


The nature of the problem

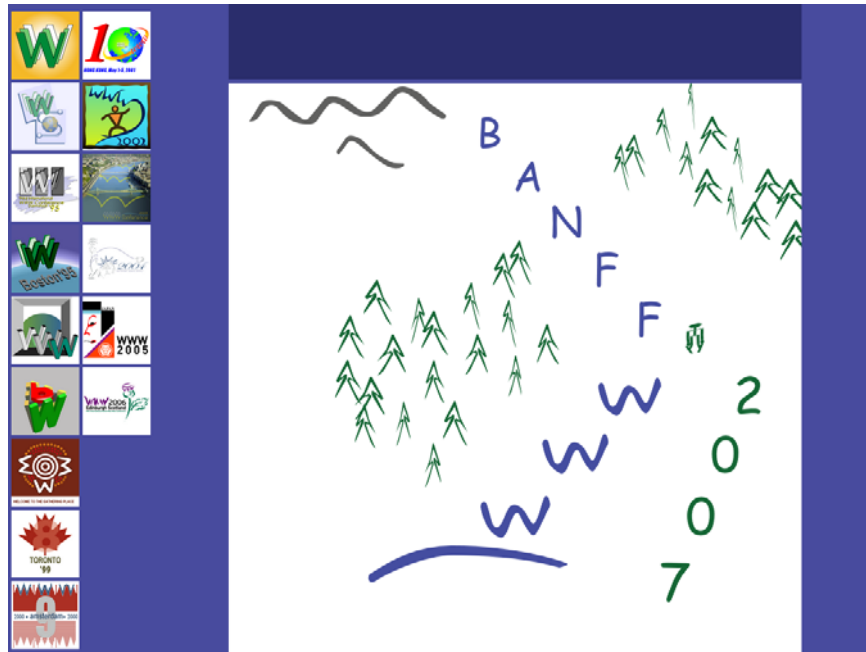
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- Digital objects are just bits
- Hardware, operating systems, application programmes, storage formats, transmission formats, are all subject to continuous change
- Poses challenges for continuous access
- Bits have only been around for 50+ years
- Cave paintings, ancient manuscripts, ... have much longer lifetimes

