head' and visually re-visit places they had only touched and heard before. They would help others that seemed lost, taking them to their favourite places. Some players had to understand 'how it works'. Others discovered the inner workings of the space through social play. For others, a solitary exploration - an exclusive dialogue between the space and themselves - was crucial. The transient reality of trg accommodated them all. After anywhere from a few minutes to a few hours committed to trg, the players would leave, usually after a long chat, perhaps a 'look behind the scenes' and often with many hugs and 'thank-yous'.

We explicitly called trg an 'experiment', knowing that the nature of responsive works is that engaged players are required to test the initial hypotheses. It is often the case that during the experiment, we find several gaps, loopholes and surprises in the environmental and technological design. Therefore, even while the environment is open to the public, there is still some aspect of development and adaptation occurring within the system (as well as ongoing repair of the most fragile parts of the physical components). No matter how carefully these spaces are designed, they can never work exactly as anticipated. People's actions and reactions never cease to surprise.

Formally, we worked with an anthropologist to examine how people thought and felt about the experience. Through interviews, questionnaires, observations and focus groups, she provided many fruitful insights into the wishes, fears

FIGURE 16
Discussions with the players

and expectations of the players. Informally, most participants were willing to share their enthusiasm and their thoughts with us, enabling us to incorporate their suggestions into subsequent versions of the environment. Both these methods confirmed that there was often significant correspondence between our intentions and players' experiences. The stories told by the participants frequently mirrored the conceptual, ethical and aesthetic aims which we set ourselves in the beginning of the project. In a similar way to the development process, in which the developers felt that we were perpetually approaching completion, the participants kept coming back, bringing new people, exploring other parts of the space, or just popping in for a drink. For them, as for us, generating transient realities became an ongoing adventure.

A few of our inspirations for this text (in order of appearance):

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- *Wilson, R.A. (1986): Cosmic Trigger Volume I. Falcon Press, Phoenix*
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- *Merlau Ponty, M (1962): Phenomenology of Perception. Routledge, London*

Image credits:
Figures 1, 8, 11, 13, 14
photo: Damjan Svarc
Figures 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15, 16, 17
photo: FoAM

FIGURE 17
experiencing trg

- *Calvino, I (1993): Six Memos for the New Millennium. Vintage International, New York*
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Pataphysics:
- *Jarry, A (2001): Adventures in Pataphysics (Atlas Anti-classics S.). Atlas Press, London*

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- *http://www.viridiandesign.org/notes/401-450/00418_notes_from_high_ground.html*
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THE CARE AND FEEDING OF TRANSIENT REALITIES:
REFLECTIONS ON "MINDING THE BABY"

Tim Boykett

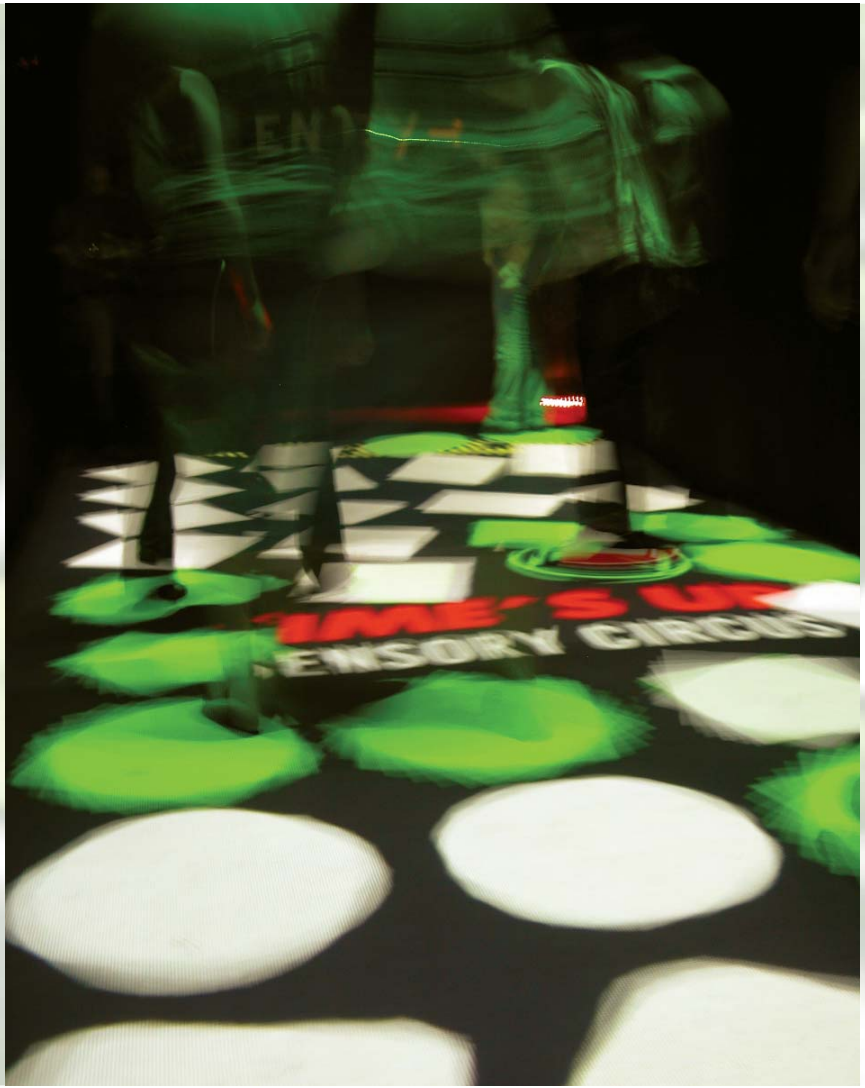
Abstract

Building systems that are somehow different to what we commonly regard as reality, is a job requiring a considerable number of approaches, a swathe of technology and a backpack full of perhaps well-worn (worn out?) metaphors. When such systems become unified to an extent that they are best understood as a single complex system, a complete reality unto themselves, then they begin to regard the space of the visitors as some kind of external world in which the system perceives and acts and are perhaps better described as protocognitive systems. Keeping such systems operable, their chaotic behaviour within certain boundaries, tightening the screws and maintaining electrical integrity, might be best seen as ongoing psychotherapy, or just minding an unruly and temperamental child.

The following text is an attempt ("essay") to summarise several aspects of the author's motivation for, interest in and experiences with temporary mixed reality environments. The multiple levels of metaphor are perhaps confusing, but the region of memespace that is being discussed here has few accepted boundaries or descriptors. I can only hope that the collection of various points of illumination and vantage points of perception, taken at speed, leave some kind of coherent after-image in the mind of the reader.

Art Jail

Mixed Reality systems tend to need a very controlled environment in many ways: not only is it important to keep rain and wind away from the electronics and construction as well as the visitors, but the acoustic environment is fragile and detailed and the projection technologies need near darkness for clear images. As a result, the spaces in which MR environments are set up tend to be dark, quiet halls, concrete bunkers with cold seeping from the walls, the only airflow a nasty draft that annoys the kidneys. The term introduced to us by our friend Alex Davies for these environments where we spend weeks setting up installations and often even more time minding them is the "Art Jail" - locked up for the sake of our constructions, conditions that would get Amnesty International up in arms if we didn't have a choice. But we choose to do this: peering into computer screens, mousing incessantly with a constant diet of nasty coffee (there is no kitchen, so the coin operated machine has to suffice) and take-away nutritional greasiness, clambering under constructs to adjust some bolts, following reams of cables along scaffolding pipes and under stage elements, pondering the exact source of the error in the data stream from some sensor subsystem. What the hell were we thinking?



So where is the payoff? I think that this book, if not the entire TRG program and the inspirations for it, are trying to investigate this and are a cloud of reasons for undertaking this work. Essentially it comes down to something very simple: building worlds that are more. More what? More of everything.

World building

There are so many ways to build worlds. Equations of physics, the telling of a tale, cardboard boxes and a paper crown for the queen. The techniques we are investigating under the moniker of Mixed Reality include projections and virtual reality systems, multichannel audio, sensors and actuators, machines, devices and architecture. The realities are built of objects, physical, acoustic and projected; their actions and responses. Without actions, without reactive behaviour, the objects are (mere) decoration. The important thing about our world that we know is that actions define the interpretation; being able to swim and to fly, the properties of friction and gravity, the purring or play-fighting of the cat.

Thus we imbue objects with the possibilities of action, with sensors to perceive and actuators so as to be able to act and react. We define relationships of sensor data to actions, to allow a visitor and the system to co-structure the behaviour of a mutually defined space. We cannot control the actions of a visitor, at best we can open certain directions and encourage the more richly elucidated approaches. But we do have complete control over the behaviour of the objects in the space, inasmuch as we build and define them. One approach is direct control: the system is used by certain operators to interact directly with the visitors with the objects as marionettes. These objects may be audio content, images or physical objects. This leads to a kind of intense, mediated improvisation, where the object controller(s) are on stage at all times, adapting to and playing with the actions of the public. A simple example is shown in Figure 1a. A nontechnological example of such a system is the telling of a story, where the speaker varies the details and the flow depending upon the perceived reactions of the audience; more dragons or landscape description if needed, or a quick fast forward to the triumphant return of the princess. A semitechnological idea of this can be seen when a DJ plays the mood of the audience with tracks, picking up on what works, bringing in new sounds as needed, not just playing the hits in Top-40 fashion.

Marionette control is complex and all-consuming - a lot of expertise is needed to play a one-man-band, we do not have enough fingers, elbows and thumbs. So we begin to augment our capabilities with player pianos and connections between the puppets. As the entire system with which we are operating is computer mediated - our marionette strings are fly-by-wire rather than direct control - it is relatively easy to add software systems between the controller and controlled. Sensor systems can replace the eyes and ears of the improvisor, the direct connection of a visitor's actions to the result-

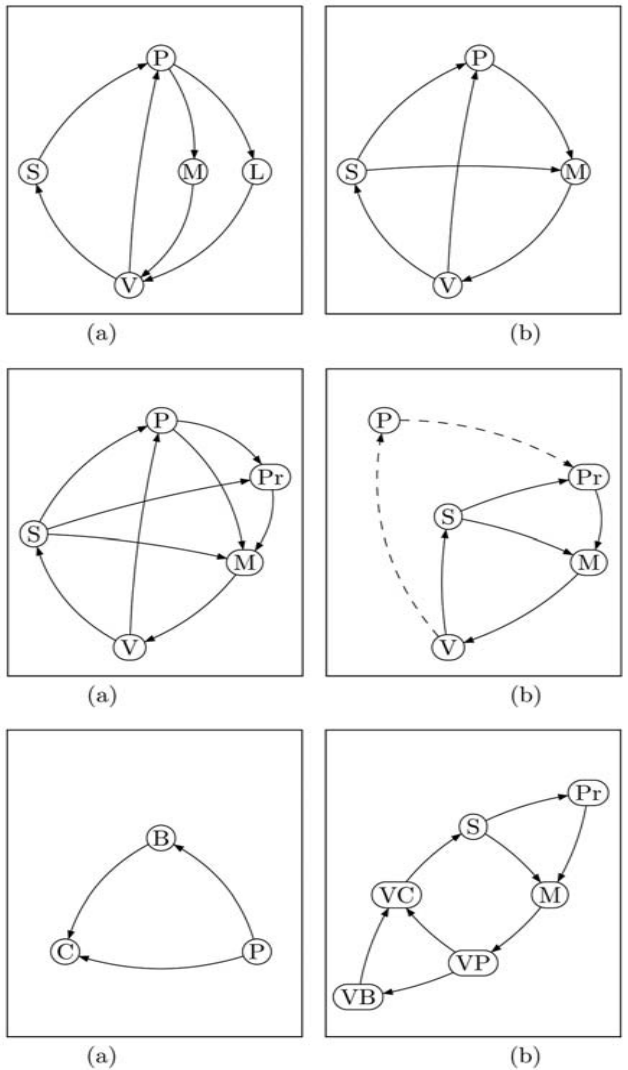


Figure 1: (a) A simple puppeting situation. The visitor (V) is observed by the puppeteer (P) directly and through sensors (S). Then P controls the music (M) and lights (L) for the visitor's experience. (b) The puppeteer saves some work by connecting certain sensor values directly to some sounds and lights. Let's call them media (M) for simplicity.

Figure 2: (a) The puppeteer replaces some of her motions with some simple processes (Pr) which act out small sequences under her control and directed from the sensors. (b) The puppeteer has embedded enough of her activity and decision making into software. Now she can watch the interactions less intensely.

Figure 3: (a) A simple but useful model of the public person, reduced to the elements of Perception (P), Control (C) and Biomechanics (B). The arrows indicate dataflow. (b) Removing the puppeteer from Figure 2b and replacing the visitor with the public person model (VB, VC, VP) we see the symmetry in the situation.

ing effects short-circuits the reaction loop of the puppeteer. We see this is Figure 1b. The rules of the world are slowly taken out of the mind and fingers of the puppeteer and reimplemented in software and circuits, processes with parameters adjusted according to the actions of the visitors.

The simplest end of these world-rules starts off with a reaction: if X then Y, push button - ring bell; turn knob - adjust light. Once a process starts to have an internal state, complexity is added (Figure 2a): the knob controls the rate of flashing of the light, the button adds a beat in a sequencer, the lever offsets the pneumatic cylinder. Before we know it we have rolling patterns of sound, light and action feeding from the multiple control mechanisms enabled by the sensor systems, levers effecting tones and rhythms, dials adjusting tempos and intensities, camera-based body tracking systems allowing subtle actions in the space to effect broad sweeps of change in the audiovisual environment. Somehow the visitor is no longer causing reactions, rather the entire system takes off on its own and the input systems available allow only general changes to timbre and the direction of development; the world has a mind of its own and the puppeteer can only effect its mood (Figure 2b).

It is at this point that the behaviour of the system as a whole begins to become something else. Rather than a collection of gadgets that react to the actions of the autonomous and controlling visitor, the system, the new, localised world that we are building begins to become a system with its own agenda, a system that perceives the motions of the visitors within its internal structure, trying to maintain some balance in the internal processes. One possible term for such a world is a protocognitive system, as this system is attempting to perceive and understand and coherently react to the world surrounding and inhabiting it. Rather than a robot that is localised in a box with wheels moving in some environment, the robot system has taken over the extended architecture of the space, its "outside" is the environment in which the visitors meander (Figure 3b). The outside world where the visitors spend the rest of their time is largely irrelevant - the internal world of the visitors, their home life and internal psychological quirks are not relevant here: only the "public person" is relevant and they are defined by their actions within the space. This space has become a complete reality unto itself, a transient reality generated between the actions of the visitors and the new laws of physics that this space implements.

A model suggested for the public person reduces them to three components: What they perceive (Perception), what they do (Control) and the strange collection of autonomous and automated responses that lurks in the recesses of their mind (the Biomechanics) (Merit and Boykett, "Closing the Loop", 1998). Naturally perceptions are the input to the biomechanical system, the biomechanical system has outputs that are control. Some direct reaction from perceptions to control are also observed. We obtain a triangle as in Figure 3a. If we replace the Visitor in the previous diagram (Figure 2b) with this triangle of data flows, and keep the Puppeteer out of the picture (she trusts the computer and has gone for coffee), we see the symmetry between the vis-

itor and the environmental system. The simplified public person has become equivalent to the reactive system. This is the basis for the use of the term protocognitive system. The visitor knows as much about the inner workings of the system (Pr) as the system knows about the home life of the visitor (VB). Both are irrelevant for the duration of the experience.

Live coding as psychoanalysis

Getting a system, a distributed collection of machines, sensors, computers and outputs, all working at once, is a nasty task at the best of times. Then when you are trying to tweak the parameters to get it to do just the right thing, you end up in trouble.

The Live Coding paradigm has arisen in 2004-05 as some kind of follow-up to the coding aesthetics that became ever more important in the new century. As Max/MSP/Jitter and PD/Gem/PDP and related environments have become more capable and common, performers have started using these tools to build complex and interesting instruments for performance. A lot of early work was based upon building these systems and then implementing effective UserInterfaceGuideline conforming skins for them: front ends that were accessible to the uneducated user, or performance skins that enabled the easy use of the instruments in performance environments. But as the process meme caught on, performers were setting up systems that did more than just respond to tweaks of a knob box or fancy key- tapping; the performer had begun to outsource some of the performance intelligence to the machine by setting up processes that ran semiautonomously. As these processes ran, the performer would modify parameters, perhaps the timing delays in an event chain, or the rate of decay of some effect. As the processes became more than just extended knob boxes, the performer realised that some aspects of the process were no longer controllable: the most efficient way of changing the parameters desired was by opening the patch and modifying it. Live coding was born.

Of course this can be seen as a follow-on to the performers who took to the stage with an empty sampler, where the entire performance would be built up as the performance happened. Or there are certainly a range of other interpretations and lines of inspiration. But we are not interested in a historical analysis of the aesthetics of code.

Installation work has always been process-driven. One main desire is to have systems that remain a part of the installation and carry out the plans of the designers in their absence. Whether this was implemented as the allocation of weigh and pivot points in a wind-driven sculpture, the timings of blooming in a garden or the source code of a genetic algorithm, an essential part of the installation was and is a process. As tools became available, it was no longer necessary to have an intricate knowledge of electronics or declarative programming languages. Systems were developed to allow programming in a relatively intuitive fashion. Systems like Max or PureData

opened the doors for people to begin to think about controlling more complex systems in interesting and no longer so deeply technical ways.

For the sake of argument, I am not going to try to use different words for the techniques of coding by writing and compiling C code or coding by building data flow networks. This is all coding. We shouldn't be so snobby. But there are some reasons that these things differ, about which we may speak at another time.

With this ease of programming, the possibility to code large amounts of interrelated patches has arisen. Fifteen years ago, some tech person would hand code some machine to undertake a very specific process, a complex and highly goal oriented project. Coding has now become simple, code re-use is ubiquitous. Tools such as MIDI, OpenSoundControl and netsend have enabled groups of several computers to share data flows, to stimulate one another, to modify the flows of data in one another, to generate and use the data flowing in the network. Systems such as PureData and Max allow a program to continue to operate even while the program is being edited. This is perhaps the most essential part of the Live Coding idea: the system is still running even as I work upon its innards. Chopping out some subprocess and replacing it with another does not require that we restart the entire program. We don't need to put the patient to sleep when we operate upon her inner workings.

This is important for several reasons. We no longer need to shut down the responses, disconnect sensors and data flows and wait while we restart the modified subprocesses. We save time. We can watch the data flowing as we modify certain parameters of some objects, responding to the intricacies as we see them. We enjoy a tight analysis-implementation loop. We do not need to get the entire multimachine system from a start state into the state in which we are interested in modifying the behaviour of a process that might be quite involving, or even verging upon the impossible.

This is, of course, similar to our own capacities for modifying our own behaviour under self-reflection. We do not have to write down how we will approach the next encounter with some colleague and implement it overnight, rather we realise in the midst of the encounter that we are heading down the wrong track and modify our behaviour "on the fly", getting our foot out of our mouth before we shoot ourselves in it.

Note that this is something like fixing the tuning of the car while at 140 kmh on the autobahn: it is only in this situation (warm engine running fast) that the problem turns up, so this is the situation that we have to deal with the problem in. I don't know if I would want to operate upon a motor at 3500 rpm and 140kmh.

Perhaps this is why, deep in the darkness of a distributed installation, with machine sounds, pneumatics and sound scapes all around, aware of several projection surfaces and monitors showing moving images, one feels a lot

like the engine room crew of a small boat going into battle after being knocked around. Knowing that at all costs, the machines have to keep running, but that there are a lot of things that can and will go wrong, one develops a feeling for the sounds that are right and wrong, the rhythms of machines and mechanics, the flickering of lights on interfaces and patches. The permanent sense of alarm, the basic understanding that all senses have to be paid attention to at all times, where every difference in overall feeling is an indicator that something, somewhere is different - this feeling keeps us on out toes as we hang out in the control room or the bar.

An installation is not just some kind of machine which is to be kept at peak performance. The optimisation that we are carrying out as we act as white blood cells is not simply speed or efficiency. It is the behaviour of the entire system that we are interested in tuning. If we could speak of machine psychology here, we probably should. So let us pretend that we can. We are trying to implement behaviour patterns in these systems that make interesting installations. Whether we regard the system as a whole as a single psychology, or whether we think of the various players in the system as individuals and then imagine the entire system as a mob psychology is probably a redundant distinction. However we think of these things, in the end we have interacting systems that define some behaviour. If this behaviour is not doing as it should, then our goal is to modify it. Inasmuch that this behaviour can be referred to as psychology, the modification of this behaviour is psychotherapy, or psychiatry. I do not know whether we need to be doctors in order to perform these tasks, but as we are essentially operating upon the nervous systems of these systems, perhaps the role closest to ours is that of the neurosurgeon.

Or is our role merely the nightwatchman at the power plant, trying to keep all the systems working and ready to jump when something goes a bit awry? Paratechs, so to speak, always ready with a spanner and a mouse, ready to re-route a video signal or disable a midi signal, adapt to the breakages and misfortunes. Trying to adapt the parameters to maximise - something. Something like interestingness.

Or is our role more of a parent minding unruly children, trying to keep them playing games, keep activity up whilst also within certain bounds of safety and learning, not just plonking them in front of the TV, but not just letting them go feral in the park with frogs.

There is a distinct difference here between the classical artist's role as a provider of an object that will be installed in the space available, illuminated correctly and maintained in whatever way is appropriate by technicians. Rather the complex of behaviours needs more than just a technician's touch, there are subtleties in the approaches that are more than just replacing a broken light globe or a contact switch. It's realtime psychology, on some proto- or pseudo-cognitive system.

Photo credits: Time's Up

THE DINNER PARTY

S. Pearl Andrews in The Science of Society

The highest type of human society in the existing social order is found in the parlor. In the elegant and refined reunions of the aristocratic classes there is none of the impertinent interference of legislation. The Individuality of each is fully admitted. Intercourse, therefore, is perfectly free. Conversation is continuous, brilliant, and varied. Groups are formed according to attraction. They are continuously broken up, and re-formed through the operation of the same subtile and all-pervading influence. Mutual deference pervades all classes, and the most perfect harmony, ever yet attained, in complex human relations, prevails under precisely those circumstances which Legislators and Statesmen dread as the conditions of inevitable anarchy and confusion. If there are laws of etiquette at all, they are mere suggestions of principles admitted into and judged of for himself or herself, by each individual mind.

Is it conceivable that in all the future progress of humanity, with all the innumerable elements of development which the present age is unfolding, society generally, and in all its relations, will not attain as high a grade of perfection as certain portions of society, in certain special relations, have already attained?

Suppose the intercourse of the parlor to be regulated by specific legislation. Let the time which each gentleman shall be allowed to speak to each lady be fixed by law; the position in which they should sit or stand be precisely regulated; the subjects which they shall be allowed to speak of, and the tone of voice and accompanying gestures with which each may be treated, carefully defined, all under pretext of preventing disorder and encroachment upon each other's privileges and rights, then can any thing be conceived better calculated or more certain to convert social intercourse into intolerable slavery and hopeless confusion?

TOWARDS AN ANTHROPOLOGY OF MIXED REALITY PHENOMENA

Alkan Chipperfield

In this short article I will endeavor to reappraise the work of some well-known cultural theorists and suggest a picture of what one possible anthropology of mixed reality phenomena may look like, with the proviso that the discussion will only attempt a topical outline, speculative and heuristic in orientation, schematic and formulaic in elaboration. The article aims merely to survey a few aspects of the conceptual frameworks of these theorists in the hope of appraising mixed reality within a number of successive spheres of contextualization.

Mixed Reality and the "Global Information Society"

I will begin by noting a variant of a now-familiar perspective: the idea that we have moved into a global information age. Scott Lash argues that an "information society" is not primarily one in which the production of information displaces the production of goods, nor that information becomes the most important factor in production - he argues that information society is one in which "the principle of 'society' becomes displaced by the principle of 'information.' An order in which sociality becomes displaced by a certain 'informationality'";[1] in which social relations at all levels are becoming "less about sociality than about informationality".[2] This informationality, Lash argues, is not an instrumentality nor a finality, but an immanence. Information and communication engender networks that operate over great geographical distance yet in full temporal immediacy in what is now primarily a global media society.[3] And this mediation has become machinic - "with the proliferation of digital media, the experiential density of mediatic objects becomes so significant that we can speak of a parallel space."[4] This space is topological rather than topographical, and people within it are not connected by a social bond as such, but through socio-technical ties - "they are joined by links that are as much technical as they are social."[5]

In this sense, Lash speaks of the advent of flattened, non-linear, and lifted-out "technological forms of life."[6] By flattening Lash means that all kinds of dualisms and the dialectical relationships allowed by such dualisms are swallowed up and fused into a single "flattened" continuum. The dualism of subject and object, observer and observed, of theory and practice, of virtual and real, of imaginary and actual, of self and the other, are absorbed into an informational continuum in which space is, as it were, flattened and therefore destroyed.

Without here developing a critique of Lash's ideas, it is not difficult to see in these terms a certain relevance for mixed reality environments. In mixed reality, it could be said, these tendencies are taken even further, for in such a world one cannot disengage. That is, no matter what one does or does not do in a mixed reality environment there can be no escape, since, in principle, everything an agent's mere being will have some kind of reciprocal repercussion in the media-saturated world. This is of course the design intention, but it might be asked what the consequences of such total engagement might be for a wider public. Just as one cannot disengage, one cannot step back and reflect upon one's experience in the dialectical manner that Lash has in mind. In principle there is no separation between thought and action - everything is swept into an immanent continuum. In this perspective, mixed reality might be described as a technocultural black hole that absorbs, flattens, compresses and collapses everything that comes within its gravitational suction.

