Evolution and change through Action. Process; Growth of a model. Growth by evolution.

KNOWLEDGE

ThoughtSticker environment with Entailment Mesh and Ardstube display (Image 8)

In ThoughtSticker the intention was to facilitate a transformation in the state of knowledge and understanding (and the corresponding mental model) held by the student.

DIFFERENCE

Quote from Ecology of Mind by Gregory Bateson

"*Information is the difference that makes a difference*"

Difference of opinion; Disruption; Leading to Conversation; Leading to Convergence; Awareness of change; The difference that makes the difference;

THROUGH ACTION

Musicolour, Switchbank (Image 5)

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A Manual for Maverick Machines

Karen Martin

DIFFUSION GENERATOR

Trying to select themes and images to illustrate and represent Gordon Pask's work is an overwhelming task. His output was prolific and covers an extraordinary range of disciplines with ideas that intertwine and thread across projects. What is the best way to approach this? Should each cube represent a single project? Perhaps, but then how would we see the recurring concepts that draw this disparate body of work into a coherent whole? I chose to place each theme on a separate cube and allow the repetition of sub-themes, projects and images to reveal the strength of Pask's ideas.

Images 1, 2, 3, 5, 8, 10, 12, 13, 14, 15, 17, 20 Copyright Paul Pangaro

Images 4, 6, 9, 19 Copyright Jascia Reichardt

Images 7, 11, 16, 18 Copyright Richard Brown

For information on the projects shown in the photographs see the descriptions at the back of this eBook.

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Transformation is the change from one state to another; The process of transformation results in transformation of the output and occurs in response to feedback. Transformation is the updating of the model; Transformation is the process towards conflict, negotiation and understanding.

GROWTH & EVOLUTION

Dendritic Glass, Copper LED Close Up; Richard Brown (Image 16)

INDIVIDUAL - HUMAN

Gordon Pask at his desk (Image 1)

A conversation can take place between two or more people or a conversation might happen within a single individual. A conversation might begin as a response to the environment or as an updating of a mental model.

FEEDBACK

Black SAKI (Self-Adaptive Keyboard Instructor) in the Systems Research Office (Image 2)

Conversation can be thought as a feedback loop. One participant in a conversation acts as the event that triggers a response from the other participant(s). This response can be the event that triggers the next conversation.

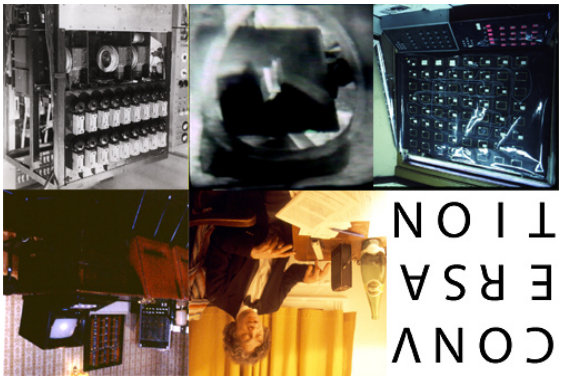
DISRUPTION & CONVERGENCE

Entailment Mesh in the ThoughtSticker Environment (Image 3)

Pask's view was that new knowledge or information acts as a disruptive force in a

For Pask, 'conversation' was a process that he refined into a theory of interaction. For me, this sophisticated theory is a thread running through Pask's diverse output, revealing similarities between projects as varied as a machine that converted sound to light (Musicolour) and an automated typing instructor (SAKI).

Pask thought of conversations are dynamic constructions created between participants. If even one of the participants changed then the resulting conversation would be different.



ThoughtSticker used a knowledge structure to mediate a conversation. As a result of the student's interactions, new perspectives in the knowledge were displayed on dynamic graphics tubes. 'Agreement' is used as the primary measure of success.

Dendritic Glasses I, II and III
Richard Brown, 2007

Three metals, Aluminium (Al), Iron (Fe) and Copper (Cu)sandwiched between glass, held in cotton wool in a conductive solution. Over time, the metals transform due to electrical activity generated by the disimilar metals.