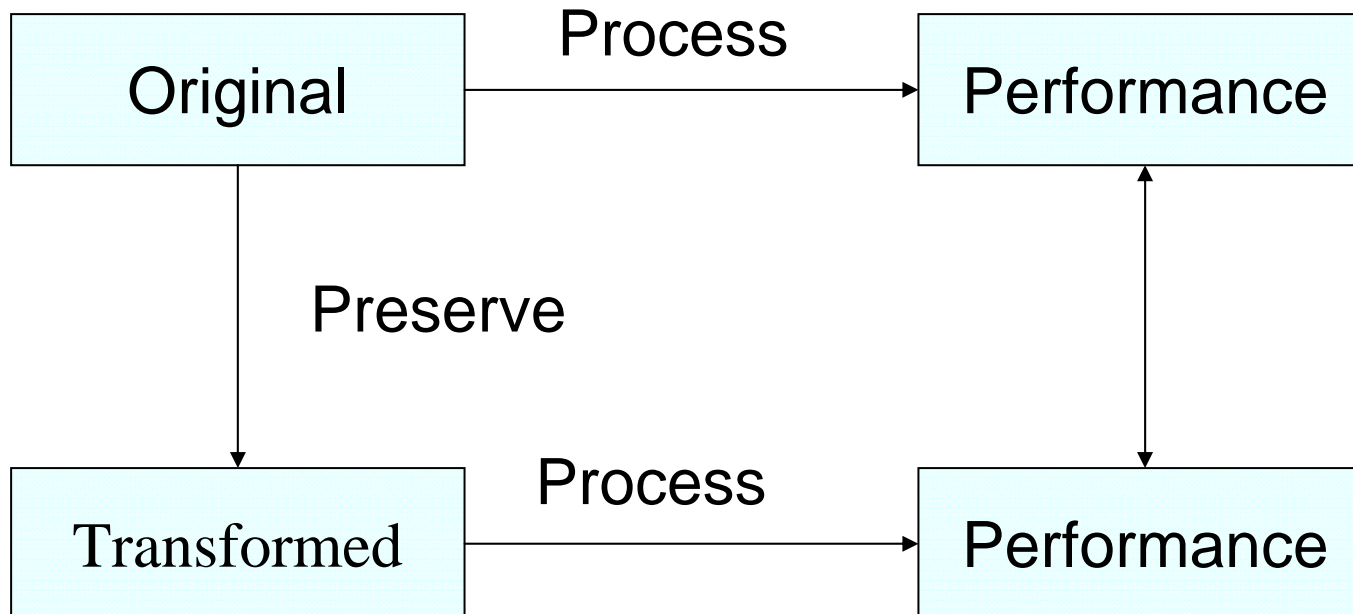
Example

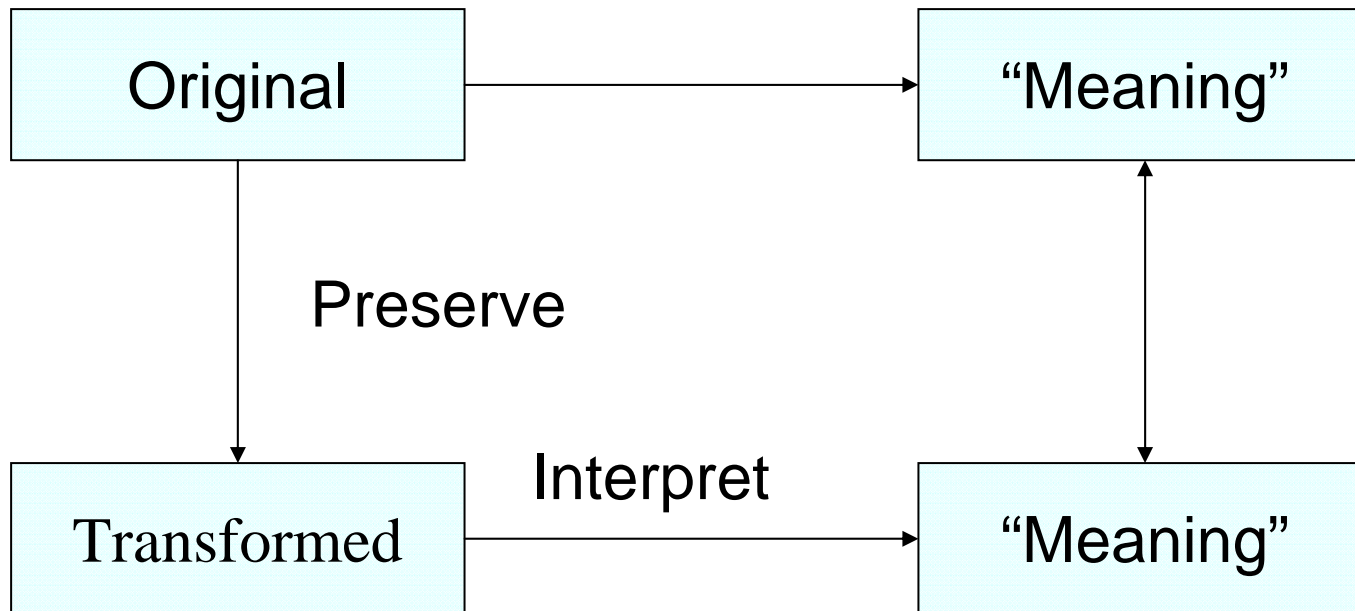


- WWW conference logo animation, Bob and Paul Hopgood
- Scalable Vector Graphics (SVG), standardised by W3C, first version 2001
- Now have 20 logo sequences, recently re-issued for 20th anniversary conference
- Issues
 - Ambiguities in standard
 - Browsers have different interpretations & degrees of strictness
 - Original Adobe SVG plugin is best implementation, but no longer maintained