[1] *Scott Lash, Critique of Information, London: Sage, 2002, pp. 75-6.*
[2] *Ibid.*
[3] *Ibid. 68, 75-6.*
[4] *Ibid.125.*
[5] *Ibid. 20.*
[6] *Ibid.*

Producing Space

To see if this black hole can be turned inside out I now turn to Henri Lefebvre and briefly mention his theory of the production of space. Lefebvre traces a history of space from the ancient world through the medieval ages to the present, arguing that the space of the present time has become abstract space. He writes that "the reduction with which we are concerned is directed towards the already reduced dimensions of Euclidean space; … this space is literally flattened out, confined to a surface, to a single plane".[7] This may sound close to Lash's understanding of technological forms of life; but there is a vital difference: for Lefebvre, space of this sort is brought about precisely by the domination of an absolute Cartesian duality between subject and object. He describes it as the space of bureaucrats, "of blank sheets of paper, drawing-boards, plans, sections, elevations, scale models, geometrical projections, and the like."[8] This abstract space implies an abstract, disembodied subject, and is a space dominated by Logos, by rational organisational forms. Recall that for Lash, it was precisely the elision of the absolute, transcendental subject and the dissolution of rational processes of dialectical reasoning and perception that flattened out technological forms of life into an imminent and spaceless continuum.

Lefebvre holds that long before abstract space, long before thought space and spatial thought, there was the production of space, the lived experience and making of space.[9] He writes that "In the beginning was the Topos."[10] It is the space produced by the body, and therefore is both bodily and social, since, according to Lefebvre, the social is fundamentally a spatial phenomenon. Bodies generate space by and for their gestures,[11] and through the mediation of rhythm "an animated space comes into being which is an extension of the space of bodies."[12] The living organism, says Lefebvre, has no meaning or existence in isolation from its extension in the space that it creates.[13]

Lefebvre defines three types of social space. Rather awkwardly, he calls these spatial practice, representations of space, and representational space. Spatial practice is the total assemblage of lived and conceptualised space that is secreted by a society; it is the quality of space, physical, social,

[7] *Henri Lefebvre, The Production of Space, D. Nicholson-Smith trans., Oxford: Basil Blackwell, p. 313.*
[8] *Ibid. 200.*
[9] *Ibid. 174.*
[10] *Ibid.*
[11] *Ibid. 216.*
[12] *Ibid. 207.*
[13] *Ibid. 196.*

technological, that we can observe, for example, in a particular city. Representations of space are conceptualised spaces, the spaces of scientists, planners, urbanisms, architects, and, it might be said, of software programmers, all of whom, says Lefebvre, "identify what is lived and what is perceived with what is conceived."[14] Therefore, this kind of space tends to manifest in systems of verbal, intellectually worked out signs. Representational space on the other hand is "space as directly lived through its associated images and symbols, and hence the space of 'inhabitants' and 'users'."[15]

Already it is not hard to see an incipient theory of production of mixed reality spaces in this tripartite schema of perceived, conceived, and lived spaces. For although Lefebvre has cities, nations, and entire historical epochs in mind, it is easy to see how these ideas can be applied to such (usually) microsocial realms as mixed reality environments. For example, we might ask what types of space a mixed reality environment is composed of, according to Lefebvre's model, and how these types of space interweave, augment or diminish one another. And so representational space could be understood here as the physical and social space in which participants actively produce their worlds through gesture and motion, in augmented physicality. Representations of space could be understood, over and above the global design of the mixed reality setting, as the abstract layer of computer code, the software algorithms which have been conceived by the programmers and which drive the various interactive components of the mixed reality environment. And so forth. For Lefebvre holds that in any of the productions of space that cultures and communities engage in, each form of social space will be present to varying degrees.

Phenomenology of Technological Relations

Moving on, I would like to suggest that the idea of producing space can be embedded in a more explicit phenomenology of human-technology relations. From the general idea of the production of space, we can ask how this production may take place specifically through technology. Bear in mind that I am speaking of technology as a whole, and my theorisation of specific media-computational technologies that are used in mixed reality productions remains inadequate. For this phenomenology I turn to Don Ihde's philosophy of technology and lifeworld, which draws on the work of Husserl, Heidegger, and Merleau-Ponty. Central to his philosophy is the contention that "technologies transform experience, however subtly, and that is one root of their *non-neutrality*," and that "*for every revealing transformation there is a simultaneously concealing transformation of the world, which is given through a technological mediation.*"[16]

His perspective has two broad dimensions - phenomenological and hermeneutic. By phenomenological Ihde means, in a simplified sense, "a philosophical style that emphasizes a certain interpretation of human experience and that, in particular, concerns perception and bodily activity."[17]

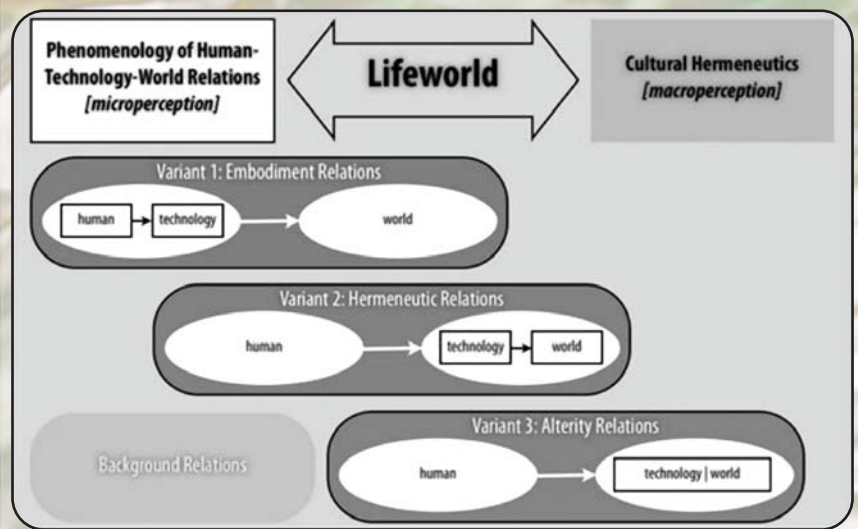
[14] *Ibid. 38-9.*

[15] *Ibid. 39.*

[16] *Don Ihde, Technology and the Lifeworld: From Garden to Earth, Bloomington: Indiana University Press, 1990, p. 49, italics in original.*

[17] *Ibid. 21.*

Hermeneutics, on the other hand, is concerned with the cultural context of interpretation within which perception and bodily experience take place. Therefore, Ihde discerns two levels of perception: that of microperception (phenomenology of human-technology relations) and that of macroperception (embedding of human-technology relations within their cultural-hermeneutic context). The relationship between these two levels of perception is one of figure-to-ground, in that "microperception occurs within its hermeneutic-cultural context; but all such contexts find their fulfillment only within the range of microperceptual possibility."[18] Significantly, therefore, this conception allows for an understanding of human-technology experience that accounts both for its structural constraints and also its "multistable range of ambiguity such that this structure is compatible with a wide range of different cultural-hermeneutic contexts."[19] I will come back to this point in a moment.



This "double-sided analysis of the range of human-technology relations," then, looks at the microperceptual and bodily experience, on the one side, and "a cultural hermeneutics that situates our existential life,"[20] on the other. On the microperceptual side, Ihde proposes three variants of human-technology-world relations: embodiment relations, hermeneutic relations, and alterity relations. (The idea of hermeneutic relations in this context should be distinguished from the idea of macroperceptual cultural hermeneutics just mentioned.)

Embodiment relations are those in which, phenomenologically speaking, the tech-

[18] *Ibid. 29.*

[19] *Ibid. 30.*

[20] *Ibid.*

nology is taken into one's experiencing by way of "perceiving through such technologies and through the reflexive transformation of [one's] perceptual and bodily sense."[21] Hence, technology in this relationship is in a position of mediation; the technology itself is a medium through which our senses are directed to something beyond the technology itself. The technology can "withdraw" and become transparent, and the degree to which it is transparent can serve as a measure of how well the technology is designed.[22] These relations of embodiment are, Ihde notes, not limited either to simple or complex technologies.

Hermeneutic relations arise not when the technology becomes an object in itself but indirectly mediates something beyond itself. The mediation in this case occurs through a hermeneutic relationship. No longer does the technology directly extend our sensorium. This technology must be learned, and in this way it can be called a hermeneutic human-technology relationship. Ihde uses the example of control panels with gauges and dials which refer to something beyond themselves, for example a thermometer referring to temperature. But to perceive temperature through a thermometer one must enter into a hermeneutic relationship based on a learned interpretation.

Alterity relations are "relations to or with technology."[23] Beyond hermeneutic relations, this kind of relationship is one where the technology has become quasi-other, and emerges as a focal entity that may be the recipient of the kind of attention humans give to different forms of the "other."[24] Here, the technology does not refer directly or indirectly to something beyond itself; it is rather an end in itself. This is the kind of relationship we might have with automatons, robots, simulated lifeforms, even a simple spinning top which has exerted universal fascination for its seeming to take on a quasi-life of its own. Ihde distinguishes one further relationship, a background relation. This is where the technology is displaying neither transparency nor opacity, but has "withdrawn" into the background of our awareness.[25] While it does not occupy our focal attention it exerts a conditioning of the context of our experience.[26] Different technologies will texture environments differently, and Ihde writes that "Background technologies, no less than focal ones, transform the gestalts of human experience and, precisely because they are absent presences, may exert more subtle indirect effects upon the way the world is experienced."[27] It may be helpful to think about mixed reality environments in terms of this scheme. We may be able to become more attentive to what kinds of human-technology relations are operative in a mixed reality environment. How a background relation may become more focal and morph into an alterity relation or an embodiment relation, how an embodiment relation may articulate with a hermeneutic relation, how these shifts in relationship may be designed and orchestrated, and what repercussions this might have for participants and producers.

Shifting to Ihde's notion of macroperception, it may also be helpful to think in terms of how these entire assemblages of human-technological relations are embedded in the wider culture. Ihde calls this a cultural hermeneutics as distinct from a phenomenology of technology.[28] Through this distinction we can grasp how specific technologies possess both a structural determination that is non-neutral, but at the same time may be articulated within a multidimensional set of cultural possibilities. Technologies may "fit easily into a number of cultural, multistable structures" and this is the "essential, although non-neutral, ambiguity of technology."[29] Ihde terms this indeterminacy multistability. Once more, it might be informative to ask how mixed reality environments are multistable within the variety of cultural-hermeneutic contexts in which they are created and presented.

[21] *Ibid. 72.*

[22] *Ibid. 73.*

[23] *Ibid. 97.*

[24] *Ibid. 107.*

[25] *Ibid. 109.*

[26] *Ibid. 111.*

[27] *Ibid. 112.*

[28] *Ibid. 124.*

[29] *Ibid. 131.*

Public Event, Play, and Transformation

Within such cultural-hermeneutic contexts, mixed reality productions will often be designed as public or semi-public events. And this leads to the next sphere of contextualisation to which I shall turn. Don Handelman suggests we view public events as discrete and distinctive social phenomena in their own right, as "culturally constituted foci of information-processing. In these activities lie crucial junctures of events and the social orders that formulate them."[30] Considered as such, public events can be understood as nodes of concentrated, condensed communication; they can be operators of and on social order; not only may they affect social order, they may also, according to Handelman, effect it.[31] Public events appeal to both the cognitive and emotional faculties. In sum, they are, Handelman writes, "devices of praxis that merge horizons of the ideal and the real, to bring into close conjunction ideology and practice, attitude and action."[32] Handelman's theory of public events affords yet another opportunity to take up a tripartite schema. He defines three types of public events - events-that-present, events that re-present, and events-that-model. Events of presentation are those that simply present a version of social order, but one devoid of contradiction or discord. They exclude puzzle, paradox, contradiction, or multiple possibilities. Handelman cites the paradigmatic case of the Nuremberg Rallies of the Nazi party: public events designed to be overwhelming in their mass, magnitude, might on sight, and presence of power.[33]

Events that re-present, on the contrary, are ones in which social realities are brought into comparison and contrast; where versions of social order are juxtaposed, inverted, and re-presented in multiple propositions and counter-propositions. Handelman says that events that re-present are "like multiple or magic mirrors that play with forms of order - that refract multiple visions of the possible."[34] This may no doubt serve as a good description of many forms of artistic performance, but I think that Handelman's notion of events-that-model is the most relevant for an understanding specifically of mixed reality phenomena. Events-that-model are microcosms of the lived-in world, closed systems that operate in parallel with the wider world. Yet this microsystem can come to behave as if it were a whole world for its participants.[35] An event-that-models is purposive, it is a maker of change that is neither haphazard nor aimless. It "contains futures within itself."[36] Additionally, an event-that-models will possess regulative capac-

[30] *Don Handelman, Models and Mirrors: Towards an Anthropology of Public Events, Cambridge University Press, 1990, pp. 76-77.*

[31] *Ibid. 15.*

[32] *Ibid. 16.*

[33] *Ibid. 41-44.*

[34] *Ibid. 49.*

[35] *Ibid. 27.*

[36] *Ibid. 28.*

ities: cybernetic feedback systems that will enable it to monitor its own progression.[37] The event-that-models has "built into itself incompatible, contradictory or conflicting states of existence, and in the course of its working it must overcome, synthesize, or otherwise solve these."[38]

In this sense an event-that-models is intrinsically transformative. Transformation, Handelman writes, requires the introduction of uncertainty into the presumed stability of the phenomenon that is to undergo this radical transformation. This intervention into the very structuring of the cosmos and person may threaten to unleash forces that potentially are subversive or destructive of human and natural orders.[39] Yet, when such forces are set loose within models that are organized in accordance with systemic premises, then transformative work can proceed apace in controlled and predictive ways. 'Uncertainty' is crucial to the logic of events-that-model.[40]

Such uncertainty in events-that-model may be described as liminal. Following Victor Turner, Handelman understands liminality to be "the fluff of indeterminacy in its focused condition"; it is "a medium that is intensively processual: fluid, shifting, vital, and replete with energy; yet without the capacity to stabilize itself."[41] A telltale sign of liminality is the presence of the ludic, which can "spring forth to shatter routinely accepted arrangements."[42] Handelman suggests that play is brought into controlled contexts in events-that-model, and hence in some cases may become a game, in which "the flux of play is harnessed to orders of cosmos and the world."[43] There is no real contradiction here, since even when the result of transformation is the very state of liminality and playfulness per se, this state is achieved in a mixed reality event through very careful background direction and planning which is highly purposive and by no means haphazard or aimless.

Play is an important idea in mixed reality phenomena, as readers of this collection of articles will be aware. By way of conclusion I note Richard Schechner's thoughts on play, which he presents in schematic summary as six templates of "play acts," but which he develops into a far wider, even cosmic vision. Play, Schechner says, creates its own permeable realms and bounds, and that these multiple realities are "slippery, porous, and full of creative lying and deceit."[44] Play is dangerous, and therefore security is needed at the outset of play; but once underway, the risk, danger, and insecurity are part of the thrill of playing.[45] In a cosmic sense, Schechner elaborates on the Indian concept of maya-lila. It will be recalled that maya is this phenomenal creation of appearances. Lila, Schechner notes, is a more ordinary word denoting play, sport, or drama, and is etymologically related to the Latin ludus and through this to the English ludic, illusion, elusive, and so forth.[46] The gods project maya through their lila, cosmic creative play, but so does every sentient being. In the process of creation "maya and lila create, contain, and project each other: like a snake swallowing its own tail," and thus "maya-lila generates a plenitude of performances: interpenetrating, transformable, nonexclusive, porous realities."[47]

[37] *Ibid. 30.*

[38] *Ibid. 30-31.*

[39] *Ibid. 31.*

[40] *Ibid.*

[41] *Ibid. 66.*

[42] *Ibid. 69.*

[43] *Ibid. 71.*

[44] *Richard Schechner, The Future of Ritual: Writings on Culture and Performance, New York: Routledge, 1993, p. 27.*

[45] *Ibid.*

[46] *Ibid. 29.*

[47] *Ibid. 34.*

Concluding Remarks (in lieu of a Conclusion)

This survey has attempted to draw together a few theoretical tools that may lend themselves to an understanding and contextualization of some dimensions of certain kinds of new media productions that have come to be known as "mixed reality." It has, firstly, noted how mixed reality might be seen as an extreme symptom of what Scott Lash calls the global information age, and all that this entails within Lash's polemic. Secondly, in order to offer an alternative to and an indirect critique of Lash's vision, it has attempted to suggest that mixed reality productions have the capacity to "produce" space, quite contrary to Lash's notion of the "flattening" effect that he argues is to be found in the global information society; and the contention that mixed reality environments can generate novel and possibly transformative spaces is backed up through a cursory appraisal of Henri Lefebvre's work. Third, in order to draw such ideas about the production of space into the context of the kind of technology-saturated environments that mixed reality productions typically implement, it has turned to Don Ihde's philosophy of technology to show how various kinds of human-technology relations might be theorised. Fourthly, this survey has tried to bring the preceding considerations - a) the production of space, in large part through b) the modality of human-technology relations - into the context of their most typical domains of cultural expression: public or semi-public events. It has done this by looking at Don Handelman's theory of public event. Following Handelman's emphasis of the central importance of transformation to events-that-model, it has proceeded to note the inseparable connexion existing between liminality and the ludic, and concludes by way of suggesting that the idea of play - for example, in Schechner's use of the cosmogenic notion of maya-lila - allows us to reach into a transcontextual domain the philosophical underpinnings of which perhaps well serving as a credo of sorts for designers of mixed reality productions.

Above all, I must emphasize the caveat that this article should not be seen as offering solutions to any preconceived hypotheses. Its sole intent is to provoke questions, and also, hopefully, some productive frameworks for asking them - which themselves, of course, will hopefully lead to further questions being asked about the most appropriate questions to ask of such slippery, multi-dimensional and multi-modal phenomena mixed reality productions and producers are. From such questions it may or may not in the end be appropriate to devise some tentative hypotheses, which will be the next step of my own research and development in my capacity as an anthropologist of mixed reality.

Cranberry Spinach Salad

Ingredients

1 tablespoon butter
3/4 cup almonds, blanched and slivered
1/2 kg spinach, rinsed and torn into bite-size pieces
1 cup dried cranberries
2 tablespoons toasted sesame seeds
1 tablespoon poppy seeds
1/2 cup white sugar
2 teaspoons minced onion
1/4 teaspoon paprika
1/4 cup white wine vinegar
1/4 cup cider vinegar
1/2 cup vegetable oil

Directions

In a medium saucepan, melt butter over medium heat. Cook and stir almonds in butter until lightly roasted. Remove from heat, and let cool.

In a large bowl, combine the spinach with the roasted almonds and cranberries.

In a medium bowl, whisk together the sesame seeds, poppy seeds, sugar, onion, paprika, white wine vinegar, cider vinegar, and vegetable oil. Toss with spinach just before serving.

Emergent patterns (or poppy seed panna-cotta)

Ingredients

1l of heavy cream
2 vanilla bourbon pods
3 tablespoons of vanilla sugar
5 tablespoons of black poppy seeds
1 lime (for zest and decoration)
gelatine or agar-agar powder (as required for 1l of liquid)
sugar to taste

Preparation

Cut the vanilla beans lengthwise and scoop out the seeds. Mix the seeds with cream, sugar and vanilla sugar in a saucepan. Add the vanilla bean shells and put on a low heat, while constantly stirring until the mixture boils. Take it off the fire, add gelatine/agar-agar, poppy seeds and lime zest. Pour the mixture into dish(es) that can function as moulds. Leave in the fridge for at least 4 hours. Just before serving, take the dish(es) out and put them in warm water (au-bain-marie) for 10-20 seconds. This allows the panna-cotta to detach from the bottom of the dish. Put a flat serving tray on top of the dish and quickly flip them upside down while holding the dish and the serving tray firmly together. The panna-cotta will slowly slide onto the dish and keep its shape. Garnish with thin slices of lime and sprinkle with additional poppy seeds.

DEFYING PHYSICS WORKSHOPS OR HOW TO ENDURE A WEEK IN A CREATIVE PRESSURE COOKER

By FoAM

Mixing realities is a practice still in need of deep investigation and groundbreaking discoveries. Hiding in the gaps between specialised and disciplinary knowledge, inspiring reality mixtures are drawn out by heterogeneous teams of artists, scientists, anthropologists, or even cooks. Several artistic and scientific groups are working out their own approaches, their particular concoctions of technologies and media, shared among the small network of collaborators and sympathisers, but few of these developments are currently accessible to artists with no prior knowledge about the mixed reality field.
Technical issues are often the first barrier to understanding the MR 'how-to'. Presently, there is no single system that an artist can use to mix realities. There are usually arcane brews of hardware and software developed by both multinational corporations and 'one kid in their bedroom'. Finding and mastering all the bits and pieces needed to get the physical and the virtual to converse is not a trivial task...

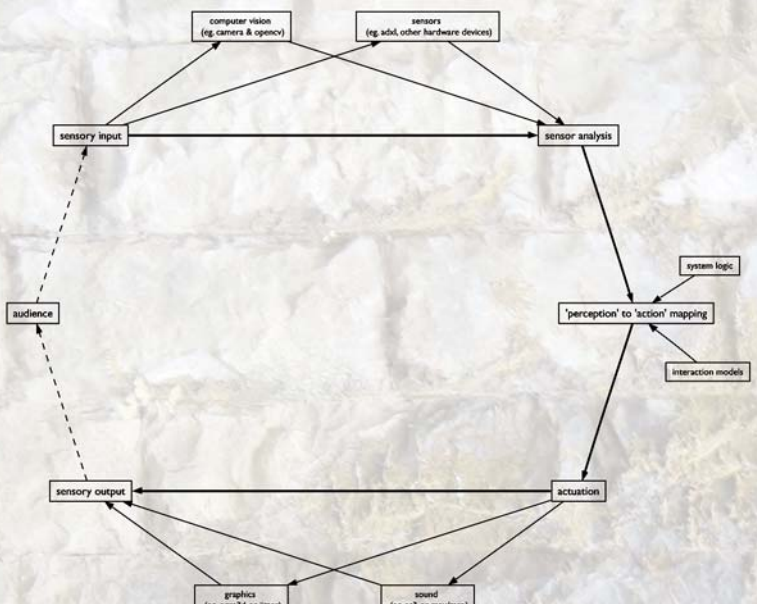


Figure 1. Example MR system driving FoAM's trg environment

Once the initial technological challenges have been met, other complementary skills are required before an artist or engineer can venture into the blender of realities.

Collaborative creation: Taking part in an MR production requires an understanding of multidisciplinary design processes and complex, intricately co-dependent development structures. Open communication, tolerance and assertiveness must become well-balanced skills.

Humility and observation: As a participatory art-form, MR works incorporate a variety of audience-participants (with a range of physical, cultural and psychological characteristics). The apprentice reality-mixers learn to understand the importance of observing people using the environments, for evaluation and subsequent improvements of the systems.

Social interaction: MR works can become both very personal and very social experiences, due to the level of subjective engagement, immersiveness and body-centredness. We have found it crucial to provide casual social spaces in which participants can prepare before entering the worlds, as well as 'de-compress' afterwards.

Philosophical and psychological foundations: Engaging in mixing realities can become a deeply personal and psychologically disturbing endeavour. By meddling with the assumptions we make about reality, we necessarily confront our own cultural biases about perception and interpretation of what is'real'. These biases will consciously or unconsciously seep into the worlds we make for ourselves and others to dwell within. It is important to grasp what we understand as reality (or what we want it to be), in order to allow other visions and stories to become a part of ours.

TRG has been a significant part of a continuous learning process, which started long before and will continue into the future. Since we are interested in sharing information and experiences with a wider circle of practitioners, we decided to test some of our hypothesis in two hands-on workshops.

FoAM designed and organised two workshops, as a part of ".x-med-k." - a broader series of workshops on experimental media, organised in collaboration with Nadine (http://www.nadine.be) and 0kn0 (http://www.okno.be) from Brussels. The following pages look back at the methods used during the workshops, with the aim of drawing attention to the plethora of entangled technologies used in mixing realities, as well as the social and professional skills that collaborative productions demand. The following text is woven through with excerpts from radio interviews with two of the workshop coordinators, Julian Oliver and Yon Visell. Julian's focus on free software by and for artists introduced the possibilities of toolsets that can become a part of the creative process. Yon's interest in human and machinic perception, as well as embodiment of these perceptions in mixed

reality environments added subtlety and theoretical foundations for several experiments during and after the workshop.

Yon: The way that we work is treating these environments as serious experiments. This is probably appropriate in terms of acknowledging the lack of good tools for really designing things and creating in space, as well as the amount of time that's involved in really constructing your vision.

Learning and Unlearning in .x-med-k.

The first workshop 'Defying Physics' was coordinated by Julian Oliver, Nik Gaffney and Maja Kuzmanovic. The applied part of the workshop involved developing a virtual environment that could respond to physical movement in real time. With this focus, the workshop was primarily exploring the field of augmented virtuality. Facilitating the second workshop 'Responsive Environments' were Yon Visell, Nik Gaffney, Lina Kusaite and Maja Kuzmanovic. This workshop involved 2 groups each designing a prototype for a responsive environment, with an equal mixture of real and virtual, thereby focusing on the field of 'hybrid reality'.

Yon: I think it's quite different to some of the other workshops which are targeting more specific technologies, because our domain was really in terms of how things can respond to you, what are the qualities of sensing, of responding and of changes that you can make to the surroundings.

Both workshops were composed of hands-on sessions, targeted towards development of small, experimental prototypes. They provided an opportunity to solidify the participants' knowledge, while learning additional techniques particular to mixed reality technologies. The sessions were designed to encourage team-work and the sharing of skills and knowledge between the workshop leaders and the participants, but most importantly between the participants themselves.