Quotes are taken from:

Bateson, G., *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution and Epistemology*, University of Chicago Press, 1972

Pask, G., "A Comment, a Case History and a Plan" in *Cybernetic Serendipity* edited by J. Reichardt Rapp and Carroll. 1970. Reprinted in *Cybernetic Art and Ideas*, J. Reichardt, London: Studio Vista, 1971

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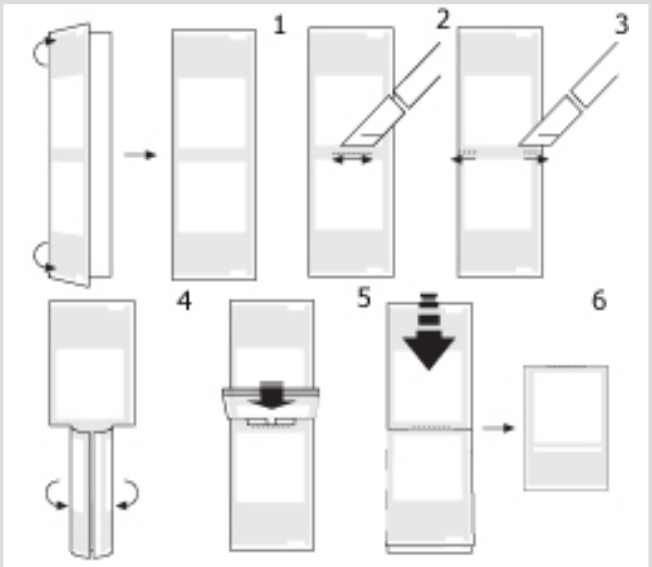

Gordon Pask, 1953

Musicolour was a machine with which a human performer might create a musical performance. It took the music created by the musician, transformed it and created an aural and visual representation of these changes with the intention to inspire.

SAKI (Self-Adaptive Keyboard Instructor)
Gordon Pask, 1956

SAKI covered a range of programs, aimed at improving keyboard skills. The program measured the accuracy (keystroke and sequence) and speed (rhythm) of the typist and adjusted the exercise tasks to increase the typists practise on areas of error.

Colloquy of Mobiles
Gordon Pask, 1968

An interactive computer-based system composed of five mobiles which communicated with each other by light and sound. The audience took part in the conversation between the machines using torches and mirrors.

ThoughtSticker
Gordon Pask, 1976

PROJECT DESCRIPTIONS

Learning as construction; model-building; model-remaking; updating, adapting, transforming; evolution and growth;

CONFLICT - NEGOTIATION - RESOLUTION

ThoughtSticker; Ardstube and Entailment Mesh (Image 8)

Conflict as disruption revealing difference. Resolution as convergence and understanding. Process of learning as growth involving the construction of mental models.

TRANSFORMATION

SAKI (Self-Adaptive Keyboard Instructor) (Image 2)

Change from one state to another. Growth and evolution. Process of change; Change through action, participation, interaction, conversation. Transformation of models. (Re-)construction of models.

All of Pask's projects involved computation in some form. As usual, Pask had a very broad understanding of what computation might be; from the algorithms and programming of a digital computer, which he famously described as 'a kinematic magic lantern' to the analogue computing of electro-chemical processes.

Computation as a series of state-changes. An input or starting state, undergoes complex changes to reappear in a transformed state as an output. This output state becomes input state.. Computation as conversation.

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subject's existing knowledge structure/model of the world and forces a process of adjustment and negotiation until a point of convergence is reached where the old model is updated to assimilate (or reject) the new information.

INTERACTION

Colloquy of Mobiles, Close up of Male with Mirror (Image 4)

The cyclical notion of interaction between the mobiles, with interruptions from people, contrasts with more linear concepts of interaction often embodied in Artificial Intelligence (AI) and, more recently, ubiquitous computing and responsive environments.

PERFORMANCE

Musicolour, Switchbank (Image 5)

Performance as conversation between performer and audience; Performance as conversation between performers; Machines as performers.

learning.

LEARNING

Musicolour, Switchbank (Image 5)

Learning as participation; Learning as construction of knowledge; construction of models; construction of prototypes; construction of computation; Learning about computation; learning through computation. Learning as interaction, conversation, exchange.