- Bitstream preservation
- Technology preservation – hardware and software
- Migration – to new media and/or file formats
- Emulation – replicate original look and feel on modern hardware (or run as virtual machine)
- Universal Virtual Computer

- Due to National Archives of Australia (NAA), The National Archive (TNA) UK and others
- *Source* of an object combined with a *process* creates a *performance*
- Archival strategy then is to transform the original object with related information to produce a transformed source that retains the essence of the original
- i.e. retains its *significant properties*
- Familiar questions from visualization and accessibility
 - Do you see what I mean?
 - Do I mean what you see?
- Challenge then is to identify the significant properties of the original object and retain these under transformation



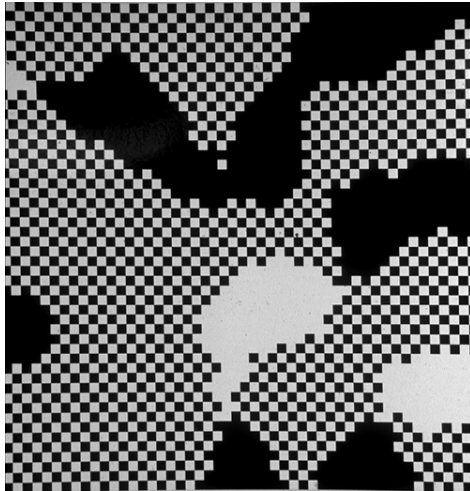


JISC Significant Properties of Vector Images

- Mike Coyne, Mike Stapleton, George Mallen (System Simulation), David Duce, Bob Hopgood (Oxford Brookes University)
- Can think of process of creating graphical output as a binding process
- Link significance to:
 - application conventions e.g. hatch patterns denoting specific materials, linestyle denoting specific diameter of a co-axial cable
 - trade-off, e.g. precise colour vs. colour for differentiation, colour for differentiation vs. linestyle for differentiation
- Suggested levels of significance and significance values
- Could think of producing a significance report to be used as a set of guiding principles for transformation

Computer Art Images

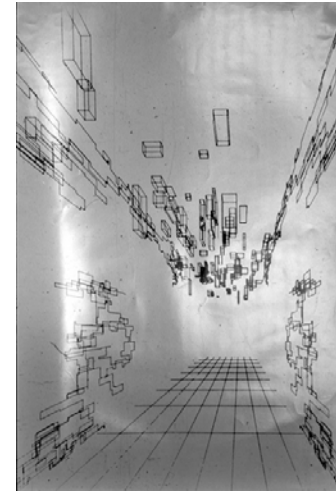
Lambert Meertens & Leo Geutz (circa 1973)