Yon: That was the idea - to get people involved in it, talk a little about it and see once we mixed them all up, what they would come up with. We were the ones who provided the participants with the tools, but also words, thoughts and imagery, that have mixed with their own experiences and influenced whatever they were doing.

By situating the workshops within the context of TRG, the participants had a chance to become a part of some of the discussions concerning the conceptual, aesthetic and technological decisions that were relevant to both the prototypes developed during the workshops, as well as the larger scale environments constructed within TRG. The media technologies used in the workshops ranged from general-purpose free software, to specialised and experimental applications developed specifically for TRG.

Defying Physics: MR media worlds

Julian: I'd like to be able to take pretty much anyone with minimum computer experience and turn them into quite a competent developer.

The Defying Physics workshop was organised in July 2004, in Château de Halloy in the picturesque Ardennes region in the south-east of Belgium. During the workshop we wanted to play with responsive media worlds able to change their behaviour based on the input from the physical world (such as physical movement, biometric, geological, astronomical or other data). The workshop involved a combination of artistic presentations and screenings, free-form design sessions, discussions, concentrated tutorials and hands-on development.

During an intensive 9 day workshop, the participants worked in an interdisciplinary team to design a media world using the site of Halloy both as the source of inspiration and the reality in which the media would be 'mixed'. In a process where learning and applying the knowledge occurred often in parallel, the participants were exposed to different methods used in collaborative, site-specific concept development and design.

The workshop started on a Saturday morning, while sipping coffee and learning about the site from its history and legends, as revealed to us by local historian Leon Descy. A more personal atmosphere of the site was soaked up during a psychogeographic drift, after which we engaged in the making of subjective maps and trajectories. Through this simple low-tech excercise everyone became acquainted with each other's interests, perceptions and ways of visualising the experience of navigating through an unknown territory. During this process, a rich collection of raw materials, visual impressions and sound recordings was gathered, that were later used for textures and samples in the media world. The challenge began when we attempted to visualise the surrounding in collective mind-maps and conceptual diagrams. These techniques helped us reach a collective vision of what a 'virtual extension' of the site might look, sound and feel like. Compressed into 2 days, many common behavioural patterns of collaborative design came to the fore: from dominant and

Figure 2:
From concept to implementation

over-ambitious visions, to the resignation of 'let's just make it work'. And to increase the pressure, the group had to go through the painful process of reducing an ideal design to a feasible implementation in less than a week...

After 2 days of designing the imaginary extension to Halloy on paper, the participants became acquainted with the principles and practicalities of 'mixed reality' systems.In this process, they were introduced to open source media tools such as:

- Blender, a software package used for developing 3d graphics and animation
- nebula / fijuuu, a game engine with a custom extension for audiovisual performances
- PD, a realtime visual programming environment for audio, video and graphics
- Audacity, an application used for audio editing
- Gimp, an application for still image editing an manipulation, equivalent to Photoshop.

Julian: We were looking at free software tools specifically for artists. There is enough energy there, enough demand.

The choice of open source tools was a conscious decision to introduce the artists to the idea that 'production quality' software can be used legally without necessarily requiring financial investment. Moreover, such software can be further developed by the artists themselves (or by their more technologically skilled collaborators), if they want to add or change particular functionality. During many discussions it became apparent that the participants preferred using a mixture of open and closed source tools. By comparing proprietary software (such as Max/MSP and Jitter, Photoshop, Maya etc.) with the freshly learned Blender, PD and Gimp, most people came to the conclusion that it would be worthwhile to invest time in learning software that was not burdened by proprietary licenses and high cost.

Julian: It's a case of who defines our practice and who defines the shape of our output. This is not asking that everyone becomes a programmer, but everyone can have some influence (or the possibility of influence at least) to produce an alternative studio, a studio that better suits our needs.

In order to put their knowledge into practice, the participants were given the task of translating their site-specific concepts into an implementation of a simple prototype for a media world. The participants used a mixture of systems, with which they had a range experience with - mainly Blender, PD, nebula, Gimp, Max/MSP and Final Cut Pro, as well as OZ, FoAM's custom developed system for acquiring sensor data from the 'real world'. The 'tangible' outcome of the workshop was a prototype media environment, designed as an infinite cave. Its walls were constructed from computational equivalents stone, fallen branches and mud, sedimented with fragments of natural and cultural detritus. The players entering the cave would hover, drift and spin through the dark space, attracting a swarm of fireflies by exploring the contents of the cave. Fast and energetic movements would send the fireflies buzzing to the far sides of the cave, allowing for a few seconds of undisturbed exploration, after which the flies flew around the player's viewpoint again. The players wore a small computer, with sensors able to measure particular qualities of movement, which was translated in real-time to the orientation of the 'cave' and the dispersion of the 'fireflies'. This little world was projected onto a semi transparent screen stretched across one of the old passages between the main château and the garden. Later on we experimented projecting on the walls of the buildings, on the white clothing of the participants, who decided to become moving, flexible screens.

Figure 3: Experiencing the worlds

The workshop leaders wore many hats as the week progressed - sometimes as tutors of particular software, other times co-developers, other times facilitating social events and movie screenings, as well as gathering food in the nearby woods and catering for the group. The fact that the workshop was taking place in a remote location, meant that the participants and leaders were working together, as well as sharing food and accommodation, mixing learning and socialising.

The discussions and development continued sometimes throughout the night, as the whole atmosphere was devoted to collaboration and learning. However, even though the workshop did not have the pressure of a public outcome, the process evolved in an intense way, through the typical curves of collaborative design which were compressed into the space of a few days:

- from creative drive and energetic motivation to frustration with limitations of technology, to seeing these limitations as a way to focus the artistic visions;
- from a visionary concept to a focused, but extremely limited implementation, emphasising the importance of functional sketches;
- from exhilarated ideas to cross-disciplinary disagreements, which

lead to a wider understanding of the approaches involved;
- from resolution to despair when confronted with technological challenges, to appreciating the value of improvised solutions and compromises;

This process culminated in a presentation of the prototype, which was a humorous and entertaining social 'event'. The workshop finished with the freshly invented game of 'blow-ball', played until the last evening had become early morning, after many courses of barbecued delights had been long digested.

Figure 4: Blowball

Responsive Environments

Yon: Responsivity is a kind of subset of interaction that moves away from normal human computer interaction to more interesting things involving the movements of the body and things like that.... retrospectively the aim was to take a bunch of artists who are interested in the topic and all together think about the possibilities for responsive environments in an artistic sense.

The workshop was held at the FoAM lab in Brussels, in November 2004. Following the legacy of the Defying Physics workshop, Responsive Environments was geared towards expanding the participants' knowledge of the hybrid reality field. The hands-on sessions were setup to solidify and bring together newly acquired technical abilities with the artists' professional knowledge, encouraging the application of old and new skills in a collaborative process.

Yon: I'm not sure what we taught them. I think you always learn something by being able to observe such a situation. For me it's really fascinating to observe the participants working together and negotiating about their project. It was great watching what people come up with in terms of composing their own constraints and how they conceive of something which has to be concrete. I think a lot of their time they spent cutting their ideas down

into something they can work with in terms of techniques, or working with things like sensing.
The more concrete part of what I talked about was really not a survey but a kind of pointillistic description of different ways of sensing movement, especially in terms of continuous responsivity or change.

The workshop began with lectures, artistic presentations and technical demonstrations, followed by the collaborative design and implementation of 2 prototype responsive environments. To complete the development process, the participants choreographed semi-public usability-testing sessions, based on FoAM's ethnographic methodology used in TRG and other projects. In order to follow this ambitious path in a flexible and productive way, the group had to commit to a process of collaboration, enabling each participant to have enough space for individual contribution and responsibility, while working towards a shared vision. Everyone was there to learn about working in heterogeneous groups, with people of varying levels of technical knowledge, thereby understanding the complexity of making rich, interactive artworks, where nothing is 'a mere matter of implementation'.

The workshop coordinators set 5 ground rules, to ensure sufficient freedom for exploration, while keeping the group focused on the tasks at hand. The 5 guidelines for 'open-space' collaborative workshops (used for conflict resolution and problem solving in large groups) seemed to be most applicable:

- whoever is present, they are the right people for the project at hand (design a project around the people and their skills, rather than pressing requirements on people without the appropriate skills)
- whenever a process starts, it is the right time (even if it starts on the last day)
- whatever happens, it is the only thing that could have happened (no regrets)
- when it's over, it's over (if anyone does not feel comfortable, interested or motivated, it is OK to leave)
- do what you need to do, and go where you need to go, but don't waste time (everyone is responsible for their own quality of work and experience).

The workshop began with an overview of the field of mixed reality (together with its artistic applications), along with more theoretical discussions about the processes and technologies involved in sensing and perception.

Yon: For me what is important are not the distinctions between individual senses, like sound versus vision, because the ways we perceive the world around us and the ways we interact with it aren't based on one sense. Something like a microphone has a tangible, visual experience and then touching it and hearing it are other important aspects of this object and it's not possible to

separate them completely and to preserve its 'nature'. I feel that it's not in the nature of the world to talk about the senses in a divided way. There are lots of correlations to that idea in perception and they haven't been really reflected in engineering, but it's an interesting emerging field.

Specific attention was paid to the methods of translating actions in the physical world (such as movement, speech, breathing, etc.) into data able to be used to shape generative sound and graphics. The workshop was targeted towards learning about various approaches to interaction, and responsivity, exploring the interfaces between the physical and digital worlds. Interaction focused on co-construction was a basic principle used to describe three aspects of the process: first, the relationship within the collaborative teams, second, between team and the public, and most importantly, between different technologies and media. In terms of technology, the workshop leaders paid extensive attention to the link between the hardware used for input from the physical world (sensors, cameras, single board computers and PIC-chips) and software used to generate responsive media output (mainly Max/MSP and PD). Processes of sensing, perception and translation of 'real-world' information into digital media were discussed at length, followed by a technical demonstration of methods for sensor-data analysis in software. These demonstrations were focused on technologies that the participants could use later in the week to develop their prototype environments.

Yon: ... when it comes down to the engineering part of it, it is easy to explain the sensing technologies, because then you can say - Here is the sensor and this is what you can do with it, this is how it works, this is how to get it to do something very simple and controlled.

In order to to link the workshop with the TRG project through conceptual topics, as well as technology, four themes were chosen to guide the design and development of the prototypes: recycling, force, tuning and (dis)integration. On the first day, the participants were given a 'homework' assignment, which involved bringing textual, visual and sonic material associated

Figure 5: Excerpts of the mindmap

with one or more of these themes. On the second day, a mind-map was made, using these materials. The participants then separated into two groups, each of which focused on translating a section of the mind-map into a design for a responsive environment.

For the next four days, the groups were designing, redesigning and implementing their visions, shaping them into the two prototypes. The process involved

- agreeing on a concept,
- translating the concept into a feasible design,
- dividing the tasks
- working on the different components individually
- integrating the components
- calibrating the media output
- testing the prototype
- improving the design
- removing the errors and bugs
- testing again (as long as time permits)
- presenting the results
- evaluation.

Yon: You perceive the environment, you understand the relations of things there, you process it, say what is moving, what is there. But then the environment itself becomes an intimate part of your perception about it. Because the mind really isn't very good at keeping an abstract count or keeping track of what is going on in space and so the space is always a representation for this kind of processing that goes on. The most important thing is that the space acts as a kind of memory for itself because the mind is not very good at remembering the huge amount of rich details that are present in the world. So that presence in the world is crucial for its own remembrance. You can extend that idea to things like different mental processes. This is interesting for active/responsive space, regarding the way that spaces are already activated by the mind. In a sense responsive environments are already a domain in which much of the thought and imagination take place. When you think of imposing some other active system on top of that, there is a negotiation that takes place and complex relationship between what is real and what isn't.

Even though the participants were aware of the tight timeline, the design and discussion process lasted for several days, with the implementation being left until the last moment. On the last day (according to schedule), the development process was abruptly stopped in the early afternoon, when the participants experienced the horror of a 'feature-freeze' instituted by the workshop coordinators. Feature-freeze is a well known term in software design, meaning that no additional features can be added after a particular moment in time - 'what's done is done'. The only thing that can still be worked on is the very important, but often neglected calibration between the different components of the system and bug-fixes. This was the moment when all media and materials had

to come together, resulting in a coherent interactive experience. As in any production, the first attempt at calibration is always difficult. For example, some parts of the software didn't want to communicate with each other, or connecting the sensor input to the media system caused unpredicted effects to disrupt the carefully composed visual output. Some feedback loops simply didn't want to loop. These problems required swift improvisations which gave the environments the appearance of coherent entities, but made them fragile and quite prone to crashes. Even though there were a few minor glitches, the installations were functioning for an entire evening.

Yon: ...you are seeing results, you are experiencing results that aren't what you anticipated and it gets fed back into refining whatever it is you are trying to do.

Two curious prototype environments were presented. One of them was a meditative space, where the rhythm and the volume of breathing was translated into an escalating response in visuals and sound (to the point of 'ze big bang' when the experience was explosively reset to the beginning). The creators wanted to convey an experience in which 'inactivity does not mean passivity'. This meant that the interaction was designed around unconscious human actions, such as breathing, blinking and the beating of the heart.

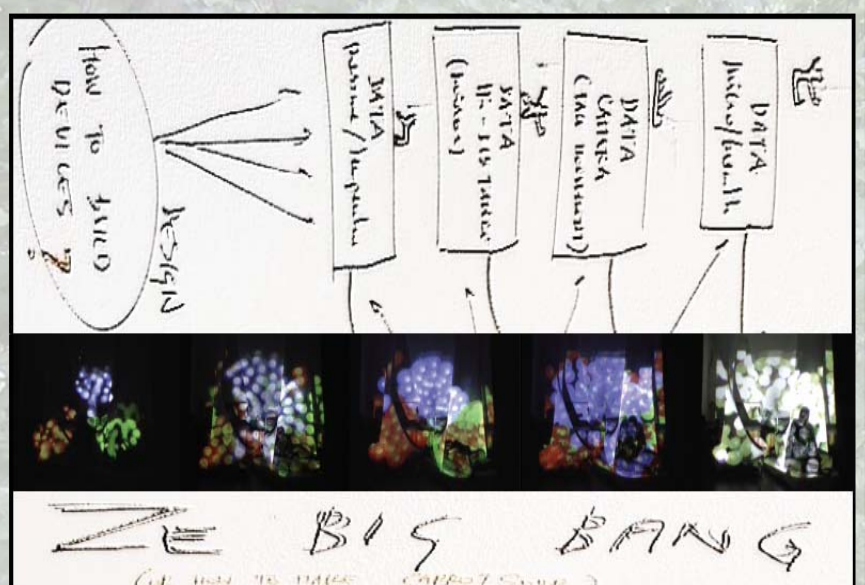


Figure 6: Diagrams for Ze Big Bang

Yon: Your mind is in the space. The space is the place to experiment and play. In addition to being vibrant and physical, play can also be a deeply cognitive process.

The environment was designed for three players at a time, laying on mattresses, surrounded by a slow, stretched-out sound-scape and curved, semi transparent screens, on which the breath became visible as a play of multi-coloured boids.

Yon: One group worked with breath sensors. There were two different kinds of breath sensors used in the workshop. One was connected to the movements of your chest and the other to the volume and frequency of your breath. The other group worked on visually tracking movements on a kind of cushion that they put together within a soft cylindrical space.

The other prototype was designed for more active players. The group wanted to amplify the varying motions of people's sitting behaviour. The installation consisted of a stretched fabric cocoon, able to function both as the input interface and a projection screen. It was designed for one participant at a time, whose movements were amplified and processed to become an abstract audiovisual environment.

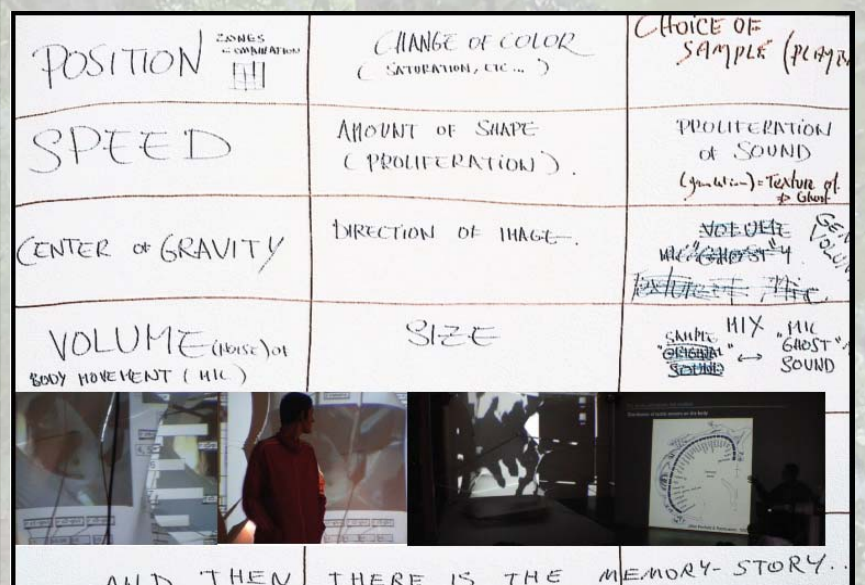


Figure 7: Diagrams for the Cocoon

Ethnomethodology

The workshop was designed to stress the importance of prototyping and testing, to the point of involving the audience in the development process. Two of the participants (one per group) were introduced to different methods of usability testing. The most appropriate for the installations at hand was the 'ethnomethodological' approach to testing human-computer-interaction - looking at the ways in which people make sense of their actions in a social setting. The participants designed the procedures according to which the two groups would test each other's installations, in order to learn how the installations were used and how closely this followed the design (or diverged from it). The two 'ethnomethodologists' had their hands full with notes, cameras and most difficult of all - an impatient audience.

Yon: Well, we can influence participants' perception. You can't control people's behaviour and it's actually difficult to communicate to people that you truly don't want to control their behaviour. It's maybe one of the challenges that you are trying to design without constraining people to a narrative. So you need a more sophisticated methodology actually to evaluate... once you got it open to the public you should observe what people do and try to understand what's interesting there. I mean it's a little bit weird that way because it's like positioning yourself relative to the experiment and this work should not be an experiment on people. They shouldn't be just lab rats...

Several people passed through the installations and it gradually became more apparent just how different the players' experiences were from the intentions of the developers. These findings pointed out that even if the design and implementation process happen smoothly, testing these systems and artworks in public situations can provide valuable feedback. In a professional production process, there would be the possibility of improving the experience based on this feedback, but the time for such iterative design and development process usually takes months, if not years. However, the participants learned a methodology they would be able to apply as part of their own productions, over longer time-scales.

The things we learned and the things we didn't...

Julian: the thing I learn the most by giving workshops is to come up with better analogies, better ways of describing abstract concepts.

The workshops were intense and productive while they lasted. How much impact they had on the participants' practice remains to be seen in their future works. Many new friendships and collaboration plans were established, which could be seen as a measure of success. However, as the setup of the workshops was quite experimental, there are many things that could still be improved.

Learning from each other's mistakes has proven to be valuable for both the organisers and the participants of the workshops. Each of us has had fresh insights and suggestions for future developments, both in terms of educational approaches and the subjects that we want to learn more about. A common thread was a wish to dig deeper into the 'stuff' that makes reality so compelling. In future workshps, we are planning to change scales and look at the constituent elements and fundamental principles of the different realities we want to mix. Before venturing into spaces on a human scale again, we will observe and dissect the methods and materials that can make smoother, stickier reality emulsions.

Yon: I feel like in the amount of time we had for the workshop, you barely have time to begin understanding each other. So I think that I should have spent more time communicating about things and making things and seeing what you can put together out of whatever you can find. And experiment on each other and yourself and discover the connections that are possible. Maybe next time...

DATA ECOLOGIES

Tim Boykett

The Data Ecologies Workshop was convened for two days in May 2005, dealing in various ways with the ideas of Digital Physics and several related concepts. Digital Physics is the general name given to a swathe of theories that attempt to explain our physical universe as some kind of digital process: cellular automata, self-modifying graph structures, defect systems and suchlike. We were interested for several reasons. On one level, we (the partners in the TRG project) were using physical metaphors for our projects, which are also highly computational. However a second swathe of ideas were more important. We are in the business of creating realities that are somehow the same, yet somehow distinct from our common reality. The field of Digital Physics seems to offer some inroads here: they are talking about ways in which digital processes can create a world exactly like our own, down to the level of quantum strangeness. Perhaps some of the concerns that they had would be of relevence to our problems in the creation of transient realities.

It was a welcome surprise that the speakers and attendees were so flexible in their approaches and in the ideas that they brought with them, that we were able to get well outside the original scope of the discussion and into a realm that touched on a lot more areas of interest than we expected.

The speakers included the following:

Ed Fredkin has been a ground breaking computer scientist since the 1950s, Professor at MIT and Carnegie Mellon University as well as responsible for some fundamental breakthroughs in the field of reversible computation.

Tom Toffoli is Professor of Computer Science at Boston University. His work with the physics of computation, including the series of conferences in the 1990s, has been fundamental in establishing and demonstrating that many physical effects might just be side effects of computational or general process phenomena.

Jürgen Schmidhuber has been applying the work of Gödel and Zuse to problems in general computation and artificial intelligence. He is based at the IDSIA laboratories in southern Switzerland. He also managed to show that he can clown well with a pole balanced on his forehead.

Karl Svozil is a Professor of theoretical physics in Vienna. Not only has he been active in the field of Digital Physics as a researcher, but he has a strong background in the philosophical history of Digital Physics, as well as being an active participant in contemporary art practice. A long term interest has been the theory of the Intrinsic Observer, which came to be very important during the workshop.

Hartwig Thim is emeritus Professor of experimental physics at the Johannes-Kepler University in Linz. He has been carrying out experiments with microwaves that raise the possibility of a preferred frame of reference for our universe.

Daniel Miller is a research associate at Carnegie Mellon University (West). He has been responsible for the development, with Ed Fredkin, of the details of their SALT model for computational physics, as well as being involved in the production of bands ranging from De La Soul to the Butthole Surfers.

Nik Gaffney is a founding member of FoAM as well as a musician, graphic-designer and autodidact para-academic. His projects and interests range from evolutionary aesthetics through to theories of mind and consciousness.

A broad spectrum of attendees including students from the local Arts University, practitioners from Prague and members of the local community, as well as several online participants made the discussions inspiring and very multifacetted.

For the remainder of this article, I will attempt to summarise some aspects of the talks given and the ensuing discussions. This should lay some of the ground-work that might help in reading the papers included here, as well as other papers that the reader might find when following up on these ideas. The flow is sometimes a little forced, or even broken: in the raging torrents of discussion there were many points that were jumped over or returned to from other directions. I can only hope for the reader's sympathy and a little bit of effort to skip around. It was hard work during the discussions, too!

Games and Worlds

Dan Miller explained one of his motivations for his work as originating in the early computer games he played way back. Why couldn't he drive off the road, why couldn't he update his car, why did someone have to program the amount of speed one needed to knock a wall over and then prerecord the sequence of it falling over? It should be possible to build worlds rather than define them, or perhaps even growing ("Grow your own world" is a FoAM slogan) them will be the way.

In current virtual space and game environments, the world is made up of a number of objects: players, vehicles, weapons, soda cans. These objects have properties and ways to interact - each property and interaction has to be defined and coded for, every possibility has to be planned, there cannot be any surprises. This is in conflict with the world in which we live, which is made of small things (atoms and such particles) stuck together into larger and larger things. The properties of the larger things arise from the properties of the smaller things, collected over a volume; the interactions of the larger things arise from the interactions of the parts. There are

surprises. Once all the basic laws are defined, in a so-called Theory of Everything (TOE), the properties of the rest of the world can be derived as they derive from the properties of the smallest parts.

Digital Physics is not proposing that the world is a simulation of things (e.g. The Matrix), rather that the smallest things in the world are not particles of some sort, but actually digital things. The Big Question, the sought after TOE of Digital Physics, is to find what sort of digital process(es) could produce (something like) our universe. Cellular Automata are a very popular class of examples and have been investigated considerably, the monad theory of Cahill is a very different type of theory that also shows much promise. More arcane theories use noncommutative geometry, propositional calculus or any of a number of more or less complex theoretical bases.

A very much simpler question is the determination of digital systems that give rise to dynamics somewhat like that which we know from our world. This is not only relevant for building game and play systems. As we begin to determine what kinds of properties digital systems need to have in order to provide a basis from which we may be able to obtain something like our world, we begin to determine the properties that the digital physics TOE might have. This helps us get closer to finding it. Or closer to finding at least one possible TOE - there may well be many possible theories.