INTERVENTION - ADAPTATION

Dendritic Glass III, Set up; Richard Brown (Image 7)

Disruption in existing model, state; Forcing change; Revealing difference; Leading to negotiation, conversation, interaction and participation; Resulting in convergence, understanding, updated models, feedback, adaptation and construction.

CONSTRUCTION OF KNOWLEDGE

Content of Gordon Pask's Bookshelf (Image 20)

Learning was one of the fields to which Pask applied his knowledge through the construction of machines such as SAKI. However, as with construction, learning could also be considered conceptually and the interaction process in Pask's Conversation Theory draws heavily on his ideas of

NETWORK

Colloquy of Mobiles, 3 Figures (Image 6)

The mobiles, or figures, create a network of interaction which exists independently of the audience. This network is electronic and social, with actions by one figure triggering reactions in others. These interactions are picked up by the network of figures and ripple through the inhabited space.

ANALOGUE

Dendritic Glass III, Set up; Richard Brown (Image 7)

Computation as analogue switching mechanisms; Growth of computational processes through binary choices; Leading to unpredictable consequences; Analogue materials;

MODEL

Entailment Mesh and Ardstube in the ThoughtSticker Environment (Image 8)

In response to a student's actions the ThoughtSticker environment would display a

continuously updated, personal, model of their knowledge structure on the Ardstube (display). ThoughtSticker environment itself is a model embodying Pask's theories of learning processes.

SYMBOLIC

Pseudo-binary code

Computation is generally considered as code; the manipulation of mathematical symbols. But these are only symbols and at its heart, computation is the process of determining something by logical methods.

HUMAN - THRU - MACHINE INTERACTION

Musicolour, Switchbank (Image 5)

Musician produces sounds; Sounds transform to light through Musicolour; Light inspires musician; Musician transforms sounds; Sounds transform to light through Musicolour; Light inspires musician; and so on..

THEATRE & DRAMA

Musicolour Hall (Image 15)

Place and process of performance. Time-based. Adaptive; Responsive; Participatory; Changing; Improvised; Transforming; Constructing;

(Image 19)

Improvisation as response to state; improvisation as response to feedback. Improvised action. Improvised change. Improvised transformation.

AESTHETICALLY POTENT ENVIRONMENTS

Extract from 'A Comment, A Case History and a Plan' by Gordon Pask.

a) It must offer sufficient variety to provide the potentially controllable novelty required by a man (however it must not swamp him with variety - if it did, the environment would be simply unintelligible.)

b) It must contain forms that a man can interpret or learn to interpret at various levels of abstraction.

c) It must provide cues or tacitly stated instructions to guide the learning and abstractive process.

d) It may, in addition, respond to a man, engage him in conversation and adapt its characteristics to the prevailing mode of discourse.

Along with Heinz von Foerster, amongst others, Pask took the original theory of cybernetics and developed a '2nd-order cybernetics' in which the observer is considered as part of the system. This shift in position emphasises that objectivity is always subjective. This concept, along with the cybernetic ideas of feedback and transformation, informs Pask's work and Conversation Theory.

DISRUPTION & ADAPTATION

Colloquy of Mobiles, Male between Females (Image 9)

Social system of machines interrupted by an audience of human observer/participants using lights and mirrors. Actions create reactions and transformations.

FEEDBACK LOOP

Musicolour, Switchbank (Image 5)

A constant loop of audio-visual feedback between performer and Musicolour allows the performer to adapt their performance in response to the output generated by the machine.

OBSERVER / OBSERVED

Gordon Pask and his wife Liz (Image 10)

In his text on 1st-order cybernetics, Wiener places the observer outside of the system. Gordon Pask and other 2nd order cybernetics set the observer within the system, accepting that their very presence would have some effect on the

Pask had a life-long interest in the theatre and these sub-themes explore how this knowledge informed his theoryof interaction and the conception and construction of his computational experiments.

BOREDOM

Musicolour, Switchbank (Image 5)

Boredom as state. Boredom as lack of action. Boredom as trigger for change. Giving feedback on state of boredom. Human condition; Machine condition.