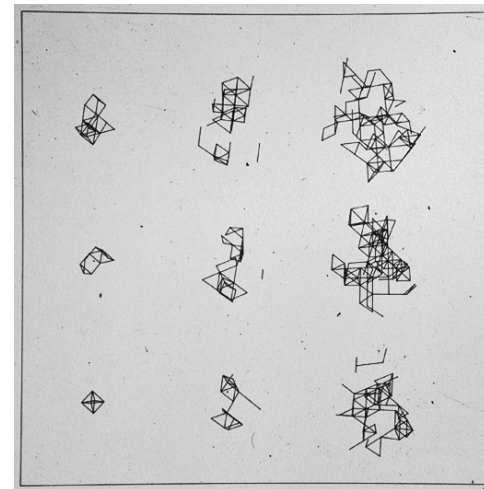
Manfred Mohr 1971



Georg Ness



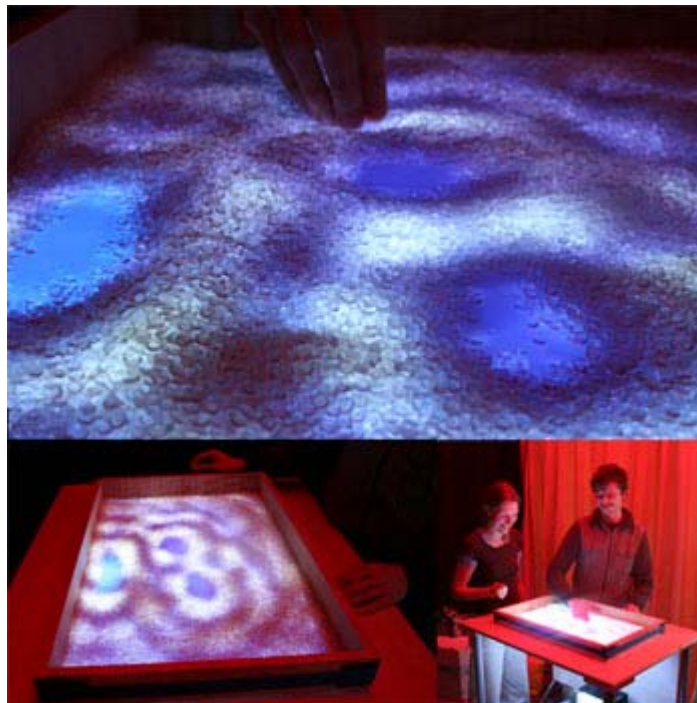
Paul Brown 1979



Significant Properties

- Significant properties of early computer art works vary
- In only one case was text significant at a metric value of 9
- Several were significant at a metric value around 5 and a few had values around 2
- Most of the line drawing needed a reasonably fine line but otherwise not significant. Only one line drawing made significant use of thick lines
- Many consisted of a regular pattern of characters used because of their overall grey scale intensity
- Fill-rule only specified in a few of the area filled works
- Colour primarily used for differentiation. One or two had sufficiently precise differences between colours for colour to be significant

- **Granulatsynthese**
- Roland Schroeder-Kroll, Martin Berghoff, Steffi Beckhuas, University of Hamburg
- Name derives from vinyl granulate used as main interface component. User moves and forms the material, creating landscape of granulate with “hills and lakes”. Resulting shapes control generation of sounds and visuals
- Visuals projected from underneath semi-transparent table surface; waves pulse and move through projection plane and landscape, corresponding to generated sounds
- Invites one to play with the granulate like a sand box. Deeper aspects discovered by exploring work, revealing potential as musical and visual device
- Inspired by works such as SoundVision and Scrapple as well as Japanese rock gardens and sand animation movies
- Winner of Eurographics Association’s John Lansdown Award in 2007





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- How should one deal with that?
 - Wherein lies the experience?

But

- From Paul Brown ...

I've reconstructed many of my early plotter works using contemporary technology. To me these are essentially “identical” or maybe even better than the originals but the art world is unlikely to agree. This is the distinction between an artist working in the “conceptual domain” and an art world addicted to the unique artefact. Somewhere in here is the concept of the “original”.