The determination of digital systems is probably not enough: it is highly unlikely that the system itself is readily perceivable as something that we would recognise as being similar to our universe. It is the process of representation to our senses that also needs to be taken into account; how do we perceive the objects in the digital space and how do we perceive their dynamics? What is the space that we perceive them moving inside of? If there arises a space, how do we define our position within that space, what are the properties of distance and interaction that need to be taken into account? One aspect of this problem has been addressed by David Chalmers in another context (obervers, experience, qualia) and will be discussed below. Another significant problem raises its head here, a problem that has been discussed by Julie Tolmie amongst others. A representation of a system or a state (a "zustand") is often taken to be "an artist's impression" and is often quite invigorating and suggestive, inspirational and even quite clear. However such impressions are, of course, mere impressions. The extra information that can be supplied by "the artist" in the process of creating the impression can add far more to a system's representation than is actually there. A detailed discussion of this topic is beyond the confines of this article, but the outline can be seen as follows. A system can be seen as a collection of data: time series, relations, etc. A representation of this system is a mapping from this data set to some more "intuitive" data set, for instance (moving) images or sound. The hard part of the representation problem is to choose the right aspects (structures) in the original data set that need to be carried across and which structures need to be ignored. The exactness of the mapping

is also an issue; a loss of exactness can support (or distort) understanding significantly. One extreme is an exact mapping where the exact details of the original dataset can be obtained from the representation, where no real interpretation has taken place. Such representations are clear, yet carry (perhaps) no understanding. The other extreme is perhaps best seen in the stochastic composition techniques of John Cage and many others. The structure of the dataset is completely ignored, it is treated as a random number generator that is then used to make certain aesthetic decisions in a composition. The talent of the composer in such a piece is to build the mapping in such a way that all possible data sets, ignoring internal structure, lead to compositions that sound "good" - this is the artistry and talent of the composer. Such a representation transmits no structural information of the data set; no understanding can be derived. These two extremes are problematic, thus Tolmie and others claim that for formal systems, representations have to be far more formal; an artist's impression is a dangerous thing, possibly breaking understanding rather than supporting it and covering up important structure with the (broad) brushstroke of personal aesthetics.

Theory of Everything Else

Nik Gaffney turned several conversations on their head when he presented another take on the ideas of physics and other sciences. He stated that FoAM's main concern lies in looking at, or for, a Theory of Everything Else (TOEE). In contrast to a TOE, a TOEE would look at the world, see which bits were explained, at least in part, by some current scientific theory, then look for some theories to describe, analyse or otherwise play with everything else. Many of these phenomena are everyday, or at least possible every day: heightened awareness, qualia, flow, co-inspiration, comprehension, intuition, play. How to think and talk about these things? How to build spaces for experiments in playfulness, as opposed to experiments in hadron collisions?

But this begins to fall back into the last paragraph of the last section: perception, control, understanding of systems that may or may not belong to a TOE. When we build a system as we decide it, argues Toffoli, we know everything about that system. We can claim to understand it, at the deepest level: we built the dynamics. We have the TOE for that system. However, perhaps we do not understand the system as such, perhaps we have knowledge about it, but no wisdom, perhaps we can explain everything that happens as a microscopic level but cannot explain why it acts in certain ways when we play with it in certain ways. There are surprises. This is where the value of a TOEE might lie - learning ways to talk about systems where we know the microscopic details, but do not understand the large scale dynamics. How do we take this system, defined technically and exactly in some formal description language and make it intelligible, able to be interacted with? Here we are dealing with perception and play, inspiration of why one should bother to play with the system, why this toy is more fun than some other toy.

Perhaps the toy is the representation theory of groups, homology theory, or chess; perhaps it is the Leary-Wilson theory of brain circuits or the evolutionary ideas of Dennett or Dawkins; perhaps it is the cooking style of the Incas. Without inspiration, an understanding of interaction (herbs with spices, rooks with pawns) and a representation (a language, whether verbal, visual or acoustic), all these fields remain closed.

Jürgen Schmidhuber has another take on the TOE. Akin to Hassan i-Sabbah's reputed last statement "Nothing is true, Everything is permitted", Schmidhuber's conjecture proclaims "Everything happens." This literal theory of everything then talks about how various correlations between all possible possibilities lead to some kind of consensus and some kind of basis of things being more or less likely. Not Everett's Many Worlds Interpretation of quantum physics, but an Every Possible World Interpretation. This is one of the more peculiar theories floating around these days. One interesting aspect of such a theory, where there is nothing assumed other than some kind of computational background in which all the possibilities are played out, is that space, time, matter and all things are mere epiphenomena. Three-, seven- or ten-dimensionality does not need to be assumed or conjectured; it may or may not arise, that is all. Everything is permitted. And because there is always some world where any given statement is false; Nothing is true.

What is a Physicist?

This question seemed to plague the speakers and attendees. Toffoli introduced the claim that physicists are accountants - keeping track of all sorts of details, the conservation laws on motion and matter, energy, charge and momentum. The inverse claim could be made too: that accountants are physicists. This claim might work for so-called "forensic" accountants, those who investigate the books of companies, such as Enron, whose accounting rules (the laws of physics) are distinct from those that most accountants know. The forensic accountant then starts to investigate the evidence and to develop theories of money flow and the gravitational effects of certain bodies. This process is not unlike that of a physicist or other scientist investigating some new phenomena; perhaps the accountant can then explain the alchemical sleight of hand that leads to certain members of the board transforming lead into gold.

However this claim that physicists are accountants was adapted by Karl Svozil who claimed that physicists are, or at least want to be, shamans, capable of reprogramming the structure of our universe. Perhaps he was imagining the alchemical impulse, perhaps he was visualising the desire to get to the bottom of things. That the physicist wants to dive into the subtleties of our universe, to get lost in the machinery, to come back with some strange new gem of understanding, some trick to keep the tribe, or at least the funders of research, in awe.

A third claim is made by Reg Cahill in his paper; he imagines the physicist as an engineer. This is somewhat similar to Svozil's claim of physics shamanism, but it seems that Cahill's approach is more aimed towards the creation of strange things and the understanding of that process (engineering) as opposed to the creation of wonder (shamanism). But perhaps I am reading too much into these words.

Reference Frames

Over a century ago, Michelson and Morley attempted to measure the speed of the ether that was believed to permeate all of space. Their famous null result is taken to be one of the cornerstones of relativity theory: there is no ether, thus there is no prefererred reference frame, thus relativity holds. Then the theory predicts Lorentz effects, these are observed and relativity is accepted. All is well that ends well.

Several of our speakers and some others have something to say about this. Tom Toffoli described a scenario of a flock of sheep and a shepherd, and explained the way that the shepherd can notice relativistic effects in the movement of the flock. Lorentz effects are known to be a simple corollary of a theorem of Aleksandrov, which Karl Svozil was surprised to learn from some geometrical mathematician friends. There can be a preferred reference frame, or not; it just doesn't matter. Specific relativistic effects have been investigated by Hartwig Thim and colleagues, and have not been found. In particular a rotational Doppler effect should be observed and is not. The original results of Michelson and Morley have been reinvestigated by Reg Cahill and he has found that not only was their null result not quite so, but that a number of extra features of their data are also quite unusual and can be possibly explained using his "inflow" model of quantum foam. Ed Fredkin attempted to find evidence for anisotropy (evidence of a preferred frame) in the data sets from some high energy colliders: the supply of data was blocked for political reasons (this kind of research is just not allowed). Finally Dan Miller gave a wonderfully entertaining explanation of relativistic effects using the computer game Pong.

It would seem that the status quo claims that preferred reference frames do not exist, are not allowed to exist, and anybody who mentions them is (perceived as) a bit peculiar. However it seems that a preferred reference frame is not a problem in itself. There is nothing standing in the way of a TOE that requires a preferred reference frame, as do cellular automaton models. Ed Fredkin went so far as to challenge anybody to come up with an interactive system without a (preferred) reference frame. With the general tendency towards cellular automaton models and geometrical simulation, this seems hard, but a theory like that of Reg Cahill, based as it is upon Wheeler's ideas of pregeometry, or the theories of Summhammer, where space emerges from dataflow, require no given metric or frame of reference; it creates the geometrical structures it "needs" from the evolution of its relational structure. Such a system could be the sort of structure that will meet Fredkin's challenge.

Implementation Issues explain Quantum Computation?

The speed of light makes sense in an implementor's view of a digital universe. Given that there are only so many things within a certain distance, the programmer need only take account of those things that are close enough to be effected by a local event. There is a vast positive computational effect here. This is a problem with models such as Cahill's which have locality emerge as a property of the system rather than a given. Because all monads in his universe are connected, even if only very loosely, then every effect is felt everywhere. In fact Cahill's model, using the inversion of matrices whose dimension matches the number of particles in the universe, is computationally insane: building simulations of nontrivial worlds is impossible. On the other hand, such models point to a possible explanation for the power of quantum computation. If the universe is, in fact doing a lot more computation that it appears to be, or than would be reasonable to perform to simulate what is (apparently) happening, then perhaps we can get to use some of that excess computational power by setting up the right sort of quantum situations.

Many discussions touched upon the questions of how a deity, the universal programmer, may or may not have gone about building our universe as a computational system. Such arguments resonate badly with one's evolutionary heart, yet the arguments are based upon a solid basis: in some sense a computational Occam's Razor. From a world-builder's point of view, such arguments are even more reasonable; we are playing god to a certain extent, building worlds, "so we may as well get good at it."

The Intrinsic Observer

The various theories of intrinsic observers in physics were raised repeatedly. It seems that the original paper in this field was published in 1978 by Tom Toffoli, who happened to be present at this meeting. His work was picked up by Karl Svozil, who has written a lot about it. This ideas was talked about a lot in the early 1990s when the ideas of perception in virtual spaces were being discussed more intensely. The field of Endophysics is largely dormant, the concept of the intrinsic observer still receives some use in contemporary physics. The application of this field to perception and action in virtual realities, a strong theme in the early 1990s, seems to have been disregarded, although echoes continue (Diebner et al, 2000).

The theories of the intrinsic observer let us talk about the observational or knowledge possibilities of an observer who can interact with a system but who changes that system in the process of perceiving it.

The physical background from this theory comes from quantum observation problems (the Heisenberg principle) and was the basis for many early developments in automata theory (Moore). In fact, it has been shown that many of

the strange properties of quantum systems can be built using discrete automata theory models (Svozil).

David Chalmers has integrated some of these ideas into his prototheory of consciousness. In Chapter 8.5 of "The Conscious Mind" he discusses various ideas around the field of digital or informational physics and how physics and experience might interrelate. In particular the ideas of physics being, at its bottom level, an informational process (an idea related to, but not identical to that of Digital Physics) with the only thing that "really exists" being information. He summarises his approach with the maxim "Physics is information from the outside; Experience is information from the inside." Chalmers' main thread in "The Conscious Mind" is his insistence that qualia (the elements of experience) are real things which are not logically supervenable upon physical facts. He goes so far as to envision a theory of experience as a separate aspect of reality, arguing that at the middle of the 19th century the theory of electromagnetism was as unimaginable as a theory of experience is today. This kind of radical technological dualism is diametrically opposed to the theories of neurologists and philosophers of consciousness such as Daniel Dennett, who are materialists in the sense that they deny anything other than material and processes: all aspects of consciousness are phenomena arising only from the interplay of physical material. Regardless of which particular camp one would like to fight with, it is nevertheless the case that the actions of players in virtual or mixed reality (MR) environments are well-described as a kind of dualism, and that the resulting theories of dualism might be very useful in the understanding of experience in MR environments.

As we are interested in digital systems with which the player can interact, with actions in the space and perceptions of that space, where these actions change the content of the space, we are interested in what parallels can be drawn between MR experience, dualist theories of cognition and the intrinsic observer and what these might mean for the field of mixed reality research. What sort of properties do we need to implement in a system so that enough information can be transferred to the player through their actions and perceptions? How do we take advantage of the player's physical experience and physically-based perceptual systems in order to convey the virtual space most effectively? How do we model a player's level of understanding or knowledge about a system's inner functionality? How can we provide levels of information that are appropriate for a given player's level of understanding? What effects in, and aspects of, the MR space will lead to body awareness falling into a state of automation, so that the entire experience of the player is within the MR world and their body is a transparent interface to that world?

This field has a lot to do with the general problem of modelling and describing large scale interactive systems. One of the goals of a related project Qfwfq/VAPOUR (as currently proposed by FoAM and several academic collaborators), is to utilise the tools of algebraic interaction descriptions, based

upon graph models in order to describe the parts of a mixed reality system, and the placement of various parts of it, within an extended architectural system. The travels of a player or visitor through these are a trail of experience, action and perception, and the models and tools provided by the theories of the intrinsic observer should enable us to better describe and analyse what the player actually perceives and understands from the system.

Information Aesthetics

Karl Svozil's article about the informational aspects of aesthetics casts an interesting physicist's perspective upon the problems of perception, in particular the perception of beauty. Tying in with his discussion of the intrinsic observer, he is interested in many aspects of perception and observation. One of the core elements that arose in the discussion was that something can only perceived as interesting if it falls between the informational content of blandness (minimal information) and noise (excessive information). And of course such an idea of interest defines a moving target: how much do I need to know about something for it no longer to be noise? And how much knowledge then makes it boring? The whole problem of interpreting perception can be redefined as a kind of decoding - given these perceptual data, how can I decode what is "behind" it - what are/were the intentions, the meaning behind some creation (of course this is difficult when we start to deal with nature and natural aesthetics - a major part of Svozil's approach). Upon first hearing, distorted electric guitar was a shock and led to massive returns of the first singles (from the Beatles) carrying recordings of distorted guitars, as the purchasers believed there was a manufacturing error. Today a distorted guitar is normal, we have moved on from that moment of confusion. The extra information in a distorted guitar has now been included into our model of what we can decode easily, it is the intricacies of how that sound is used that become interesting. Whether the theories of the intrinsic observer and informational aesthetics can explain the phenomena of "Spinach Music" (music that you don't enjoy, but you appreciate it because you know it is good for you) is another matter. Dan Miller brought up the aspect of "otherness" as a basic indicator of interestingness, yet we know that there needs to be enough familiarity so as to perceive that it can even be other to our position.

There is a ongoing body of projects within embodied artificial intelligence, building from Luc Steels' work with the Talking Heads Experiment (THE). The THE let robot perceptual systems develop languages of their own in order to describe visual patterns perceived via a moved camera. In some follow-up work robot systems outfitted with perceptional and actuator systems try to work out new and novel ways to make things happen in their environment. One is also reminded of Nik Baginsky's guitar playing robot that consisted of a collection of subprocesses trying to predict what the next action of the guitar would sound like. The better the process was in the prediction task, the more likely that subprocess was to be able to take control of the guitar playing circuits. Baginsky described this process as starting with exploratory noise, then becoming interesting as the level of control became sufficient that the subprocesses were able to almost know what would happen if they played, but their competing processes couldn't quite get there. Unfortunately the guitar playing processes would at some point discover the blues: the experimental phase was over and it would be time to turn off the robot. Somehow curiosity had given way to predictability, and machine generated blues doesn't really do the job.

Svozil then continued to talk not only about the scarcity of attention and the related perceptual processing power as a defining aspect of interestingness (we only have so many seconds to recognise a predator), but also the scarcity of input labour power needed to create beautiful things as a major part of aspects of ornamentation and the details of construction. This is well described in his article.

Recognising Interestingness

Interestingness is not only a problem in aesthetics. The field of Digital Physics is endeavouring to develop digital models of physics from a bottom-up direction. They are not modelling from the top down, defining the several possible interactions of an electron and a photon. Rather, they are looking at systems that have their own dynamics, and if we interpret the data the "right" way, we get things like electrons and photons that interact in the ways that we know.

These bottom-up systems tend to be rather complex, there is no easy way to determine what the relevant aspects are, how to interpret the data in the right way. There is a great problem in determining whether a given system, defined purely in terms of simple interactions, will give something like the physics we know. In general this problem is highly intractible: we are talking about massively complex systems with high degrees of chaos (in the technical sense) possible in their dynamics. However it seems that the physical systems that we are used to have certain properties that make them more amenable to being physical: conservations laws, space as such, particles as some coherent structure in that space, limited speeds of travel of information or matter.

This aspect has a mirror view in the systems which we are creating. If we wish to use bottom up structures that are readily extensible, then we may want to be using something like the systems used by the digital physicists. Then we need to determine appropriate representations of these system so as to allow and encourage coherent and interesting interaction. A system might be exactly represented by a large set of 24 bit values. These values can be displayed as the individual pixel values on a screen or projection, however this representation will quite possibly not allow coherent interaction - the data and the correlations, causations and interrelations are not being

displayed, are not (readily) perceivable. Analysing the possibilities of action within the system to be represented, we need to search for those aspects that closely match the general properties of the system that we readily perceive; physical systems acting in a three dimensional space with localised effects. For instance it may be appropriate to render a complex system as a three dimensional world where those aspects that can be changed by the players are rendered closer to the "front" and those that are dependent rendered further away. Causality should be rendered by proximity, it aids clarity if chains of event follow a curve that is reasonably smooth. Discovering these physics-like properties of systems helps in their rendering and in interaction with them.

Of course this problem is well-known in the "real world" of economics, ecosystems, politics, social relationships and elsewhere. For example: attempts to make the mountains safer by improving the flow of streams leads not only to flooding in the plains as the water arrives too quickly, but also to reservoirs in the mountains becoming depleted over the years due to a reduction in the water trickling into them. Effects that are not immediate are often hard to perceive. Spatial and temporal proximity helps with comprehension, whether it be the results of actions or the reply to a comment.

The two-levelled problem here is the determination of suitable representations of systems and the determination of the "interestingness" of the underlying system. This harks back to Tolmie's problems of representation mentioned above, in that a competent Cage-like representation can make a banal system appear interesting, while an inappropriate representation of a body of data can make it unintelligible; see any of the many badly designed websites for otherwise interesting organisations. Determining interestingness will most likely remain a mostly human endeavour, supported by the machines of representation, however many of the ideas of Toffoli and others dealing with arbitrary dynamics will also be of assistance in the weeding out of system that have no possible level of interest. In the process we will learn something of our own hunger for, and fear of novelty and balance it with ideas of play, structure and experience.

Summary

The meeting was two days of quite intense jamming by several players on a number of themes. Several of the themes were as expected; computational models of physical space, problematic aspects of contemporary physical theory, alternative explanations and models of known phenomena. Several themes, however, emerged in the playing and were of perhaps greater importance; the Intrinsic Observer, game play as a motivation for Digital Physics, perceptual mechanisms and representation. The papers included in this volume investigate some of these themes more closely, but we hope that further iterations of the Data Ecologies Workshop will bring us further along the paths to some interesting results.

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Computation: our "theoretical physics kit"

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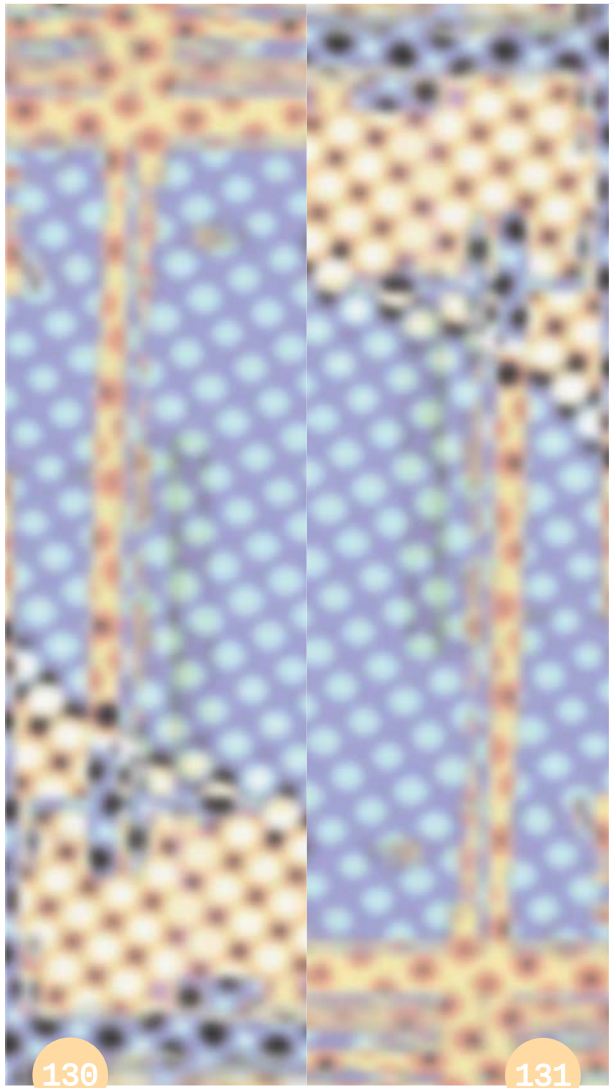
How can Everyman appreciate what theoretical physics is and what it is for? The popular press tends to emphasize the magic and the mystery of physics and the specialness of the wizards who do it. But that is just as mystifying as representing athletic champions as some sort of Olympic gods, while every one of us can exhibit a stunt perhaps 99% as miraculous, in terms of what goes into it, by just running down the street.

Fact is, all we can truly claim to understand is what we have made ourselves out of pieces we own and can play with (and that applies as much to the scientist as to Everyman). Geographical maps, neural networks, chemistry sets, soap operas, and mathematical proofs are different kinds of kits for constructing different kinds of understanding. Computation is such a "LEGO kit" for physics. Computation *is* dynamics that we can specify and run ourselves. It thus allows us to make worlds of our own and to ask what changes we may make in order to get different behaviors. When one of these behaviors is robustly similar to one we observe in nature, then we can claim that we know the way nature *might* have achieved it (if not necessarily how nature actually *did*).

It turns out that "kitchen experiments" based on *quite simple* computational models can fully capture—conceptually as well as empirically—non-frivolous aspects of physics such as special relativity and the second principle of thermodynamics.



The best way to become acquainted with a subject is to write a book about it. [Benjamin Disraeli]

1 Introduction

How can Everyman appreciate what theoretical physics is and what it is for? I doubt that a diet based exclusively on pulp press titles like "The Mystery of Black Holes," "Teleporting Schrödinger's Cat," "Thrills on the Edge of Chaos," or "The Search for the Last Quark" can be of much help.

Under the pretense to inform and entertain, such popular essays actually tend to *disempower* the reader. They try to make the author indispensable by cultivating a feeling, on the part of the reader, of irremediable incompetency[5] that can only be compensated for by the author's graciously offered "mediation" services. Ultimately, the aim is to establish a rapport of dependency; for this, well-known marketing arguments are used:

- The subject is intrinsically difficult and mysterious. Perhaps "only three people in the world" can understand it.[1]
- Like the angels on Jacob's ladder, the author can easily commute between heaven and earth, and is thus qualified to interpret for us mortals the mysteries of the gods.
- For our sake, he will suffer through—and spare us—a host of gory and boring details, and will undertake to render the subject into an instructive and entertaining mythological tale.
- Thanks to his mediation, we, mere mortals, are allowed to lift the veil of eternity and briefly look under it.
- Finally, the author will somehow imply, "Let's be frank, most of you—farmers and farmacists in a one-horse town—*never meant to do any real work* to understand those mysteries *to begin with*; you just wanted to be tickled and mystified by them!" And, in truth,

[1] When somebody told Eddington that according to the newspapers only three people in the world understood Einstein's theory of relativity—so an apocryphal story goes—Eddington appeared puzzled: "I wonder who the third could be?"

that is what will be dished out to us.

A related attitude can be recognized in much otherwise respectable academic work. There, the strategy is to remove any appeal to motivation or intuition, and present an unending series of dry, formal results one after the other. Much like a magician, the author never tells us from where he took off and where he's planning to land. The intended response is awe and astonishment—"Aren't we lucky that somebody can tame such fierce dragons for us?"

But we can truly understand only *what we can make ourselves out of pieces we own* and with which we can play as much as we want. There, no one can tell us what is right and what is wrong, since *it's us that make the rules*. We can then observe what results our rules produce. If these results reproduce phenomena from the real world, then we may claim that we know *one way* those phenomena could have come about. *This is all there is to science.*

Computation is such a "LEGO" kit for theoretical physics. Computation *is* dynamics that we can specify and run. It thus allows us to make worlds of our own. In this light, the eternal appeal of cellular automata (cf. [6]) is that *anyone* can create and run a nontrivial world and truly claim to know how it works. What may come as a surprise is that our physical world shows much evidence of having been constructed out of a kit of the same kind.

In this paper we'll show how *quite simple* computational models can fully capture—conceptually as well as empirically—non-frivolous aspects of physics such as special relativity and the second principle of thermodynamics.

We try to make our children intimately familiar with biology and evolution, or chemistry and electricity, by means of kitchen experiments that they can actually run themselves (breed water fleas in a fish tank, or make a "potato clock"). What I will show you here is a few "kitchen experiments" of theoretical physics.

2 The 2nd principle: invertibility or bust

Few topics in physics have had more words written about them and generated more debate and confusion than the *second principle of thermodynamics*, namely,

"The entropy of a closed system tends to increase towards a maximum; though in ideal circumstances it may remain constant, in no circumstances will it ever decrease."

Equivalently—though more precisely and concisely—

The entropy of a closed system grows monotonically with time.

In this context, the term 'system' is really a shorthand for 'macroscopic[2] system'—by which one does not necessarily mean a *large* system but simply an *incompletely specified* one. By the same token, a 'microscopic system' means a *completely specified* system (not necessarily a *small* one)—and this, of course, is the default or strictest sense of the term 'system'. In sum, the terms 'macroscopic' and 'microscopic' refer not to the *size* of the system but at what fineness of "grain" the system is specified. 'Microscopic' means "described in full detail;" 'macroscopic', that "a lot of detail is missing.[3]"

And what kind of a conceptual object is a macroscopic (or incompletely specified) system?

Since my aim here is not to get everyone intimidated or confused (cf. §1), I shall back off for a moment from these treacherous sands and immediately point at where we want to get, namely,

MAIN PROPOSITION. *To say that a macroscopic system obeys the second law of thermodynamics means* **no more and no less** *than that the underlying microscopic dynamics is* **strictly invertible**.

Note the enormity of what I've just said. Recall that a system that obeys the second law typically displays *irreversible* behavior.[4] Well,

[2] Of which a 'thermodynamical system' is a special case.

[3] This, of course, is almost invariably the case for a system consisting of a large number of parts, and that's why the term 'macroscopic'—originally signifying very large or consisting of a large number of parts, also came to mean one whose state and/or laws are only coarsely known.