ACTION & INTERACTION

Gordon Pask and his wife Liz (Image 10)

Taking action to change, adapt, transform state. Creating feedback. Responding to feedback. Feedback loop as interaction between components; states; individuals; Interaction as participation.

IMPROVISATION & ADAPTATON

Colloquy of Mobiles, Collage of 4 images

Constructing a model; constructing a prototype; learning through construction; constructing a mental model; Adaptation to models; Computational model; Model as example; Model as state;

FEEDBACK LOOP

Musicolour, Switchbank (Image 5)

Feedback loop of action on model; Revealing difference. Facilitating change; adaptation; transformation.

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disruption, negotiation, conversation, resolution and convergence. Through action, adaptation and transformation; Building the model;

GROWTH & EVOLUTION

A sketch by Gordon Pask of the Eureka Desktop Machine (Image 14)

Process of growth; process of evolution; Building the computational processes for action and adaptation.

From correspondence with Paul Pangaro:

"... At some point I complained to Gordon that the Eureka was old hat so far as computing engines go, and that desktop models had become all the rage. Didn't the Eureka need an update? Forthwith, via photocopies, white-out eraser fluid, and a fresh pen, the Eureka desktop model was created. Naturally enough, it came with its own desk."

MODEL

Dendritic Glass II, Iron; Richard Brown (Image 18)

Systems are made up of a series of components; These components might include technological, mechanical, digital, material or social elements; The output of one component is affects the action of other components in the system; Nothing is isolated; Everything is related;

FEEDBACK

Black SAKI (Self-Adaptive Keyboard Instructor) (Image 2)

SAKI includes the typist as a component in the system with the ability to moderate and respond to action by other system components.

operation of the system.

SYSTEM - MODEL

Dendritic Glass; Richard Brown (Image 11)

A form of electrochemical emergence. The filament growths from the iron share a similarity to Pask's electrochemical device that could recognise sounds, known as Pask's Ear.

SPIRAL - CONVERGENCE

Spiral of Convergence; Heinz von Foerster (Image 12)

Heinz von Foerster's Process of Convergence: The spiral represents a process that converges over time to a stable place (centre of the spiral). In cybernetics, processes such as mental concepts have this form.

Testing theories and ideas of interaction generally requires the construction of a system with which people can interact. These images illustrate the different forms and materials with which these prototypes were constructed. To Pask, 'construction' was also a conceptual approach, in which the designer constructed the framework of a system, but the outcome of each participants interaction with the system was a construction tailored to their individual idiosyncracies and requirements.

COMPUTATION

Pseudo-binary code

Building computational processes; components of state, process of disruption, transformation and feedback. Building the prototype; building the model; Building for action; building for thought.

THOUGHT PROCESS

ThoughtSticker; Ardstube and Entailment Mesh (Image 8)

Building thought processes; components of state, existing thoughts, mental models; process of

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STATE

Colloquy of Mobiles, Close up of Male with Mirror (Image 4)

State-change as dynamic process; Action as the process of change; Existing state, future state, past state; Transformation between states;

Transformation through taking action; Through growth or evolution; Through conversation, participation, interaction; Achieving new state; new knowledge; new models. Taking action to reach new state;

HUMAN

Gordon Pask in his study (Image 13)

The social system that exists between individuals may also be mediated by machines.

MACHINE - MACHINE INTERACTION

Eureka Computing Machine (Image 17)

From correspondence with Paul Pangaro:

"Gordon had been known to draw cartoons that sometimes appeared in his scientific papers, ... which included the birth of the Eureka machine, one of his great conceits. This was a 'pocket calculator' that stood atop Corinthian columns and that came with its own sources of true random numbers: roulette wheel and weather vane. Despite all this - as Gordon's hand-written caption attests - the Eureka, "when dismantled via thumbscrews, fits easily into pockets."

IMPROVISATION

Musicolour, Hall (Image 15)

TRANSFORMATION / STATE

Colloquy of Mobiles, 3 Figures (Image 6)

Transformation from one state to another through interaction. Predictable and complex transformations result in unpredictable states. Transformation triggered by noise and interruptions. Converging on stability through learning.

Adaptation as improvisation; Disruption causing improvisation; Improvisation and adaptation as performance; Improvisation in Conversation; Conversation between components;