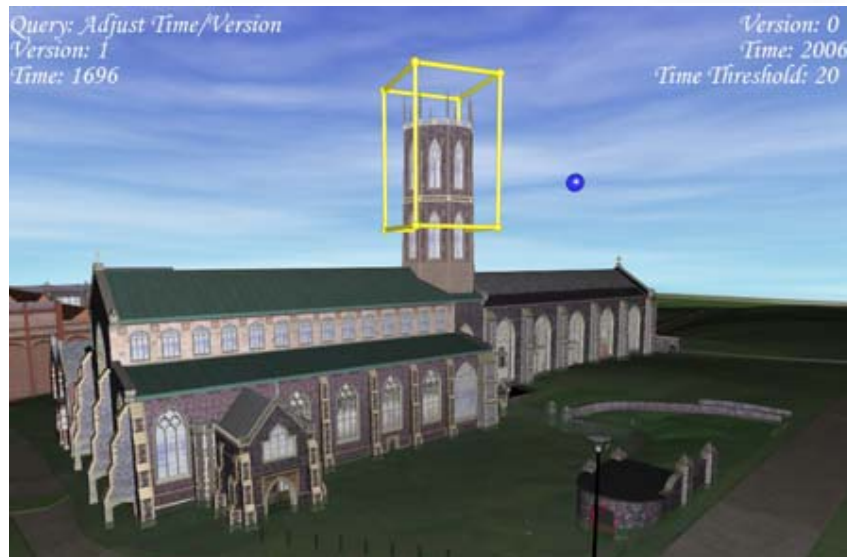
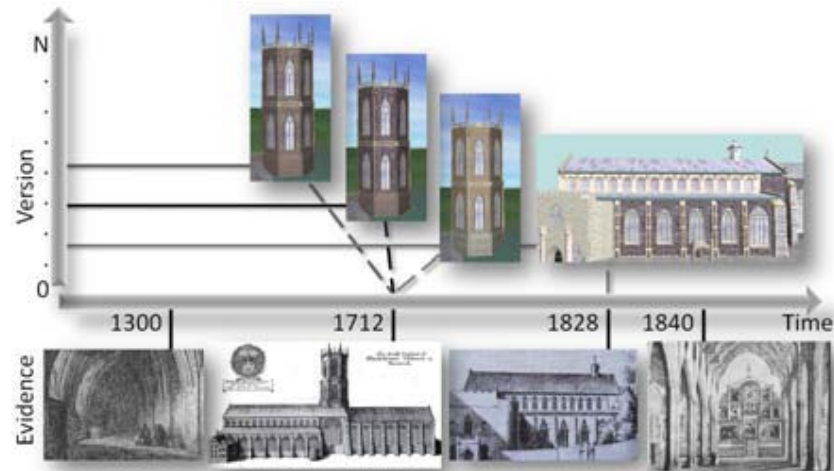
- From Longevity of Electronic Art, Howard Besser, UCLA School of Education & Information Studies, written February 2001
- Lack of fixity
- Dynamic
- What is the boundary of a work? (Pieces that link to other pieces)
- Formal elements (similar notion to significant properties) that may need to be resurrected in any future viewing situation
- Authenticity – how to guarantee over time?
- But most important

- **What really is the work?**
- 1980 “Hole in Space”, the Electronic Café set up video projection screens and hidden microphones in storefront windows in LA and New York
- These were hooked together via satellite, and waited to see how long it would take people to notice they could communicate with people across the country, and how they would choose to use this
- People played games, called their relatives, arranged times to meet
- What is the work? The video feeds, the plans for the installation, interviews with people in the crowd? ...

Thus ...

- Document *why* object is being preserved and precisely why it is being preserved in a particular way
- Broader perspective
 - different players/artist, critics, conservationists etc may have different perspectives on the “original”
 - many ways to preserve, modulo the perspective
 - importance of metadata
- In the digital world, preservation may branch, analogy with archaeological reconstruction

Uncertainty



- Real-time visualisation of multiple time dependent reconstruction hypotheses for a cultural heritage site, Laycock et al, VAST 2008
- St. Andrew's Monastic complex, Norwich, UK
- Data set comprises of more than two hundred individual components, totalling in excess of five million triangles, ranging from 1258AD to present day
- Images
 - Timeline view
 - Complex in 2006 with reconstruction of tower that fell in 1712