[4] When it doesn't, it's because the deck has already been shuffled so well that further shuffling leads to no macroscopic

I maintain that this macroscopic irreversibility is a consequence of the very microscopic *reversibility* demanded by the Main Proposition.

Having stated the Main Proposition and brought attention to its paradoxical nature, I will prove it. But, in line with the pedagogical objectives stated in the Introduction, I will start from scratch and use only the simplest and most intuitive concepts. The idea, in this paper, is to reduce most of physics to *combinatorics*—and, as a student said once, combinatorics is just "kindergarten on steroids!"

For us, a *dynamical system*—or, briefly, a *system*—will be a finite collection Q of objects called *states* (Fig. 1a) together with a function τ from Q to Q itself. This function, called the system's *dynamics*, associates with each state q of Q a new state $\tau(q)$ called the *successor* (or *next state*) of q, as indicated by the arrows in Fig. 1b, where, for example, the successor of state 6 is state 3.

changes (in Feynman's words, "all the fast things have already happened"). At this point the behavior has become *stationary*, and the system is said to be at equilibrium.

Though one can think of more general kinds of dynamical systems, the ones based on a finite state set already have all that is necessary for our discussion.[5]

Note that a system can be described by a *lookup table* rather than a graph. For instance, the following table

q	$\tau(q)$
0	**1**
1	**2**
2	**3**
3	**5**
4	**2**
5	**6**
6	**3**
7	**7**

describes exactly the same system as the graph of Fig. 1b. In this table, the labels and the first column are given once and for all. In fact, the latter can be treated as a sequence of consecutive memory *addresses*. Thus we have a "printed form" in which only the second

[5]The role of topology, measure theory, and group theory is to provide finite machinery to handle as best one can *infinite* systems displaying certain types of regularity, but by themselves they do not contribute any new conceptual elements to our "second principle" issue.

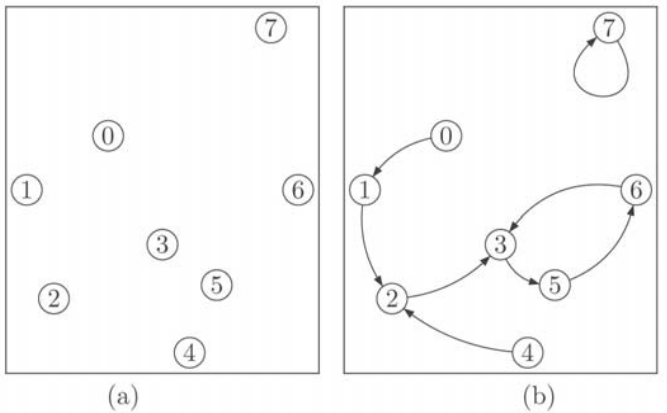


Figure 1: (a) A collection of eight states. (b) A dynamics on that collection of states. Each state has exactly one successor, reached by following the outgoing arrow; thus, the successor of state 6 is state 3.

colum, corresponding to memory *contents*, has to be filled out (we used boldface to indicate this) to specifiy the desired dynamical system.

When this table is supplied to a computer program[6] set up to repeatedly look up the next state and replace the current state with it, as the following

```
tau = [1,2,3,5,2,6,3,7]
            # The dynamics' table
q_0 = 2     # Choose initial state

q = q_0     # Starting from there
while true:  # do forever
  q = tau[q] #  state := next state
```

then we have a genuine realization of the desired dynamical system. In fact, we have expressed the system as a *finite automaton*. The differential equation of motion of analytical mechanics are but a continuous counterpart of such an automaton.

You and I are now going to play a game. Suppose that the states of

[6]The computer language used here is *Python*, a "scripting" language that is highly recommended as a tool for everyday personal use.

Fig. 1a are drawn up on a blackboard where both you and I can clearly see them. I will now think of one of those states *without telling you which*, and you have to guess it (the arrows of Fig. 1b are for the moment irrelevant).

As far as you are concerned, this is an *incompletely specified* system. That is, you have to simultaneously entertain in your mind a set of eight equivalent possibilities. They are *equivalent* because there are no distinguishing features *in the way the story is told (and that's all that you have)* that would make any those states look more or less likely to you.

Since the set contains eight cases, that number—that is, the size of the set—quantifies the amount of uncertainty you have about the situation. We we'll go one further and just *define* the 'amount of uncertainty' as *the size of the set*, that is, the *number of equivalent possibilities or choices*.

We could represent 'amount of uncertainty' on a different scale; in particular, on a *logarithmic* scale. That won't make the uncertainty any more or less, just as expressing the concentration of H^+ ions in an acqueous solution on a logarithmic scale—that's what the pH is—won't make the liquid any more or less acid. When measured on a logarithmic scale, the amount of uncertainty is called *entropy*. Using base 2 for the logs, the entropy of the current incompletely specified (or 'macroscopic') system, that is, the entropy of *your situation* as described in the story, is

$$H = \log_2 8 \ \text{bit} = 3\,\text{bit}.$$

REMARK 1. I wrote $H = 3\,\text{bit}$ rather than simply $H = 3$. This is a good way to enforce consistency. In fact, if we think of the unit 'bit' as a shorthand for '$\ln 2$', we can always identify H with the *natural log* of the number n of equivalent choices, and write, without inconsistency or risk of confusion,

$$H = \ln n = \log_2 n \cdot \ln 2 = \log_2 n \,\text{bit}.$$

REMARK 2. Using entropy, and thus a logarithmic scale, to measure the amount of information (or lack thereof) of a situation or a description is a very convenient thing for both practical and conceptual reasons—and I'm of course the first to support it. However, there is nothing mystical or magical about entropy. We could keep using a linear rather than logarithmic scale (just the number n of equivalent choices rather than the log of it) throughout all of information theory and thermodynamics without affecting in any way their conceptual contents. All theorems and formula will just have to be transliterated from a log to a linear scale, whereby sums turn into products, multiplication into exponentiation, and so forth. For instance, Shannon's formula for the entropy of a probability distribution $\{p\}$ transliterates as follows

$$H(p) = \sum_i p_i \ln \frac{1}{p_i} \quad \longrightarrow \quad K(p) = \prod_i p_i^{-p_i}, \tag{1}$$

where $K(p)$ denotes number of equivalent choices. ■

Let's continue the game. This time what is painted on the blackboard is not only the state set but also a *specific dynamics*, as in Fig. 2a. As before, I'll think of one of the eight states but won't tell you which. Your uncertainty at this stage is worth, as before, 3 bits. But now I tell you that I will give the dynamics one "turn of the crank;" that is, after having made my choice (which may be thought of as placing on the chosen state a "token" that is invisible to you) I will move the token one step forward, along the arrow that leads out of that state and into the next state. On which state is the token now?

Since you have a set of eight distinct possibilities, you have no choice but to separately follow the histories of all eight possibilities, in each case advancing the token along the appropriate arrow. But, in Fig. 2a, any tokens in states 0, 1, 2, and 3 all land in state 0; that is, what used to be four separate possibilities merge, after on step of the dynamics, into a single possibility. Similarly, states 4, 5, 6, and 7 all merge into 7. Thus, your initial uncertainty as to "which of eight states" turns, after one step of the dynamics, into an uncertainty as to "which of just *two* choices," namely 0 and 7, which you must deem equivalent since each comes from four equivalent possibilities. Your entropy has now gone down to just 1 bit, and that without me telling you anything more about my initial choice of state! If now I turn the crank a second time (and the rules of the game are that whenever I turn the crank I must tell you), your entropy will remain constant at 1 bit. In other words, you are now in a state of knowledge where you have

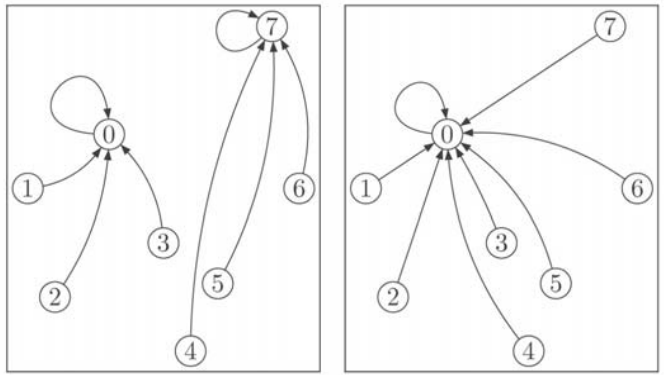


Figure 2: (a) An irreversible dynamics on those eight states: four states lead to state 0 and four to state 7. (b) A drastically irreversible dynamics: in one step, all states lead to state 0

extracted all that you could from the knowledge of the dynamics, and no amount of turning the crank will allow you to further narrow down your choices.

An even more dramatic decrease in entropy is achieved after just one turn of the crank with the dynamics of Fig. 2b. While at time $t = 0$ the location of the token was maximally uncertain and the corresponding entropy was 3 bits, with this dynamics at time $t = 1$ and therafter the token will be on state 0 *no matter where you had placed it initially* and the entropy is going to be exactly zero—no more uncertainty remains!

In sum, no matter what initial state I choose and no matter how many times the crank is turned, the entropy of your state of knowledge can only go down or remain constant—or, as a mathematician would say, can only *monotonically decrease*. In fact, it is clear that it will go down only if, as the system advances one step forward in the evolution prescribed by its dynamics, several distinct possible alternatives in your incomplete state of knowledge *merge* into a single alternative; and it will remain constant otherwise.

Remark 3. In Fig. 3a there is one 5-way merge and one 3-way merge. After one step of the dynamics the number of alternatives shrinks from eight to two, just as with Fig. 2a, where we had two 4-way merges. However, these two alternatives are no longer *equivalent*, since one came from five initial possibilities and the other from three. In such a situation, it is customary to assign to the two choices different weights or "probabilities," namely 5/8 and 3/8. These probabilities, however, do not represent *intrinsic* properties of those choices (as certain schools of probability used to maintain), but only a summary of our knowledge so far.

The story actually goes like this. To model the dynamical process in this situation of incomplete information you'll have to set up eight separate "boards" using the graph of Fig. 3a in all cases but with the token in initial position 0, 1, 2, ... repectively. An equivalent but more compact arrangement would use a *single* board and place eight *weighted* tokens on it, with a weight of 1/8 each. In the first arrangement, after one step you will have five boards with the token on 0 and three boards with the token on 7. In the second arrangement, five tokens of weight 1/8 each will land on 0 after one step (and similarly three on 7); since thereafter these five tokens willl be driven identically by the dynamics, it will be convenient to replace them with a single token of weight 5/8.

If at any time during the course of the game I decide to give you a hint such as "By the way, the state on which I had placed my token initially is not 6 or 7," then, if you want to maximize our chances of guessing right, you'd just discard the two (of eight) boards corresponding to those two initial states. This is no longer possible with the second (one-board with weighted tokens) arrangement, since weights can only tell you *how many* initial states flowed into a given state, not *which*—and you'd have to recompute the probabilities. This interpretation of probability—that is, a compact way to represent, from a given description, no more and no less than what we need to know to answer a specific question—was championed by Edwin T Jaynes and is systematically discussed in his ap-

propriately titled book *Probability: The Logic of Science*[2]. ■

If there are *no* merges whatsoever and thus the graph consists only of closed loops with no stubs or trees grafted onto them, as in Fig. 3b——in other words, if the dynamics is *invertible*—then the entropy of your state of knowledge in this guessing game will remain *strictly constant*. For example, suppose that the initial state were described by me as "one of the states with an even label." Then you would set up four boards with the graph of Fig. 3b and token initially placed respectively on 0, 2, 4, 6. As the dynamics' crank turns, the token on each board will advance one arc at a time. If you make use of the more compact arrangement described in Remark 3, with four tokens of weight 1/4 on states 0, 2, 4, and 6 on a single board, you'll see that the tokens always remain on four distinct nodes—they never flow together into a single node. Thus, no matter at what step we look at the board, we invariably see a "distribution" of four tokens of weight (or "probability") 1/4 in distinct locations. These locations will change from step to step, but they always remain distinct. Accordingly, (1) will always return the same value for entropy.

Thus, when all that happens is that the state of the system is propelled forward by a known dynamics and no other infomation is exchanged, if the system is invertible the entropy of your state of knowledge remains *constant*.

In conclusion, at any moment the entropy associated with the present context can only decrease or remain constant. If the dynamics is not invertible, one can always construct an incompletely specified initial description for which it *will* decrease; if it is invertible, then the entropy will always remain constant during the evolution from *any* initial description. In either case, it is *monotonically decreasing*.

But what happened to our original claim (Main Proposition) that entropy will be monotonically *increasing*?

Our conclusions so far are valid only in the case that you can indeed

1. Have effective recall of all the information I have given you about the initial state of the system;

2. Have effective access to all the details of the system's dynamics; and

3. As the question you are trying to answer shifts from "Where is the counter now?" to "Where will it be after 1, 2, ..., n steps?", have enough storage and processing resources to accurately compute the current position of a token for any plausible initial position of it.

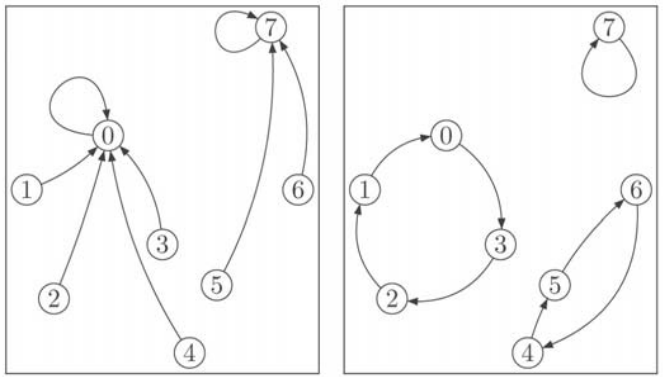
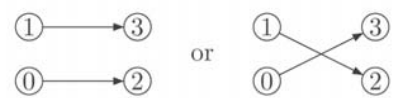


Figure 3: (a) (a) An irreversible dynamics on the same eight states; five states lead to state 0 and three to state 7. (b) A invertible dynamics. Besides having one successor, every state has *exactly one* predecessor. All trajectories are then loops with no side branches flowing into them.

For a large system having a complex dynamics you are typically not going to be able to fully meet the above three requirements. In that case, you will still be able to play the guessing game, but with a continually leaking information inventory. For example, if your vision becomes blurred and in a certain section of the graph you cannot tell whether the dynamics specifies



then when advancing a token over that section you will have to entertain *both* possibilities at once.

The "incompletely known" state of the system becomes even less completely known (in fact the entropy of that portion of the state increases by one bit), and your simulation of the dynamics must split into two separate runs, one for each possibility.

It does not matter whether your uncertainty increases by accident (for instance, when I say "Next! Next! ... Next!" you might not be sure whether you heard "Next!" six or seven times) or by choice (in computing a real-number coordinate you round off the result to three significant figures). In either case the entropy of your effective description of the system's state increases.

We thus have two complementary processes that are going on simultaneously as you attempt to update step after step of the dynamics your description of the current state. On one hand, the dynamics itself may entail a narrowing down of choices—corresponding to a merger of trajectories. On the other hand, any slip, inattention, or deliberate ignoring of information on your part leads to a spreading out of choices. Depending on which of these two processes has the upper hand at the moment, entropy may go up or down—or remain constant if they exactly balance. The situation is summarized by the following table

Dynamics	Your accounting: exact	leaky
invertible	$=$	$=+$
noninvertible	$=-$	$=+-$

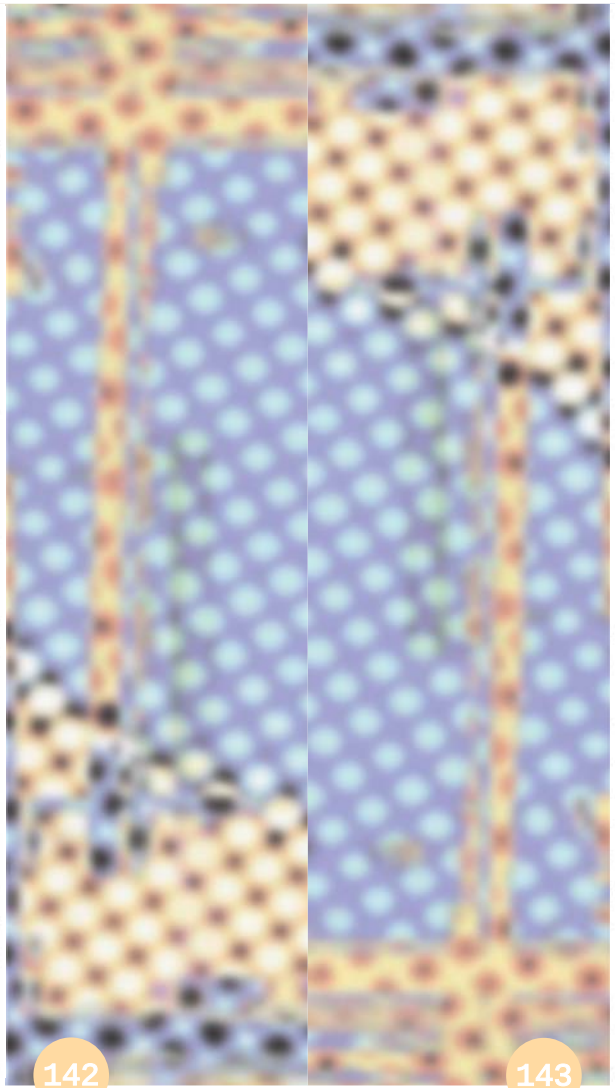
where '=' means that the entropy remains constant; '+', an increase; and '−', a decrease.

From this table we can immediately derive the two parts of the Main Propositions, namely,

direct If the dynamics is invertible (that is, we are on row 1), the entropy can only increase (+) or, at best, remain constant (=).

converse If, by some choice of initial conditions and enough accuracy in computing the dynamics, the entropy can be made to decrease (−), then we are on row 2 and the dynamics must be noninvertible.

That proves the Main Proposition. We have thus established, by means



that are mercilessly formal yet simple and directly accessible to intuition, a direct bridge beween a microscopic property of a system—the invertibility of its dynamics—and a macroscopic property—namely, the system's obeying the second principle of thermodynamics. The student who enjoys this way of getting to the very essence of a concept by forcing it to reveal itself in the most Spartan context will find Amnon Katz's book[3] very refreshing.

3 Relativity: of flocks and folds

I would like to show how the mysterious slowdown factor $\gamma = 1/\sqrt{1-\beta^2}$ (that of "the twins paradox" fame, by the way) of special relativity naturally emerges from a most elementary combinatorial/computational model—for which I will use as a scenario a shepherd trying to rally his flock to the fold.

We are all familiar with Galilean relativity. If a train moves on its tracks at velocity v, from a passenger's viewpoint a car riding along the train at the same speed will seem not to be moving, while a standing tree will seem to recede. These and similar relations arising from relative motion are captured by the Galileo transform

$$\begin{cases} x' = x - vt, \\ t' = t. \end{cases} \tag{2}$$

Note that the time coordinate t of an event remains unchanged; on the other hand, the space coordinate x of an event gets shifted by an offset $-vt$ that is proportional to the time t at which the event occurs.

Conversely, we may think of a new reference frame moving in *time* rather than space with respect to the original one. For instance, Jewish minded historians introduced the notation 'BP' ("before present") as an alternative to 'BC' ("before Christ")—the latter presumably felt to be a bit partisan.[7] This practice is all right when we are dating dinosaurs ($>$ 65 My BP), or even the invention of agriculture ($\approx$ 10 ky BP); but it would be a little awkward if the birthdate on my driver's licence (22

[7] Though this "historical note" is plausible and may even be true, I'm actually making it up here for the sake of illustration.

June 1943, a fixed date in AD notation), were written in BP notation (≈ 22652 days BP), and consequently would have to be continually incremented—by one day every day—to keep up-to-date.

Thus, given an original reference frame on which we can pin up spacetime events, we can think of a new reference frame where the x coordinate of an object moving along with it is by fiat made constant, or one where the t coordinate of an event happening at a definite time in the original frame is by fiat made variable.

In the matter of crazy coordinate transformations, you may even be familiar with the color Grue, defined as Green from the beginning of time until the end of 1999 and Blue afterwards, as well as the color Bleen, defined as Blue through the end of 1999 and Green afterwards (cf. [1]). With this new color scheme, my lawn, which in the old-fashioned scheme had always looked green, was nonetheless found to have switched colors from Grue to Bleen on 1 January 2000!

What are we to think, then, when we find that special relativity proposes, as a more accurate alternative to the Galileo transform (2), the *Lorentz transform*

$$\begin{cases} x' = \dfrac{x - \beta t}{\sqrt{1-\beta^2}}, \\ t' = \dfrac{t - \beta x}{\sqrt{1-\beta^2}} \end{cases} \tag{3}$$

(missing details to be filled in a moment). How can we tell whether this is just another crazy coordinate transformation—perhaps a conceptual joke told by professional physicists to impress other professional physicists—or instead something that we can intimately relate to?

Before calling "foul" or "crazy," let us first compare (3) with (2) and look for familiar features.

- First of all, β, which appears in (3) in the same position as v (the relative velocity between the two frames) in (2), simply stands for v/c, where c is the speed of light, and thus expresses v as a fraction of the latter. This is just a convenience: we can still think of β as the relative velocity, but expressed in different units.

  For similar convenience reasons, in the Lorentz transform (3) *distance* has been expressed in the same units as *time*, by making, everywhere we found a distance x, the replacement

  $$x \mapsto x/c.$$

  Note that, with this replacement, a distance of 1 m, for example, will become a distance of about 3 ns (1 nanosecond = 10^{-9} s; it's handy to remember that in one nanosecond light traverses one foot—or about 0.3 m).

- Besides the offset term $-\beta t$ in the first line, corresponding to the term $-vt$ in (2), transform (3) has a similarly placed offset term, $-\beta x$, in its second line. Thus, space and time seem to play a more symmetrical role in it.

- Finally, besides those *shifts* (or, more generally, *shears*) of space and time coordinates, which we were already familiar with from the Galileo transform and the other examples given right after it, the Lorentz transform also introduces an operation that *scales*—i.e., stretches or shrinks—coordinates. I'm referring to the term

  $$\gamma = \frac{1}{\sqrt{1-\beta^2}},$$

  which may be thought of as the "signature" of special relativity. For instance, what is one hour in one frame may become just one second in the other. But while we do not think it paradoxical that the relative position of a tree would shift as we move past it, it is more of a challenge to intuition to be told that, just by our moving past the tree, a potted orchid that we carry in our hands would age more slowly than the tree itself.

  It is with the emergence of this term that we shall devote our attention below.

After the flock has made the most of a patch of green, let us assume that our shepherd wants to move the fold[8] to another patch. While

[8] For the same post-neolithic reader who does not know the difference between grazing (systematically mowing down grass like cows and sheep do) and browsing (which is the way goats and

fenced, the flock will have remained compact, but the moment the fence is removed it will start *diffusing out*, as in Fig. 4. (Without losing the essence of our problem, for simplicity we shall consider a *one-dimensional* flock.)

Like a cloud, we shall view the *flock* as a macroscopic or incompletely specified system (cf. §2), where the positions of the individual sheep are not relevant and the "system" is a *state of knowledge* characterized by just two collective parameters, namely, the position μ of the "center of mass" (or *mean position*) of the collection of sheep, and its "spread" σ (or *standard deviation*) with respect to the mean. We shall assume that individual sheep move along the x axis at a constant speed c, called *sheepspeed*, but in a direction (+ or −) chosen at random, that is, with a probability p to go to the right and $q = 1 - p$ to go to the left at any step. (When $p = \frac{1}{2}$, only once in a thousand (2^{-10}) will a sequence of ten steps happen to consist entirely of steps to the right; in the great majority of cases, about as many steps will be to the left as to the right and the sheep will end up very close to where it started.) As a consequence of this random scrambling, the flock will slowly diffuse without any coherent overall motion (Fig. 4). The equations of motion are

$$\begin{cases} \mu(t) = 0 \\ \sigma(t) = \frac{1}{2}\sqrt{t}. \end{cases} \tag{4}$$

To make the flock move in (say) a rightward direction, the shepherd will ask his dog to run about it and harry individual sheep into taking a step to the right rather than the left, thus increasing p and decreasing q. If we use c as a unit of velocity, we have

$$\begin{cases} 1 = p + q, & \text{(probability is normalized)} \\ \beta = p - q. & \text{(mean flock velocity)} \end{cases} \tag{5}$$

With a vaue of β diffferent from 0, Fig. 4 will be replaced by Fig. 5 and the new equations of motion will be

$$\begin{cases} \mu(t) = \beta t, \\ \sigma(t) = \sqrt{pq}\sqrt{t}. \end{cases} \tag{6}$$

camels find and eat their more chancy food), I'll recall that a *flock* is a herd of sheep, while a *fold* is that sort of portable perimeter fence (made out of sticks and ropes) whereby the flock is kept grazing (and fertilizing) one restricted area at a time during the day—and kept safe from straying at night.

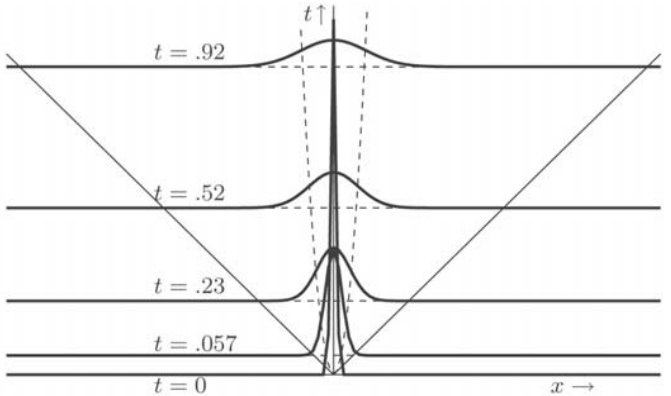


Figure 4: A sequence of snapshots of the distribution of sheep as the flock diffuses out from a compact initial configuration. The slope of two diagonal lines represents "sheepspeed," or the maximum walking speed of a sheep (see below; the two lines bound the "sheepcone," or the region of spacetime where a sheep starting at the origin can possibly be found. However, as in ordinary diffusion, the bulk of the flock will remain within a region whose diameter ("flock spread") increases only with the square root of time, as indicated by the dashed parabola with the vertex at the origin.

(where the second line reflects a well-known property of the binomial distribution).

One obvious change from Fig. 4 to Fig. 5 is that the latter appears sheared rightwards (as prescribed by the first line of (5)). Now, if the shepherd walks alongside his flock at the same speed β, in his reference frame, given by the Galileo transform

$$\mu' = \mu - \beta t = \beta t - \beta t \equiv 0,$$

the flock will no longer be moving. Is this transform sufficient to restore the appearance of the original behavior, i.e., that of Fig. 4? In other words, will a shepherd walking alongside a flock driven by the dog see the flock itself diffuse just as it would have if the dog were inactive and the shepherd still? In

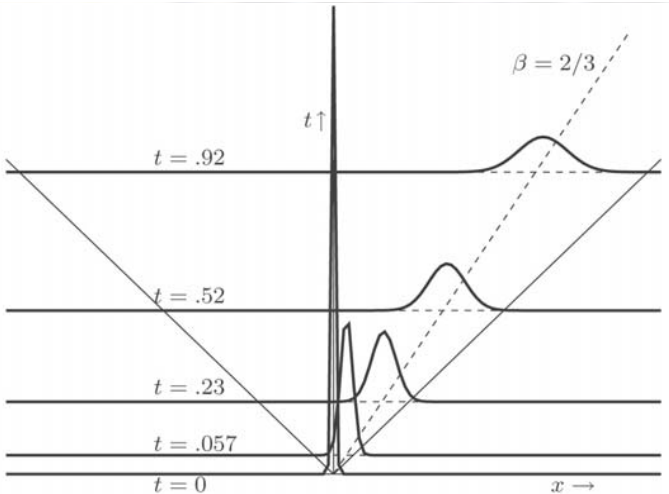


Figure 5: When β is different from zero (here $\beta = 2/3$), the flock travels as a whole even as it spreads; its center of mass follows the spacetime line $x = \beta t$.

other words, will the shepherd be able to notice that he and his flock are jointly moving by just observing the overall evolution of "sheep density?"

That the answer is "No" should be immediately evident if one looks at an extreme case. Suppose the dog is so efficient that *all* the sheep always step to the right. Then all sheep will be moving exactly at sheepspeed c, and their relative positions will never change: the entire flock will be moving together as a frozen object. In these circumstances, a flock that started out as a compact cluster—a "delta function"—will always remain a delta function. As the shepherd walks alongside it at speed c, the flock's center of mass will of course not move with respect to him, but neither will the flock diffuse!

If we look at the equation that specifies the rate of spread—the second line of (6)—and make the substitution

$$\begin{cases} p = \frac{1+\beta}{2}, \\ q = \frac{1-\beta}{2}, \end{cases} \tag{7}$$

obtained by inverting (5), we obtain

$$\sigma(t) = \sqrt{1-\beta^2} \cdot \tfrac{1}{2}\sqrt{t}. \tag{8}$$

In other words, as the flock as a whole gains a speed β, its diffusion coefficient, that is, its *rate of internal evolution*, slows down by the now familiar factor $\sqrt{1-\beta^2}$.

We can think of all this as a coarse "explanation," or at least an intuitive model, of special relativity. Suppose that somehow the universe has, deep down, fixed computational resources (here the sheep take identical steps at a fixed rate). The flock is only a high level construct of ours. If *we*, for our own convenience, divide the sheep's activity into two parts, that is, a *coherent* component of the motion, which can easily be masked out by the shepherd's walking with the flock, and an *incoherent* component, which represents the flock's "internal evolution," then it is no wonder that when more resources are poured for any reason into the coherent component (β is increased), fewer resources are left to drive the system's internal evolution.

Time appears to slow down simply because, as it were, some of it is being used for something else!

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TUNA PASTRY

Tuna Pastry

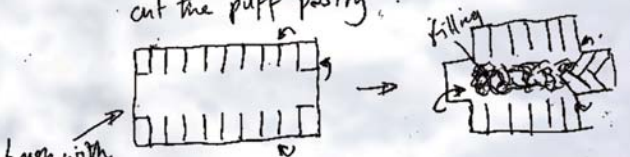
puff pastry

filling
- large tin of tuna (drain oil)
- 2x peppers, green/red, sliced
- 1 x large tomato chopped
- 1 x onion chopped
- 1 x large hand full of cheese, grated.
- 3 or 4 table spoons, tomato purée
- 1 x egg, beaten for glaze

fry the onions and peppers with the oil from the tuna until soft. leave to cool

mix the tuna, chopped tomato, cheese; tomato puree, and onions and peppers.

cut the puff pastry :-



cook gas #6 for 20 - 25 mins.

et voila!

AESTHETICS AND SCARCITY
A PHYSICS PERSPECTIVE ON ORNAMENT[1]

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Abstract

Human aesthetics is developed as a function of decryption. Decryption is analyzed in terms of computation, thus providing some principles by which artists may design appealing virtual reality environments. While too condensed coding makes a decryption of a work of art impossible and is perceived as chaotic by the untrained mind, too regular structures are perceived as monotonous, too orderly and not very stimulating. It is also argued that, due to human predisposition, aesthetics is inevitably based on natural forms.

89.20.-a,89.75.-k,01.70.+w Interdisciplinary applications of physics, complex systems, philosophy of science

dedicated to Hans Frank d. Jüngeren
painter, teacher and friend

[1] *Presented at the Data Ecology Workshop Part II at the Time's Up laboratories - Linz/Austria 12th - 14th May. URL http://www.timesup.org/laboratory/DataEcologies/index2005.html*

1 > Simple questions

Suppose you are in New York City, in midtown Manhattan, and you have ten minutes to spare. Where would you rather be: on Park Avenue? or in Central Park? Don't think about it - what is your first reaction?
Park Avenue offers modernity; it is dominated by artistic structures created by valiant human imagination. Central Park offers an artificial "natural" habitat, created by valiant human landscape gardening. Shouldn't all the trees and plants of Central Park appear boring compared to the magnificence of Park Avenue's skyscrapers?
Nonetheless, I suspect that many or perhaps even most people would prefer Central Park over Park Avenue for just idling around. (I am not considering here the curiosity of suburbanites studying man-made canyons.) Why have so many people left the city centres in favour of rural surroundings? Why is hiking and vacationing in beautiful natural habitats a means to refresh our minds?
One could also ask where one would choose to live if one were in a galaxy far, far away, shaken by Star Wars: on the planet Naboo? or on Coruscant? Again, I suppose most people would choose the natural beauty of Naboo (at least after the siege of the Trade Federation is lifted).
Virtual realities - digitally created landscapes and habitats - may someday offer a chance to spend a holiday inside a totally artificial environment created by the digital artist. At the present time, I suspect that most of us would dislike spending an entire holiday in one of the current generation of virtual reality installations, and would in fact rather undergo the rigors of travel in order to visit uncontrolled, natural spots far away. Would it not be much more risk-free, convenient, personalised, funny, satisfactory and also cheaper to go virtual? The artist, then, will want to provide surroundings that people will find most pleasing, or else fail to attract customers and audience.
There may be a simple explanation for the human preference for the natural. This explanation runs against many modern artistic philosophies, such as International Style architecture, "modern art" paintings and modern "classical" music, which upon constant exposure may be either monotonous and dull, or irritatingly irregular and erratic, to the majority of people. For the artist, the advantage of these styles is that they are systematic and may be implemented with relative ease. The aesthetics I suggest, by contrast, may impose a high burden on those who create virtual human habitats.

2 > An aesthetics of nature-beauty

We propose that to a large degree aesthetics are derived from natural forms, both ontogenetically and phylogenically. The human experience of art, at least where beauty and appreciative psychological responses are concerned, is informed by the variations of natural forms such as clouds, rocks, leaves, waves, or the songs of birds. (Two such structures are depicted in Figs. 1&2.) All human creations, in particular hermetic virtual realities, must cope with this human predisposition, which limits the plasticity and adaptability of human perception. Regardless of the artistic motive, neglect of this condition may result in a sense of provocation and ugliness for the person experiencing the creation.

FIGURE 1:
Autumn foliage near Baden, Lower Austria, Oct. 15, 2000
(© Karl Svozil)

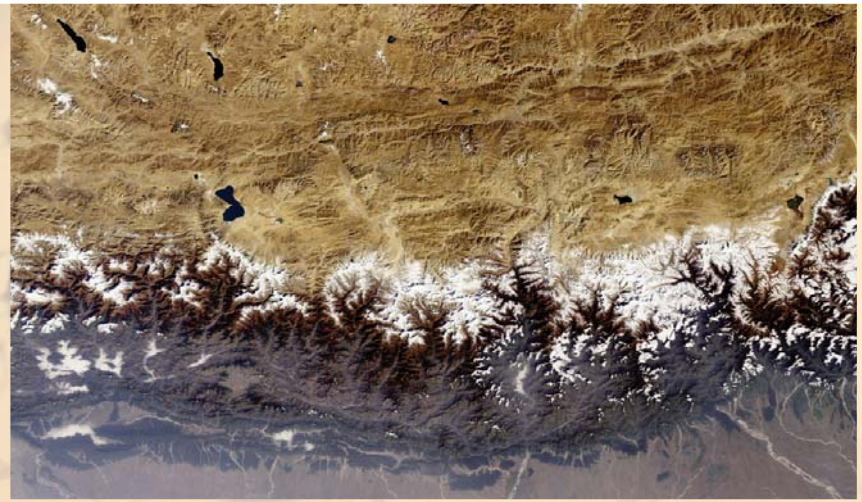


FIGURE 2:
Mount Everest as seen by MERIS at orbit # 09148 on Nov. 30th, 2003 (© ESA/MERIS)

One issue in the creation of virtual realities - and also in contemporary architecture and the arts in general - is the avoidance of monotony and uniformity, despite the scarcity of available algorithmic, imaginative or monetary resources[2]. In this paper, we will propose an aesthetics built upon what will be called "nature-beauty" (in German "das Naturschöne"[3]). We will speak of "natural entities," by which we mean specifically traditional forms occurring in the natural human habitats of the past or in the rural settings of the present.[4]

One assumption of nature beauty is the heuristic law of decryption: every pattern and law will eventually be decrypted, and the decryption process is central to the human aesthetic experience. The more complex a pattern in terms of description and production, the more difficult is its decryption. For the person embedded in an aesthetic environment, if the decryption comes too fast and easy the result will be boredom; conversely, if the decryption is too difficult, the result will be perplexity and irritation.

Descriptional complexity can be characterised by the algorithmic information content [1, 2, 3]; i.e., by the length of the shortest program able to generate that pattern or form. Computational complexity [4, 5, 6] is a measure for the amount of time and memory (space) required to generate the pattern or form from the algorithm. For example, a very short subroutine of only a few lines can generate a very large pattern or form, but it may take a very large amount of time and memory to accomplish this. The resulting pattern, then, is descriptionally simple, but computationally complex.

A related principle is the heuristic law of aesthetic complexity. At one extreme, plain structures appear monotonous; at the other extreme, totally stochastic structures appear irritating. That is to say, where patterns are simple and easily recognised, the person experiencing them quickly loses interest; and equally true, where there is no recognisable pattern at all, the person will also lose interest in the apparent randomness.

Art takes place in the region between monotony and irritation, between order and chaos. Of course, the mere absence of monotony and randomness is no sufficient criterion for art, but it can be safely stated that it is a necessary one. Any attempt to push the artistic boundaries either towards monotony or towards stochasticity must consider the human mind, which might not be sufficiently plastic to cope with the results.

Consider, for instance, the extremes of white noise and brown noise. White noise is a type of noise that is produced by combining with equal weight all different frequencies together. White noise is thus characterised by a constant frequency spectrum $1/f^0$ and is too stochastic and random to be perceived as music; it is extremely irritating to most human ears. Some compositions by György Ligeti or John Cage may serve as examples, where a great deal of randomness is intentionally introduced as a matter of style - a style that many people find irritating and incomprehensible. At the other extreme, we have brown noise-which takes its name from Brownian motion, the apparently random bouncing of molecules-exhibiting step-wise "random walk" behaviour with a frequency spectrum $1/f^2$. Brown noise appears monotonous and boring.

At the mid-point between these extremes of noise, we find what we might term "pure music," which can be characterised by a frequency spectrum of about 1/f. This type of "noise" may be termed "fractal" or self-similar "noise" [7, 8, 9, 10].

The term "noise," of course, was coined to describe sound, but the statistical analysis is easily applied to any mode of perception involving pattern recognition. For examples of "noise" in graphic or visual art, we may look to modernist paintings. "White noise" in paintings would, of course, consist of a canvas painted over with an even, uniform coat of grey paint (and there are some examples in modern art which very nearly approach this ideal)."Brown noise" would be random shapes or splotches in random colours at random locations on the canvas (and, again, there are some modernist paintings which very nearly answer to this description). "Fractal noise" in painting would consist of the regular and rigid application of self-similar patterns, along the lines of the well-known images produced by the Mandelbrot set. Such images are common in some computer graphics. What is the effect on the viewer of these types of "noise" when exhibited in paintings? Many viewers find all of these varieties of drawings to be incomprehensibly dull, which is to say lacking in any aesthetic quality at all[5].

"Noise" is descriptionally simple, even if computationally complex. Very few lines of code are required to produce an even and uniform whiteness; or a random scattering of shapes; or an endless fractal pattern. For the artist, descriptional simplicity ("very few lines of code") means that he or she has relatively little thinking to do to produce the "art." By contrast, nature-beauty imposes heavy algorithmic costs on the creators of virtual realities and arts in general, requiring a structural richness that exceeds the power of contemporary computers by orders of magnitude.

[2] In particular, architecture suffers from austerities of form and lack of sophistication, which are sometimes externally imposed upon the architects by financiers and engineers, and which are sometimes self-inflicted in the name of style. Conversely, music and some graphical arts have taken an entirely opposite turn towards an aggregation of complexity and the increase of information density per time or space - in its extreme form promoting incomprehensible, irritating noise.

[3] Compare Hegel's concept of "das Naturschöne" ("beauty of nature") [43] which is contrasted to "das Kunstschöne" ("beauty of art"), although Hegel used a top-down system based on the human mind and its superior artistic expression instead of the bottom-up approach proposed here.

[4] We do not have in mind every form occurring in nature. For example, a concrete wall is also a natural form by an extended definition; but we do not include it in our considerations, since we do not want to surrender to unbounded arbitrariness.

[5] To be fair, these forms have their adherents, and I take the relative popularity of these creations to be an indication of the utter ignorance and obtuseness of audiences, who suspend their own standards and judgements, deferring to fashionable opinions. The poet Handke has exemplified such tendencies to the extreme in his play "Publikumsbeschimpfung" (Engl. translation "audience bashing"), which confronts the benevolent and overtolerant audience with absurd slander and insults. The author had the questionable privilege to see these principles at work after he and his friend (presently a renowned Viennese academic himself) re-enacted the "Publikumsbeschimpfung"

To illustrate, let us consider how Nature herself creates nature-beauty. In terms of algorithmic information content, it takes about 4 million nucleotides (the basic molecules forming the nucleic acids DNA and RNA), and about 4 thousand genes, to describe the simple bacterium Escherichia coli (E. coli). This is the genome of E. coli, which for present purposes we may equate with lines of code and functional segments of code. Humans have about 1,000 times more nucleotides than E. coli (around 3 billion), and an estimated 40,000 to 60,000 genes. Every cellular entity on earth can be assumed to lie within those bounds. The phenotype - that is the bodily creature -generated from these codes is quite beyond the capability of contemporary computers. Even "mere" protein folding remains one of the most difficult computational challenges of our time. This compares indirectly to the exorbitant computational resources needed to simulate an entire city in detail within a virtual reality.
Ultimately, the above theses will have to be corroborated or falsified by experience and neurophysiological modelling. They relate, in some respects, to Chomsky's system of transformational grammar. One of the possible tests would be to differentiate between the ontogenetic and the phylogenetic parts of the thesis. Children who grow up in rural surroundings might, for instance, show very similar aesthetic preferences when compared to urban children, although their environmental experiences vary widely. The same should be true for people from very different environmental, cultural, social and ethnic backgrounds.

3 > Garden gnome virtual architecture?

Several arguments can be brought forward against an aesthetics built upon nature-beauty; some will be discussed below.

3.1 > Kitsch: ridiculing nature-beauty

A clever demonstration directed against the aesthetics of nature-beauty has been devised by Udo Wid, a Viennese artist and physicist. He planted a garden gnome into a flower pot, such that only a very tiny upper part of its red cap was visible. The gnome was surrounded by plants. Many people were actually taken in by this arrangement. This instalment seemed to prove the absurdity of any claims of the existence of nature-beauty-after all, an aesthetics being blinded by a planted garden gnome cannot possibly have any value.
However, I take Udo Wid's example not as evidence against the theory of nature-beauty, but as just another indication of how easily people can be seduced to perceive beauty while really being confronted with kitsch or even trash. One might even ask: so what?

3.2 > Ugliness as a by-product of progress

One artistic task is to expand upon existing forms, and sometimes such expansion results in provocation and even ugliness. We might ask whether provocation and ugliness are the inevitable companions of aesthetic expansion.
I think not. Occasionally, provocation may accompany creativity, but it is not a necessary element of artistic quality. Some groups of "artists" have

in front of a university audience of learned scholars and students plus company, which truly seemed to enjoyed the piece which obviously intended to insult them; and even sat through the reading of three full pages of the Viennese phone book.-They did not give up; we gave up!

[6] In my opinion, this has less to do with art than the need to attract attention. With sufficient publicity, artists may create a market for their work; with sufficient success, they may achieve an intellectual hegemony that effectively excludes dissidents from monetary and academic resources.

[7] Here again, some would plead for an aesthetics of unbounded relativism, asserting that ugliness is a subjective experience. My answer to them is rather simple: I do not think so! Having stated this, I acknowledge that the perfection of ugliness might be a stimulating challenge, although not from an aesthetic point of view. Perhaps

some Foundation for Relativism in Art might endow a challenge prize for the designer who is able to create the ugliest and most offensive virtual universe possible.

[8] Let me state a harsh and personal reply to those artists and engineers who disguise an aesthetics which is based on natural forms: be advised that most of your customers prefer natural habitats over simplified synthetic ones. You may like it or not, but those customers will vote with their feet and their wallets against your shallow perception of modernity. You may be fairly successful in print; you may win prizes and be selected in tenders by committees of peers; you may even be allowed or encouraged

made it to their primary business to provoke, so that the provocation itself is seen as sufficient justification for the art[8].
Creativity that results in ugliness cannot properly be called progress, no matter how intellectually and spiritually challenging. While the initial provocation may prove stimulating and produce some expansion in the artistic palette, the perpetuation of ugliness on ever larger scales is not a promising programme[7].

3.3 > Artistic dominance

Academically established schools of artistic taste have been able to dominate contemporary arts and architecture to a large degree. However, the most successful and popular artistic creations of our time do not follow such conformist trends. For instance, when the writer and director George Lucas and his team created dwellings for the Star Wars Episodes I and II, they deliberately chose Renaissance-style palaces for the residence of the Queen of Naboo. Even for Coruscant, seat of government for the Galactic Republic and the Empire that supplanted it, they invented an architecture not resembling any Bauhaus or other academic style. Indeed, perhaps the most striking and effective cinematic use of the Bauhaus and International styles was in connection with the terrors of Fritz Lang's Metropolis. I would suggest that these styles are effective for a tale of horror precisely because they make people uncomfortable[8].
Most of this critique is not entirely new [11, 12, 13], and neither is the attempt to recover beauty through natural forms. What may be new is the idea that the limits of aesthetics may be due to the human condition, a heritage of how we perceive the world, and the bounds imposed by algorithmic information and complexity.

3.4 > Scarcity of resources

One of the most influential critiques of nature-beauty was formulated in 1908 by Alfred Loos in his pamphlet "Ornament und Verbrechen" (English translation "Ornament and Crime") [14]: ornamentation is expensive; and resources diverted to decoration are wasted with regard to the functional value of the decorated objects. Those resources could for instance be much better invested for leisure or for an increase in productivity. Loos' principle can be pointedly stated by the following question: why build one pretty house with ornamentation when you can have two ugly ones for the same price?
Such thoughts blended in well with Frederick Winslow Taylor's "The Principles of Scientific Management" [15] written in 1911 in the USA, as well as the social fantasies of the Bolsheviks in the USSR. While such principles improved productivity and had a substantial impact on the growth of the economic output, they also increased the monotony of work and the human environment in general. Certain qualifications and benefits of craftsmen such as variety, identity, significance and autonomy were abandoned. Charlie Chaplin's "Modern Times" is a persiflage of these circumstances. The products became cheap, affordable and disposable but at the same time monotonous, insignificant, dull and without charm. We should ask ourselves to what extent this tradeoff between charm and abundance has been justified.

To give an example: for the functionalist, a street lamp is just a street lamp emitting light; nothing else. No matter how ugly the lamp looks, as long as it serves its purpose by emitting light. If the total cost of ownership is low, all is well in functional terms. What Loos and other modernists did not recognise was that any street lamp has an indispensable added value: by daylight, it is perceived by everybody not according to its function as a street lamp, but as a kind of street furniture or decoration. During day, the functional value of light emission is insignificant; what matters instead is the design itself.

The same applies to the decoration of facades. Ornamentation of buildings increases the cost of production and the efforts that go into it without immediate functional value to the tenants; however, it serves another, equally valuable purpose to a much greater audience: it appears pretty and beautiful. An avenue or a court framed by buildings which are ornamented looks less monotonous and austere than the same avenue or court with plain facades. Without ornamentation, objects of everyday life appear cheap and ugly.

One immediate reaction of customers is not to buy such things, to throw them away immediately, or at least to get rid of them as soon as possible. This may be one of the reasons why American products often sold better than the same products from the former Soviet block. In Eastern Europe, nobody attempted to imprint added values, because almost by Soviet definition, the product needed to serve only its intended functional value. Prettiness became equated with bourgeois decadence[9]. And as scarcity dominated, any incentive to buy and enjoy consumption was discouraged. Let me mention an anecdote: during an extended visit to Moscow in 1986, I attended a performance of the Bolshoi theatre in the Kremlin. The audience virtually cried out at a ball scene-they were so desperate for beauty and ornament! This is different from surplus societies and supply-sided markets-at least for those who can afford-where added value is an important marketing factor.

A mere programmatic commitment to ornamentation does not solve the problem of its cost, though. After all, Loos did not criticise ornamentation per se, but the extra cost associated with it, which is not met by any immediately recognisable functional value. Loos even suggested using naturally ornamented panels and templates such as wood or stone as a substitute for expensive human-crafted ornamentation.

Alas, natural ornamentation materials such as stones and wood are also expensive and not affordable to everyone (compare recent laminate floorings carrying photo reproductions of wood). And as can be seen from the beautiful parquet flooring recovered recently in the Palais Liechtenstein, Vienna, depicted in Fig. 3, even laying natural panels requires high craftsmanship and geometric sophistication.

The costs associated with aesthetics explain why the rich and the aristocracy have chosen to live in abundantly decorated environments, with beautifully crafted ornaments and art throughout history. Take the Roman villas, the palaces of the renaissance and baroque periods as examples for an aesthetics affordable only to very few.

to build some similar creations for which the 20th century has become so (in)famous: the structureless skyscrapers, the buildings made with precast concrete slabs, and the bunkers. But you will not achieve the thing that matters most, which is a virtual habitat in which people silently hang around and pretentionless enjoy their living.

[9] On the contrary, consider the "repressance"-type architecture of the Stalin time, such as the main building of Lebedev University.

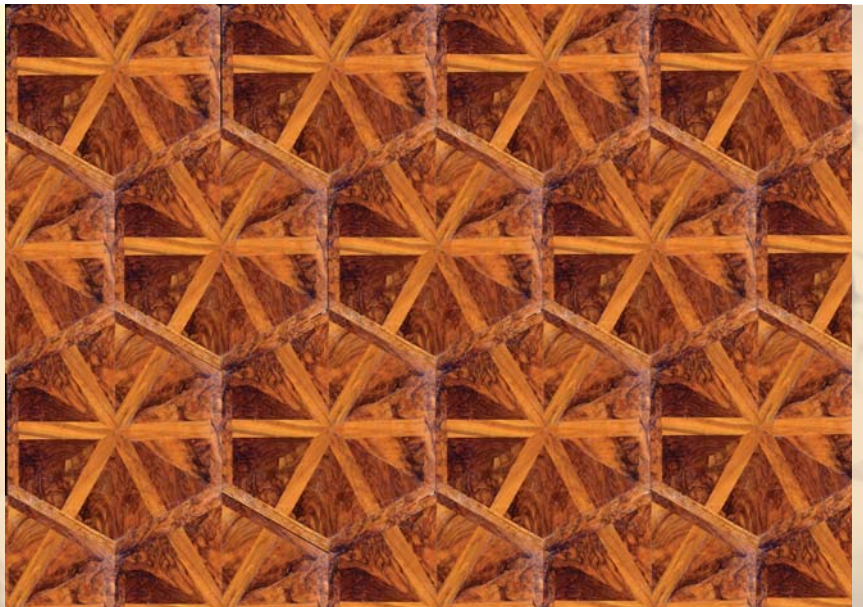


FIGURE 3:
Parquet flooring in the galery rooms of the Garden Palais Liechtenstein, late 18th century, Vienna, Austria (© Sammlungen des Fürsten von und zu Liechtenstein, Vaduz. URL http://www.liechtensteinmuseum.at)

For the commoner, ornament and art has been hardly affordable throughout history. One of the most efficient attempts to improve this situation was the production of bentwood furniture on a large scale by Thonet and Kohn industries around 1900. Although the general living conditions have improved dramatically, in this aesthetic respect, nothing has changed much: the average citizen cannot afford beauty even today and lives in almost ridiculously styled environments mimicking ornamentation [16].