Cultural heritage specific challenges

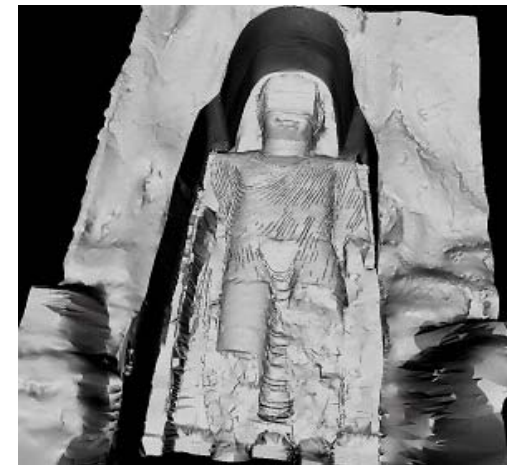
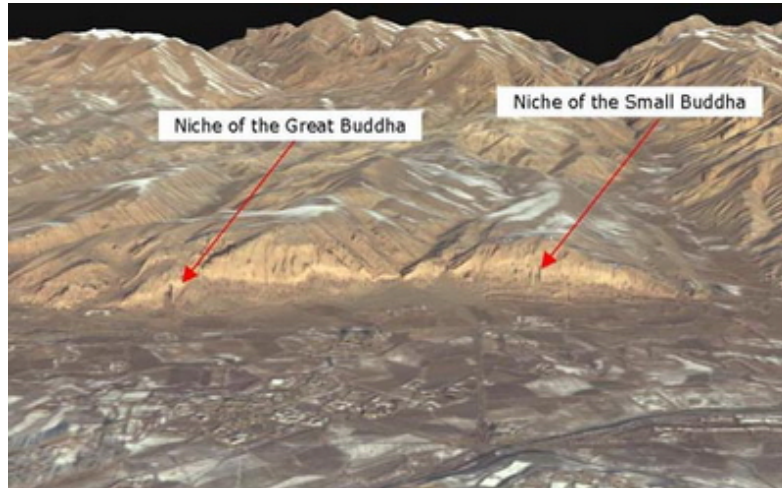
- What do you record as artefact?
 - “The Original”
 - Deliberate change over time?
 - Incremental history for condition monitoring?
 - Dramatic natural change?
 - Digital model(s) as artefacts
- What’s the semantic of an object – hierarchical details; instancing as representation of style, etc
- Who decides significance?
- In which culture? (conflict, colonial, religious contexts)

What is the “original”?



- Masonry typically reused – how might you record, use and interpret the semantics for each instance?

When things change, what do you “record”?



The Challenge of Semantics in digitisation



- What do you record? What's the significance? Physical objects; broken parts; surface indentations; Hieroglyphics? Construction? Semantic content?

- One avenue
- CIDOC-CRM standard
- Encode metadata about historic artefact by recording series of events in which it has been involved
- Artefact a player in chain of events: manufacture, change of ownership, damage, damage repair, digitization, ...
- Could be applied to migration of archived digital object
- Linking artefact to wider context

For the future – Digital Preservation Bags

- Digital Evidence Bags (DEB) in digital forensics
- *Idea*: contains pieces of evidence and history of processes applied to capture them
- Contents cannot be changed without recording what was done, by whom, when, how, why, ...

- *Idea*: Digital Forensics Workbench, tools read from and generate DEBs, and record metadata about actions performed etc.
- Digital Curation Workbench?

Pitfalls - Subtlety of Meaning

- “Knowledge” as interpretation of evidence
- Interpretation is normally ambiguous
- Events even more uncertain than artefacts
- Meaning changes with time
- Accuracy requires uncertainty to be shown
- Too much uncertainty and/or too many alternatives lead to confused messages
- Denying the complexity undermines the trust of CH professionals
- How do you represent subtlety? (CIDOC-CRM starts to address)

- Models
- The original
 - what is the work?
 - essence of the original
 - of the experience
- Importance of capturing what is being done and why?
 - who decides?
 - what metadata structures to use?
- Branching pathways, multiple interpretations
- Representing uncertainty, opinion, ...

Thank You!

Acknowledgements

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