Nevertheless, at least "offline," not in real time, we seem to be nearing an ability to produce simple and affordable ornamentation, because we are able to geometrically generate and produce patterns, tiles, ornaments and structures which show sufficient sophistication and charm not to be immediately recognisable as either unacceptably monotonic or irritatingly irregular. Even so, those tasks are extremely complex, and so we are better able to comprehend the magnitude of the problem. With many of the existing Computer Aided Design programs it is, for instance, not even possible to compute the unwindings of simple smooth non-flat surfaces. And the computational resources consumed still exceed any realisation in real time. So, from the point of view of present virtual reality modelling, true nature-beauty appears only in science fiction. But given the pace of advancement of computer technology, this time will come; and we must get prepared for it.

3.5 > What is abstract art?

Uranium 235 and the transuranium elements such as Plutonium 239 or Ununbium 277 are all natural. Nobody would call such elements "abstract" just because they have not been available before their creations in reactors. Likewise, materials such as concrete, carbon fibres or glass panels are evidently natural, because they occur in nature after they have been produced by human intervention. By the same token, the plastic explosive C4 (MilSpec: MIL-C-45010A), dioxin, or anthrax are all natural.

Moreover, a person familiar with arid grassland and tundra may find a coral reef and water waves "abstract." Nevertheless, coral reefs and water waves are quite common on our planet. A painting depicting an object which has still to be designed and invented appears to be only temporarily "abstract."

So, one could argue that, as every conceivable form is natural in one way or the other, nature-beauty is arbitrary and ill-defined. Likewise, abstract art is not qualitatively different from other art forms. In this latter respect I would agree, although I do not go along with the arbitrariness which is seemingly implied by the kind of omni-naturalness which results from too wide an interpretation of natural forms. Natural habitats do exhibit extreme forms very seldom; they are rare exceptions rather than the rule.

4 > Strategies to introduce richness

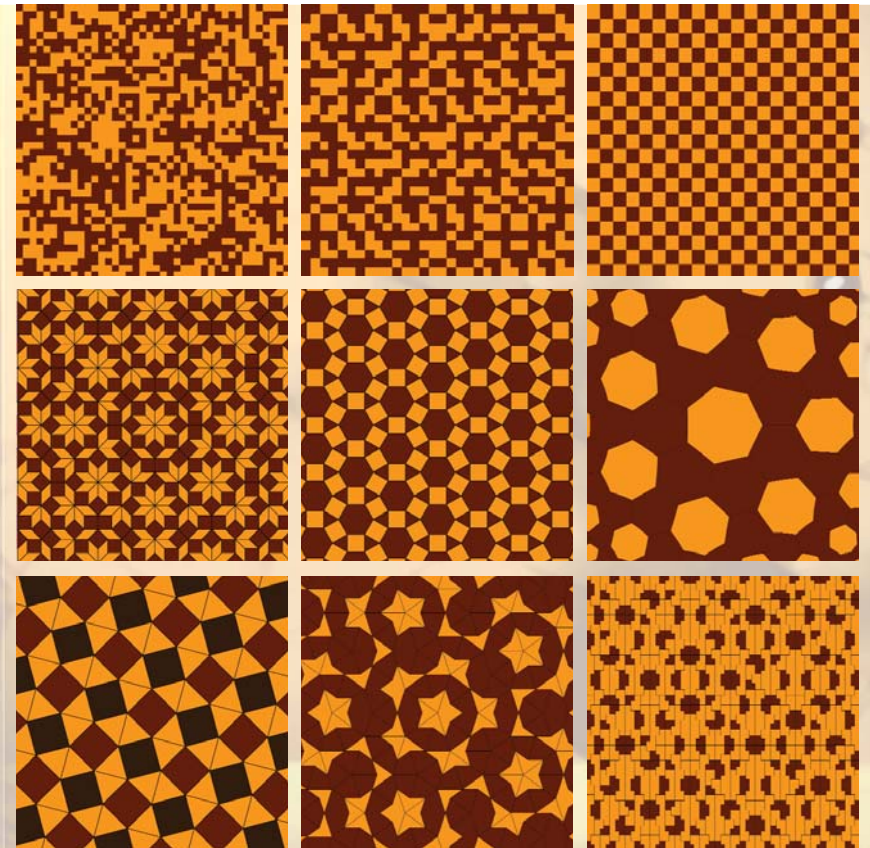
Several strategies have been applied to increase the aesthetic complexity and richness of virtual universes. Many can also be found in nature. Some of them are mentioned below. By automation, all these superficial strategies may contribute towards the better acceptance of virtual realities and ornamented forms in general without requiring too much human effort.

4.1 > Randomness and mutation

True randomness is a hypothetical postulated resource nobody knows to exist. All "algorithmic random number generators" by definition produce non-random output. Some random number modules have been proposed [17] and realised [18] on the basis of physical processes such as quantum effects. Yet, it can be safely asserted that for all practical purposes of aesthetics, pseudo-random number generators suffice.

Alas, pure randomness is perceived as incomprehensible and irritating. For a demonstration, the reader should contemplate the panel of random colour tiles in Fig. 4(a). Nevertheless, a certain randomisation may improve the perception of geometrical forms, making them appear "less perfect" and "ideal" by "mutating" them.

FIGURE 4: (a) Raster graphics (b) from white noise; from permutations in a quantum [19] and automaton [20, 21] state discrimination problem; (c) from regular tessellation through repetition; (d) Tiling obtained from the projection of a hypercube with an algorithm by Grimm and Schreiber [22]; (e-g) Tilings from an algorithm by Sremcevic and Sazdanovic (MathSource 4540); (h) Tiling from an algorithm by Lyman P. Hurd (MathSource 595); (i) Ammann aperiodic tiling from an algorithm by Sasho Kalajdzievski (MathSource 4273);



4.2 > Morphing and crossing of existing forms

This variation has been borrowed from Genetic Algorithms [23, 24, 25]. It is the deliberate use of natural forms such as leaves, trees, waves and so on, morphing, crossing and blending them into existing functional and structural entities. The shape of Ionic and Corinthian Capitals, as depicted in Fig. 5(c), are such examples. Imagine a Greek or Roman temple such as the Erechtheum in Athens build in plain Bauhaus or International Style!

4.3 > Permutation

Permutations are a means to repeat one and the same formal message over and over again without repeating it syntactically. Strictly speaking, it should be considered in the symmetry section below. One of the decisive features of permutations are the reversibility, the "one-to-one-ness" of the associated transformations. Fig. 4(b) depicts a permutation pattern previously generated in the context of quantum state discrimination [19, 28, 20, 21].

4.4 > Self-similarity

Self-similar "fractal" [29, 30, 31, 32] structures have been discussed intensively in the context of the creation authentically looking landscapes [33] and architectural form [34, 35], as well as music [9] and paintings [10]. As demonstrated by the image compression techniques from iterated functions systems [36], fractals are generated by the successive iteration of certain non-linear mappings.

It should be realised however, that although fractal forms abound in nature, their virtually generated doubles often tend to appear boring and artificial. A combination of fractal symmetry and random mutation may be a good recipe for creating interesting patterns.

FIGURE 5:
(a) Greek ornament from the Chorage Monument of Lysicrates, Athens; by Lewis Vulliamy and reprinted by Owen Jones [26]; (b) Greek ornament from left to right: upper part of a stele, termination of the marble tiles of the Pantheon; the upper part of a stele; by Lewis Vulliamy and reprinted by Owen Jones [26]; (c) Roman Corinthian and Composite Capitals reduced from Taylor and Cresy's Rome [27] and reprinted by Owen Jones [26];

FIGURE 6:
Santino Bussi (1664-1736) Stucco detail in the Sala Terrena of the Garden Palais Liechtenstein, after 1700, Vienna, Austria (©Sammlungen des Fürsten von und zu Liechtenstein, Vaduz. URL http://www.liechtensteinmuseum.at)

4.5 > Repetition

Repetition of patterns and reproduction of natural forms such as the ones in Fig. 4(c,e,g) may be a great design resource. It should be noted that without any modifications such as mutation, the repetition of small structures can be decoded very easily and thus may appear monotonous. One should, however, not underestimate the joy people experience by listening to something they already know [37]!

4.6 > Symmetry

Ornamentation by symmetric patterns is an ancient method. Contemporary mathematics offers a pandemonium of different symmetric patterns [38], the formally most advanced being aperiodic tilings [39, 22]. Figs. 4(d,f,h,i) depict such aperiodic floor tilings. These tilings would not have been possible a few years ago and therefore are not realized in any historic building.

5 > Human art versus computer generated design versus nature-beauty

So far nothing has been said about human originality and artistic talent. Indeed, the more one attempts to argue for the necessity and feasibility of

automated creation of ornamentation in accord with nature-beauty, the more it becomes clear how brilliant, gratifying and truly enjoyable human artistic expressions can be.
Consider, for example, the traditional ornaments collected by Owen Jones [26] and depicted in Fig. 5, the stucco created by Santino Bussi and depicted in Fig. 6, and Jan Van Huysum's bouquet of flowers in Fig. 7. From these experiences it may appear even questionable whether the automation of pattern formation will ever be capable to fully substitute or outperform human art. One is reminded of similar debates in artificial intelligence research and the controversy between semantics and the associated syntax, which has so vividly been expressed in Searle's "Chinese room" metaphor [40, 41] against strong artificial intelligence; or Weizenbaums artificial communicator "Eliza."

FIGURE 7:
Jan Van Huysum, Flowers (©Sammlungen des Fürsten von und zu Liechtenstein, Vaduz. URL http://www.liechtensteinmuseum.at)

In view of the preliminary nature of these issues, let me just ask a few questions: Is "algorithmic art" [42] not a contradictio in adjecto, an inconsistency in the adjective modifying a noun, as in "round square? " Why do modern biology books still use drawings made by humans rather than photography? Is nature-beauty just the expression of deeper forms which are only revealed by human artistic talent? Is the human mind capable of condensing the "essence" of natural form? That is, are natural forms mere shadows of hidden objects as in Plato's cave metaphor - and are artists capable of recognising the "real" objects behind those shadows? - Maya covering an illusory world of the senses? What is it that makes Reality feel "so real? " The song of a nightingale is beautiful, but is Korngold's "Violanta," Bach's "Matthäuspassion," or Mahler's "Sixth Symphony", his "Song of the Earth," Schönberg's "Gurrelieder," Schreker's "Irrelohe," or Wagner's "Tristan und Isolde" even more so? How is it possible for those masters to distil and create beauty from their experiences? May this be an indication for transcendence and dualism?

6 > Summary and outlook

We have argued for the necessity of ornamentation, decoration and the presence of nature-beauty as a precondition for aesthetic acceptance. We have discussed bounds from above and from below on artistic expression: art can neither exist in a scheme dominated by chaos, randomness, arbitrariness and white noise, nor can it exist in a regime dominated by too much order, monotony and dullness. Thereby, we have in mind statistical and algorithmic measures and methods to evaluate and automatically generate ornamental forms.
For those desperate for beauty and surrounded by ugliness, let me add a quite simple advise: look upward to the sky and watch the clouds pass by; go to the woods; take a pilgrimage, go walkabout! No despot so far in human history was able to eliminate clouds, plants, the sunrise and sunset.
Another practical suggestion is the construction of a network of "green corridors" through city centers. These corridors should be covered with lush vegetation and should allow pedestrians and probably also cyclists to traverse passages of ugly facades and constructions, which would be effectively coated by natural ornamentation. Another possibility would be to systematically cover great parts of city facades by plants.
Creating enjoyable habitats for the human mind by algorithmic methods presents a great challenge. Therefore, it is promising and gratifying to look into the future of virtual reality modelling by also looking back at the traditions of form, decoration and ornament. So much beauty is awaiting us in those universes when we have shaken off the armour of hatred for the forms which we always loved and sought. By wisely maintaining our cultural as well as our human heritage in evenly suspended attention (to borrow the wording "gleichschwebende Aufmerksamkeit" from Freudian psychoanalysis), it will be a liberation from a certain kind of totalitarian modernity which, whenever dominant, has created deserts of monotony and ugliness, and a step forward to enjoy ourselves within the universes which await us in the years to come.

Acknowledments

I would like to express my special thanks to Ross Rhodes for critically reading and revising the manuscript. Thanks go also to (in lexicographic order) Tim Boykett, Georg Franck-Oberaspach, Günter Krenn, Christian Schreibmüller, and Udo Wid for discussions and references. Many ideas grew from a research cooperation with Klaus Ehrenberger of the Medical University of Vienna on the coding and processing of stimuli by cochlear implants, a direct artificial interface to the cortex. Almost needless to say, I take full responsibility for controversial statements. Reproductions of Figs. 3, 6, and 7 with kind permission of the Sammlungen des Fürsten von und zu Liechtenstein.

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Poppy-seed strudel

POPPY-SEED STRUDEL

Preparation

For the dough:
Warm up the milk until it is lukewarm. Transfer into a larger bowl, then crumble the yeast into it and add a pinch of sugar. Leave the mixture to rise in a warm place for about 10-15 minutes. Pour the flower, egg, water, oil and salt into a big dish. Once the yeast mixture has risen enough, pour it into the same dish and knead together (best done by hand) until smooth and not sticking to the dish. Cover the dough with a wet tea-towel, surround the dish with a warm blanket and leave on a heater or warm window sill to rise for about an 30 minutes to an hour.

In the meantime make the filling by boiling the poppy seeds, sugar, vanilla sugar and the raisins in the milk. Cook until it becomes a smooth paste - it should not be too droopy.

When the dough has risen, roll it out to about 1cm thickness and smear the filling on its surface. Once evenly distributed, roll the strudel to a cylinder about 10-15cm wide and about 5 long. If it becomes too long for available dishes, cut the strudel in half. Mix the egg and brush the strudel with it. Place in a buttered dish (or cover the dish with baking paper) and bake for about 30 minutes until it is reddish-brown. Wait for it to cool down and cut into 2-3cm thick slices. Serve by itself, or with sour cream and a mixture of forest fruits.

Ingredients

dough:
1 kg pastry flower
1 egg
15 cl milk
1 dl water
1 packet of fresh yeast (usually about 50g)
1 dl sunflower oil
2 teaspoons of salt
1 pinch of sugar

filling:
300 g freshly ground poppy seeds
1 bag of vanilla sugar (about 25 grams)
3 tablespoons of sugar
100g raisins
20 cl milk

1 egg for coating the strudel

Pohorje Omelette

POHORJE* OMELETTE

Pohorje's famous Omelette with cranberries is a tasty bisquite desert, with a filling of cranberries and whipped cream.

Ingredients

250g flour
70g white sugar (or 80g icing sugar)
2 egg yolks
3 egg whites
10ml cream
90g cranberries (or assorted forest berries)
2 tablespoons blueberry liqueur (borovnicevec or similar)
1 packet vanilla sugar
pinch of icing sugar

Substitutions

crystal sugar can be replaced with powdered sugar for the egg white mixture. The blueberry liqueur can be replaced with other fruit liqueur.

Mix 50g of sugar with the vanilla sugar. Grease a baking tray with 20g butter and sprinkle it with a pinch of flour.

Preheat the oven to 170°C.

Whisk the egg whites until almost firm. Slowly add the mixed sugar, while continuing to whisk. Lightly mix in the egg yolks, while slowly adding flour. Once thoroughly mixed, place the batter on the baking tray, shaping into discs. Bake for 10 min. until the omelet is golden brown.

Slowly melt 20g sugar into brown caramel. Add 3 tablespoons water and cranberries, cooking slowly for a few minutes. Pour the liqueur in it. Whip sweet cream.

Serving

Place the baked omelette onto a warmed plate. Cover half the omelette with warm cranberries, fold and sprinkle with icing sugar. Serve with whipped cream.

Suggestions

The beaten egg whites will be better if the egg whites are at room temperature; (take the eggs from the refrigerator 2 hours before use). Before mixing, add a pinch of salt. Some choose to add a little baking powder just before the end of whisking. When the mixture becomes hard, stop mixing, or it will collapse.

Having the oven at the right temperature is very important for the preparation and baking of the bisquite. Most sources suggest that the ideal temperature is between 170 and 200°C. If the oven is too hot, it will be baked too soon and not rise enough. If the oven is not hot enough, the mixture will deflate once risen.

**Pohorje is a mountain in Slovenia overlooking Maribor, where the famous 'Golden Fox' World Cup in Skiing for Women has been held each year for over 40 years.*

ENGINEERING THE QUANTUM FOAM

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In 1990 Alcubierre, within the General Relativity model for space-time, proposed a scenario for 'warp drive' faster than light travel, in which objects would achieve such speeds by actually being stationary within a bubble of space which itself was moving through space, the idea being that the speed of the bubble was not itself limited by the speed of light. However that scenario required exotic matter to stabilise the boundary of the bubble. Here that proposal is re-examined within the context of the new modelling of space in which space is a quantum system, viz. a quantum foam, with ongoing classicalisation. This model has lead to the resolution of a number of longstanding problems, including a dynamical explanation for the so-called 'dark matter' effect. It has also given the first evidence of quantum gravity effects, as experimental data has shown that a new dimensionless constant characterising the self-interaction of space is the fine structure constant. The studies here begin the task of examining to what extent the new spatial self-interaction dynamics can play a role in stabilising the boundary without exotic matter, and whether the boundary stabilisation dynamics can be engineered; this would amount to quantum gravity engineering.

Introduction

The modelling and understanding of space within physics has been an enormously challenging task dating back in the modern era to Galileo, mainly because it has proven very difficult, both conceptually and experimentally, to get a 'handle' on the phenomenon of space. Even then some major experimental bungles [1] have only recently, in 2002, been uncovered [2,3], that lead to profoundly misleading concepts that formed the foundations of 20th century physics. Galileo and then Newton modelled space as an unchanging Euclidean 3-geometry, in which there was in principle no limit to the speed of objects. Einstein, building upon the theoretical work of Lorentz and the experimental work of Michelson and Morley [1], modified Lorentzian relativity to what is now known as Einsteinian relativity. The key concept here is the amalgamation of the geometrical model of space and time into, ultimately, a curved 4-dimensional pseudo-Riemannian spacetime manifold, giving General Relativity (GR), where the curvature models the phenomenon of gravity, unlike the Newtonian modelling of gravity which involved an acceleration vector field residing in the 3-space.

FIG.1
Artistic sketch of the quantum foam network that is space at its deepest level as emerges in the information theoretic Process Physics. Numerical studies have shown that the connectivity of this network is embeddable in a three-dimensional space, which is why this network is identified as that phenomenon which we know of as space. The blobs are gebits which to a first approximation are S^3 hyperspheres. These are linked via homotopic mappings. This whole connectivity pattern is fractal, in that any one of the gebits has this form for its internal structure.

Experimental evidence has resulted in the wide acceptance within physics of the curved spacetime model. However only recently [4,5,6,7] has it become clear that in those cases where the curved spacetime was experimentally and observationally successfully tested, the spacetime formalism turns out to have been nothing more that a 'flowing-space' system whose fundamental dynamical degree of freedom is a velocity field. Furthermore numerous experiments over the last 100 years or so have repeatedly and consistently reported the detection of this velocity field [3]. In particular any time-dependence and/or spatial inhomogeneity of this velocity field gives rise to the phenomenon we know of as gravity. At its deepest level this 'flowing space' is a classical description of a processing quantum foam [6,7,8].

Within both GR and the new theory of space the speed of light is the limiting speed of matter through space. However Alcubierre [9] has pointed out that this speed limit may be effectively bypassed if the matter is at rest within a bubble of space which itself is moving through space at greater than the speed of light. Elegant as this very non-Newtonian effect is, this proposal failed within GR because it required the presence of exotic matter

to dynamically stabilise the boundary, as we later show, namely matter with essentially a 'negative mass'. Here we begin the task of examining how far the new spatial self-interaction dynamics can go in removing the need for such exotic matter, and whether any residual requirements for boundary stabilisation can be achieved by means of innovative engineering, that is by essentially 'engineering the quantum foam'.

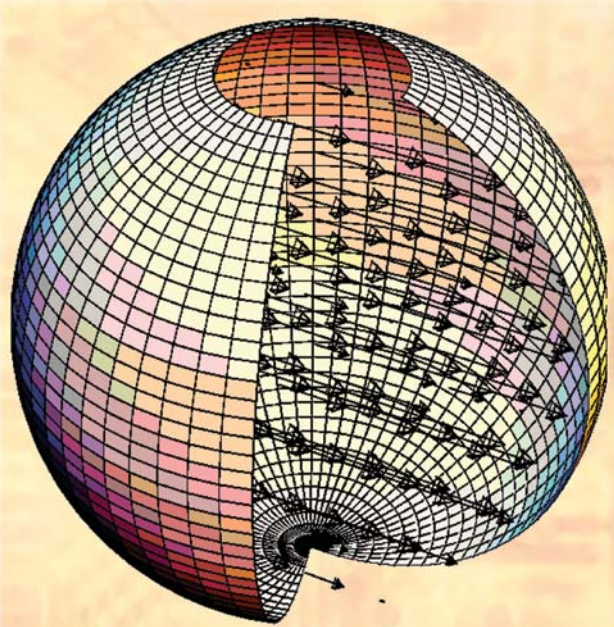


FIG.2
Velocity field for the propagating bubble given in (9)-(10). The velocity field is relative to a frame of reference in which the velocity field is zero outside of the bubble. Inside and outside of the bubble the flow satisfies both (2) and (5). The stability of this propagating bubble of space is then determined by the surface dynamics. The dynamics in (2), which is equivalent to GR, requires exotic matter at the boundary, as shown in Fig.4.
However the key insight reported here is that this exotic matter may be replaced by the more complex self-interaction dynamics of the new theory of space, as given in (5). This produces an effective matter density as shown in Fig.5

Quantum Foam and its Flow Dynamics

The new theory of space arises within an information-theoretic modelling of reality, known as Process Physics [5,7,8]. It uses a process model of time rather than, as in current physics, a non-process geometrical model of time, a model so successfully developed and used by Galileo, Newton, Einstein and others that for many physicists the phenomenon of time is actually identified with this geometrical model. Now we have a model of time that includes the distinctions between past, present and future. These distinctions cannot be made in the geometrical model of time. The radical starting point is to model reality as a self-organising semantic information system This is 'information' that is accessible and meaningful to reality itself, but not, in the main, accessible by us, even including the experimental scientists. This means in part that we reject that notion that matter and space are 'substances' or 'things' obeying 'laws'. That kind of phenomenological modelling of reality has reached its limits. Indeed right through the last century, after the discovery of the intriguing quantum phenomena, the idea had begun to emerge that reality had some 'informational' aspects to it, though this notion never successfully matured into a new modelling. The older non-process physics modelled reality using only a syntactical information system. Essentially that means that it used a symbol based system, with symbols assigned to stand for various given entities, such as electrons, electric fields and the like. As well rules or laws were proposed to determine how the symbols were to be manipulated and used for computations. This approach gave us the famous equations of physics. Such a system is all syntax. It's like a game of chess - the pieces are rearranged according to prescribed rules. Of course that a science such as physics could successfully exploit a syntactical system was a major development - it was the hallmark of the last 400 years. In such a system the only sense of meaning is that the symbol manipulators, us, may attach meanings to the symbols. While such meaning might inspire and guide us, it certainly has no significance for the symbols themselves. Within this new physics space and matter are emergent phenomena within a self-organising fractal pattern system. Therein space, at the deepest level, has the form represented with much artistic licence in Fig.1, where the fractal patterns form embedded and /or linked gebits, where the linking characteristics show that, at a coarse-grained level, there is an effective embeddability of the quantum-foam pattern structure within an abstract, i.e. not real, curved three-dimensional space. Because of the self-organising and processing of this quantum foam it essentially has differential motion, i.e. some regions 'move' relative to other regions. Of course this quantum foam is not embedded in any real background geometrical space. At the coarse-grained classical level this differential flow would be modelled by a velocity field, with the velocity field defined by reference to an arbitrary 'observer' or, more impersonally, to an arbitrary frame of reference. Differential flow is minimally described by an acceleration field $\mathbf{g}(\mathbf{r},t)$, and to be independent of any observer's frame of reference it must have the form

$$\mathbf{g} = \frac{d\mathbf{v}}{dt} \equiv \frac{\partial \mathbf{v}}{\partial t} + (\mathbf{v}.\nabla)\mathbf{v} \qquad (1)$$

which has been long-known as the Euler acceleration, first discovered in the context of classical fluids, i.e. matter flowing though a space. Matter effectively acts as a sink for the flow of the quantum foam, and the simplest non-relativistic description of matter is as a matter density, and to relate the flow dynamics in (1) to this density we must have

$$\nabla.\left(\frac{\partial \mathbf{v}}{\partial t} + (\mathbf{v}.\nabla)\mathbf{v}\right) = -4\pi G\rho(r,t) \qquad (2)$$

where G turns out to be the Newtonian gravitational constant. Outside of a spherical mass M (2) has a time-independent radial in-flow solution

$$\mathbf{v}(\mathbf{r}) = -\sqrt{\frac{2GM}{r}}\hat{\mathbf{r}} \tag{3}$$

where $\hat{\mathbf{r}}$ is the unit-length outward radial vector. Then (3) using (1) gives

$$\mathbf{g}(\mathbf{r}) = -\frac{GM}{r^2}\hat{\mathbf{r}} \tag{4}$$

So the flow formalism requires this Newtonian inverse square law, at least minimally, and so this also explains Kepler's Laws for the motion of the planets within the solar system. Eqn.(2) may be generalised with the frame independence maintained by including the next simplest structure and which accounts for space itself acting as its own source/sink.

$$\frac{\partial}{\partial t}(\nabla.\mathbf{v}) + \nabla.((\mathbf{v}.\nabla)\mathbf{v}) = -4\pi G\rho - C(\mathbf{v}) \tag{5}$$

where

$$C(\mathbf{v}) = \frac{\alpha}{8}\left((trD)^2 - tr(D^2)\right); \quad D_{ij} = \frac{1}{2}\left(\frac{\partial v_i}{\partial x_j} + \frac{\partial v_j}{\partial x_i}\right) \tag{6}$$

Eqn.(5) also has solution (3), and so acceleration (4), external to a spherical mass, and so in the solar system, with this mass being the sun, (5) is also consistent with Kepler's laws for planetary motion. However (2), which is exactly Newtonian gravity within the velocity field formalism, differs from (5) within a spherically symmetric mass, and the difference manifests as the bore-hole g anomaly. Fitting the Greenland bore hole data lead to the major discovery [10,11] that α has the same numerical value as the fine structure constant, to within experimental errors. This constant determines the structure of atoms and molecules within the quantum theory. So we see the first evidence from Process Physics of a unification of the quantum theory and gravity. Eqn.(5) has wave solutions as well as black hole solutions, and has explained the spiral galaxy rotation curve anomaly, and correctly predicted the mass of dynamically mandated black holes within globular clusters [11]. The $C(\mathbf{v})$ term may be written on the RHS of (2) as an additional effective matter density,

$$\rho_{DM} = \frac{\alpha}{32\pi G}((trD)^2 - tr(D^2)) \tag{7}$$

which plays the role of the so-called 'dark matter' (DM) effect in various systems, particularly spiral galaxies. Of course $\rho_{DM}(r,t)$ is not necessarily positive definite, and so in some circumstances this purely spatial self-interaction dynamics can mimic exotic 'negative mass' effects. Eqns.(2) and (5) can only be solved if $\mathbf{v}(\mathbf{r},t)$ has zero vorticity; $\nabla \times \mathbf{v}(\mathbf{r},t) = \mathbf{0}$

FIG.3
Shows the vorticity field of the velocity field in Fig.2. The bubble is moving towards the right. This vorticity occurs in the boundary layer of the propagating bubble of space, as specified in (9)-(10). Such vorticity must be produced by moving matter, as shown in (8), or perhaps by electromagnetic fields. Vorticity essentially describes the rotation of space, and - specifies the local axis and magnitude of that rotation.

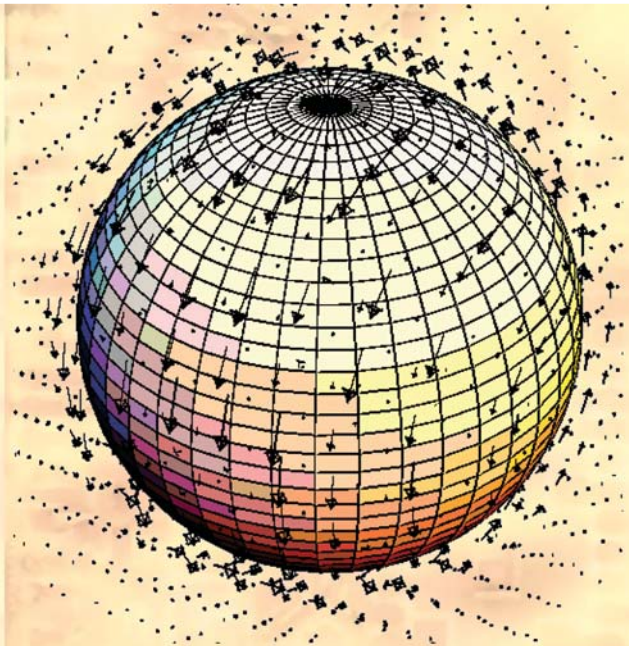
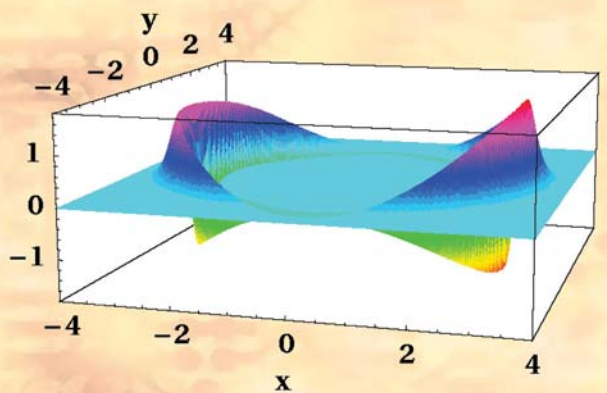


FIG.4
Shows the matter density on the RHS of (2) required in order that the propagating bubble in (9)-(10) satisfies (2), which is equivalent to GR. The plot shows the density on a plane passing through the centre of the bubble. The matter density, which resides in the boundary layer of the bubble, must be exotic, for we see that it must be negative in some regions.



For non- zero vorticity more general arguments show that 2nd-rank tensor flow equations may be constructed [5,8], and which at the simplest level introduce the vorticity induced by moving matter according to

$$\nabla\times(\nabla\times\mathbf{v})=\frac{8\pi G\rho}{c^2}\mathbf{v}_R \qquad (8)$$

where v_R is the velocity of the matter relative to the 3-space. The form of the RHS of (8) has been confirmed to within 10% in [12]. The Gravity Probe B satellite gyroscope experiment is designed to study the vorticity from (8) induced by the rotation of the earth, but as well the new space theory implies that the linear motion of the earth will induce an additional component to the vorticity [13]. The Alcubierre bubble of space necessarily involves non-zero vorticity at the boundary, as seen in Fig.3, and so involves the spatial dynamics in (8). The full flow theory of space briefly outlined above accounts for all the effects that supposedly confirmed GR, but goes further in explaining various other key effects which GR is unable to account for, the most significant being the 'dark matter' effect. This is easily seen because the 'dark matter' effect in (5) involves α as a second gravitational constant, whereas GR, like Newtonian gravity, involves only G.

Propagating Quantum-Foam Bubble Dynamics

Alcubierre's propagating space bubble involves the velocity field

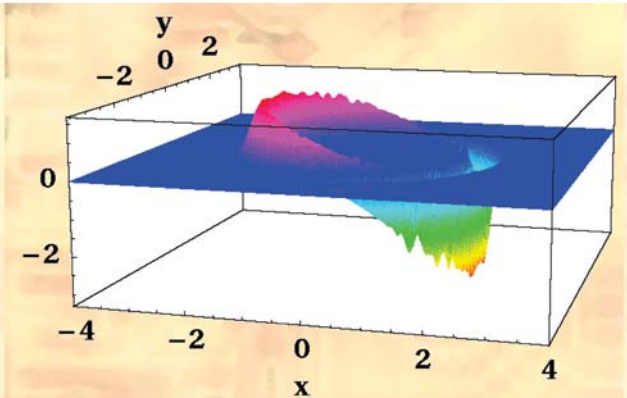
$$\mathbf{v}(\mathbf{r},t)=(v_s f(r_s(t)),0,0);\quad r_s(t)=\left((x-v_s t)^2+y^2+z^2\right)^{1/2} \qquad (9)$$

which describes a spherical bubble of space moving with speed v_s in the +x direction, as shown in Fig.2 ($f(r_s(t))$=1 at the centre of the bubble), and where the key property is that this speed is not restricted to being less than the speed of light, as it is not matter which has this speed through the space in which it is located. Ordinary matter could indeed be located at the centre of the bubble and so would be at rest with respect to the space in which it is located, but which at the same time would be travelling faster than the speed of light with respect to the external space. The function $f(r)$ models the boundary profile, and Alcubierre chose

$$f(r)=\frac{\tanh(\sigma(r+R))-\tanh(\sigma(r-R))}{2\tanh(\sigma R)} \qquad (10)$$

which gives the bubble a radius R and a surface profile parametrised by σ. Ignoring the vorticity, so that (2) is the explicit form for the GR spatial bubble dynamics, which is valid if the matter does not have a velocity large compared to c, we can compute from (2) the form of the matter density required for the velocity field to satisfy (2); this gives the matter density shown in Fig.4. As is now well known [9,15], but only within the geometrical spacetime formalism of GR, this matter density must be negative in certain sections of the bubble interface, and so would require what is called 'exotic matter'. As well we find that there is a non-zero vorticity, shown in Fig.3, and this would require circulating matter according to (8).

Fig.5 Shows the 'dark matter' density from (7) when the velocity field is given by the propagating bubble in (9)-(10). The plot shows the effective matter density on a plane passing through the centre of the bubble. This effective matter density, which resides in the boundary layer of the bubble, is negative in some regions. However this is physical for the new theory of space as this effective matter density is simply a means of describing the spatial self-interaction dynamics in (5). However we see that for the bubble in (9)-(10), this effective matter density is not the same as required for stability of the bubble, i.e. (9)-(10) does not satisfy (5). But perhaps a modified bubble velocity field may do so. If not then any residual stabilisation effects could be engineered by using ordinary matter and/or electromagnetic fields. If the bubble is evolved in time using (2), but with no matter density, then as shown in Fig.6, shock waves develop from the leading surface, and propagate back into the bubble, leading to its eventual decay.



As a part of a preliminary analysis of the Alcubierre bubble dynamics within the new theory of space we can extract using (7) the form of the 'dark matter' density that would have to manifest in order for (9) to be a solution of (5), This gives the 'dark matter' density shown in Fig.5, and this involves regions of negative 'dark matter'; however this is not an exotic form of matter, and merely indicates the nature of the spatial self-interaction dynamics that must take place at the boundary. Comparing Fig.4 and Fig.5 we see that the bubble characterised in (9)-(10) does not satisfy (5) as the required and induced density are not identical. However there may be a modified form for (9) which is a stable propagating bubble solution of (5). To find this form would require either finding analytic solutions to (5) or starting the time evolution in numerical computations with the form in (9)-(10) and evolving that forward in time with (5) to see if a modified stable form emerges. If either of these approaches were successful then we would have a strong case for believing that such faster-than-light bubbles could occur as a natural phenomenon. One intriguing role for these would be in the escape of matter and/or information outwards through the event horizon of black holes. If there are no natural solutions of (5) with any propagating bubble form, then the next stage of investigation is to discover bubble forms which can be stabilised by engineered non-exotic matter and/or electromagnetic fields. This would amount to engineering the quantum foam, an idea that Puthoff [16-18] has discussed in a different context.

The high non-linearity of (5) makes computing numerical solutions difficult. As a first step in this direction the time evolution of the bubble profile in (9)-(10) has been evolved forward in time using (2) with no matter present, either normal or exotic, and so also ignoring vorticity effects. The resulting time evolution of the bubble velocity field is shown in Fig.6. Because there is no matter/'dark matter' present to stabilise the propagating bubble we see that the bubble begins to decay, with 'shock waves' form-

ing at the leading surface which propagate back into the interior of the bubble. Over longer time intervals these waves totally destroy the bubble integrity, and only residual waves survive that carry away the disturbance into the surrounding space.

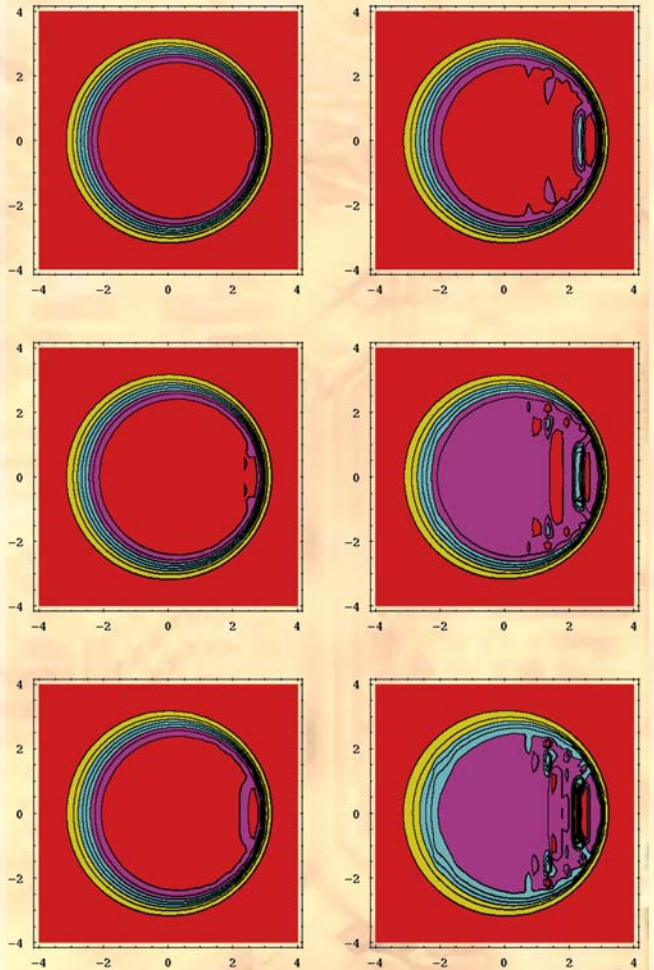


Fig.6 Shows the magnitude of the x component of the velocity field of the propagating bubble in (9)-(10) as it evolves in time according to (2), but with no matter or 'dark matter' density. The x direction is the abscissa, and the bubble is propagating to the right. The section is a plane including the centre of the bubble. The time ordering is via columns, with the earliest time at the top LHS, and the last time at the bottom RHS. As the bubble evolves shock waves develop at the leading surface, which propagate back into the bubble, resulting eventually in its decay. To dynamically stabilise the bubble, i.e. so that it satisfies (5), a different velocity form from that in (9)-(10) may be successful, or alternatively the stabilisation may be provided by engineering the matter density so that the negative matter density is effectively provided by the spatial self-interaction dynamics in (5).

Summary and Discussion

This brief look at the possibility of engineering the quantum foam has raised numerous intriguing possibilities that warrant further detailed investigation. Indeed this would be a quantum-gravity based technology, as the spatial self-interaction dynamics, which is the key to this re-visiting of Alcubierre's warp drive, involves the fine structure constant, suggestive of quantum processes at the deeper levels of the phenomena which we know of as space.

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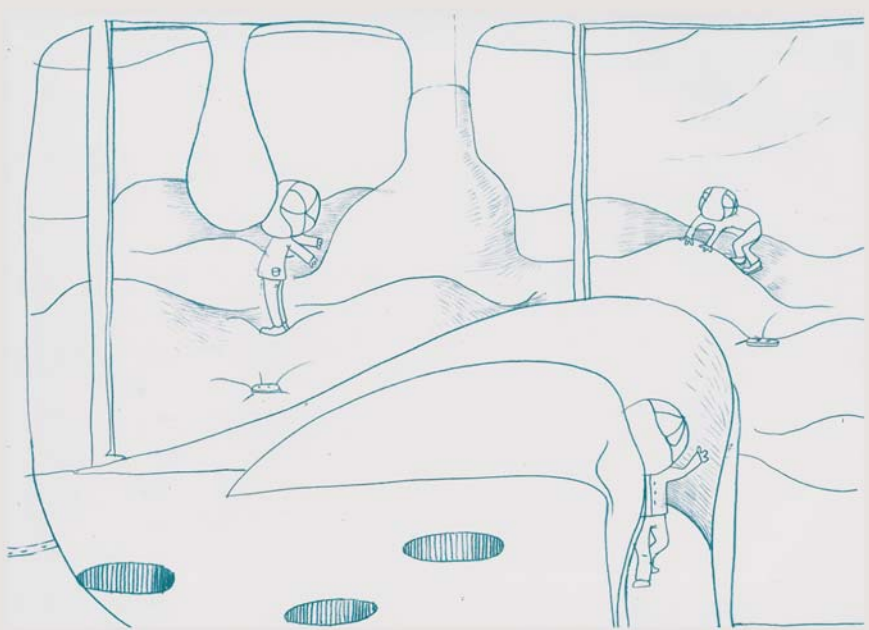
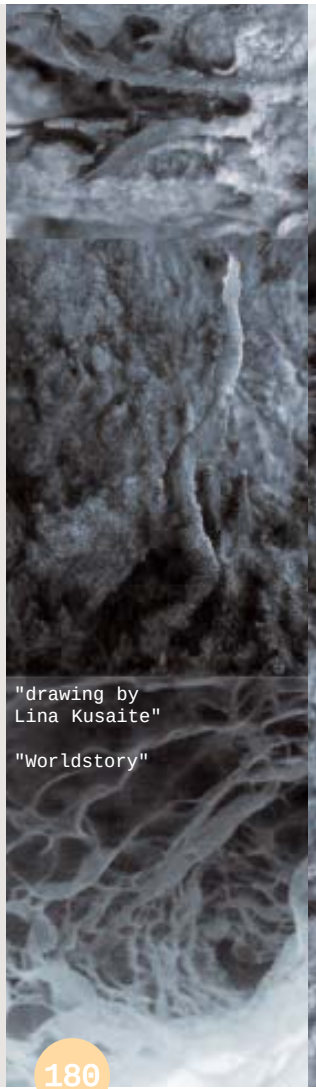
In the aeons when reality was yet unformed, amorphous horizons undulated, curled and twisted around each other, continuously transforming the shape of the universe. Depth was a treacherous dimension, that could unexpectedly become as shallow as a compact surface, or surge towards infinity without warning. Neither time, nor space seemed to want to flow in any constant direction. When they resonated with certain energies, they would begin a slow, omnidirectional expansion. Both time and space would gradually become filled with vast emptiness, cut through by large membranes, containing whole stretchable universes. In other cases, they would sway wildly across dimensions at even a minuscule disruption, thereby forming new and unpredictable reality-patterns. Wild fluctuations of the physical constants often caused the fabric of reality to become increasingly volatile, flicking the world in and out of existence.

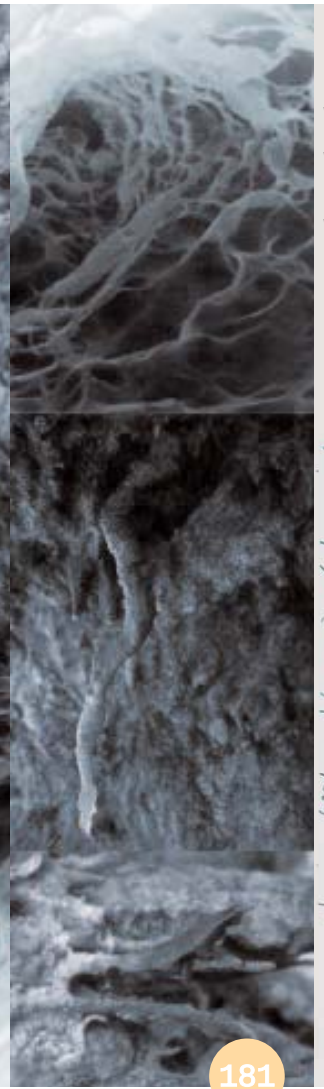
From afar, it looked like an intricate tangle of knots in a hyperdimensional tornado. From within, the clarity of forms was hindered by whirlwinds of dusty particles, amplified in thousands of oscillating vibrations. Through swarms of





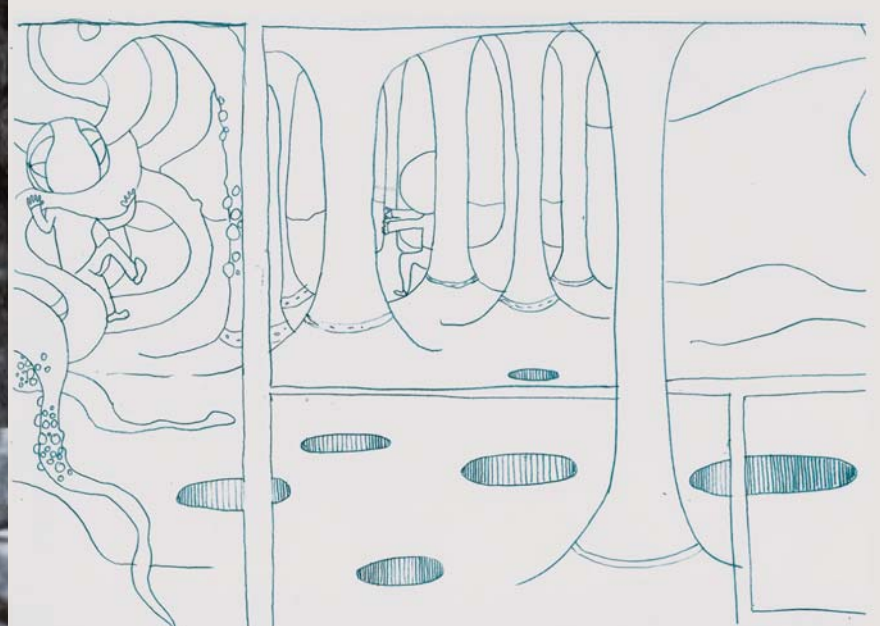
"drawing by
Lina Kusaite"

"Worldstory"



bubbling luminescent beings, the shapes of the world were formed into permeable tentacled flora, seemingly engaged in convoluted conversations. The creatures roaming this reality sensed the world through disconnected organs, unable to form shared impressions of the world. They imagined touching one world, while seeing another or listening to echoes from a distant, mutated past, present or future. Their lives were so bound to the dynamics of this unstable world, that their every action would impact the existence of reality, from the most minute to the most colossal dimensions. Both the creatures and the world lost the certainty of what is real and what is imaginary, what is cause and what is effect - all of which became increasingly entangled in a reality where everything appears to be simulating a bizarre physics and everything else acquired the elusive physicality of simulation...

"Therefore, when light, which is in itself simple, is multiplied an infinite number of times, it must extend matter, which is likewise simple, into finite dimensions (...) And some infinites are larger than other infinites, and some are smaller." Robert Grosseteste



EPILOGUE AS A PERIPHERAL MANIFESTO:

Towards creative play and imaginative intertwinement

Infusing the reality of daily life with imaginary situations is what artists, such as those involved in TRG do best. Common public spaces are our arenas for creating shared, but unexpected experiences. If successful, we are able to incite (temporary) transformation of perception, behaviour, or even world-view, for at least one person involved. In the public spaces of today, where the dominant behaviours are increasingly grounded in either cynicism or fear, we found the need to reintroduce playful moments, where it can be fruitful to be insecure and even scared. We want to surprise and cause unexpected situations to emerge from the simplest, most ordinary event (such as falling over). We want to physically alter public events and spaces, to enable creativity and imagination to be shared, left behind, picked up and modified by someone else, at some other time. Rather than making artworks for others to admire, we want to make art-worlds for ourselves to dwell in. Places that would encourage participation of intentional and accidental passers-by. Starting from there, from our own realities, we are working our way inwards from the periphery, from our small and seemingly insignificant niches, in which lived and alive experience propagates into everyday life through a myriad of experimental situations, one of which was TRG.

FIGURE 1
Portable transient realities (drawing: Theun Karelse)

TRG was a one year long series of experiments which started in June 2004 and ended in June 2005. It happened at the right point in time, with the right people and for good reasons. We wanted to see people's lives occasionally dissolve into situations where play and requiescence are of the highest value. We constructed temporary realities which aimed to provide a contrast to lifestyles drenched with a high-stress, competitive work-ethic, often hazardous to both personal health and the environment. With TRG we reacquainted ourselves with the ability to act playfully in a variety of situations; including the unlikely combinations of theoretical research, extreme sports, game-play, sewing, cooking, coding and child-care. Play, creativity, imagination and relaxation are four of the human aptitudes essential for the construction of a rich and diverse reality, yet too often forgotten on the journey into adulthood. We made environments that were designed to encourage people to play, create, imagine and relax (with us). The TRG environments became self contained realities, able to be modified and extended by many. Adaptive and open-ended, the TRG spaces flourished when shared, deformed and played with.

During the twelve months of TRG, we came a little bit closer to realising our wishes and dreams. More than thirty people across ten countries steeped their visions, time, moods, skills and knowledge into the project. We made many people smile. Many of them came back with their friends and families and laughed some more. Children refused to leave and hid under the floor until it was really time to go to bed (according to their parents). Several visitors wanted to take whole environments away with them to live in forever. Several of them learnt not to be afraid to sing in public. We ate traditional south, central and north European dishes, as well as peculiar experiments in TRG fusion cuisine (some of which we condensed into the recipes in this book). There was always a reason for celebration - for people arriving and people departing, for beginnings, endings and everything in between. Parties and toasts often lasted until the small hours of the night, with the last one extending well beyond midnight of the 1st of June 2005, when the project formally ended. Informally, the people involved in TRG, along with the events and knowledge will simmer in our memories for a long time.

FIGURE 2
The last supper (photo: Tadeja Nedog)

A warm thanks to everyone who made TRG and this publication possible!

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More information:
http://fo.am/trg/
http://www.timesup.org/sc/
http://www.kibla.si/trg/

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