if mouseSign then: Semiosis, Cybernetics and the Aesthetics of the Interactive

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When delivered as a live performance this text is punctuated with the display of interactive media, sometimes with commentary, sometimes without. In this text appropriately illustrative pieces are named. There is no way to word up, describe or account for what is done using the interactive media artefacts. The best I can hope for is that you find those works for yourselves and having experienced them reflect on the text of the paper. Or if you can not find them, then experience some others and reflect on the text. If the words here have any relevance then they should apply to all instances, and not only to my carefully selected materials.

Brunswick Parking Lot [7]

AN OBSERVATION

Thomas Kuhn, talking about the history of 'normal science' makes the point that much time and energy is spent in having to explain things again and again because they are not shared and can not be taken for granted.

Being able to take no body of belief for granted, each writer on physical optics felt forced to build his field anew from its foundations. In doing so his choice of supporting observation and experiment was relatively free, for there was no standard set of methods or of phenomena that every optical writer felt forced to employ and explain. ..... That pattern is not unfamiliar in a number of creative fields today, nor is it incompatible with significant discovery and invention.

Kuhn, [1]

These comments characterise the activities of scientists in the period preceding the establishment of a 'normal science' either before the body of knowledge in a field is established, or at times when the existing body of knowledge is found to be inadequate. 'Normal science' for Kuhn comes at a time

when scientists in a given field share a paradigm of ideas about what it is appropriate to measure through experimentation. With that paradigm in place the field develops rapidly, partly because less energy is used up in reworking definitions or advancing and countering competing views of what makes up the field in the first place.

With Kuhn's perspective in mind, at the start of this discussion of semiosis, cybernetics, and the aesthetics of the interactive it is as well to make clear certain terms and ideas.

Firstly, and most importantly, the way in which the word 'interactive' is used. This is because there is a general sense to the word 'interactive', and a specialised sense. In the general sense everything is interactive because we enter into a discourse of signs and cognition with it, a discourse which has been seen as 'hermeneutic' and which is essentially a sign process of syntagmatic-selection (syntagmurgy – see note 1). In the specialised sense, when it is used of particular instances of things which are usually (but not always nor necessarily) mediated through digital technologies, fewer things are *interactive* because the discourse of signs and cognition that goes with those things is unlike the discourse that goes with other things. That discourse includes and involves a dualled-syntagmurgy derived essentially from the cybernetic loop of interactivity and the quandary of physicality that typifies such things.

The number of things that are described by this specialised meaning is, of course, increasing, and the *interactive*, in this sense, has become an important location of cultural activities – economic activities, artistic activities, communication acts, entertainments, functions and distractions of many kinds are now located within the things that are described by this meaning. Indeed, the experience of the *interactive,* in one form or another, is an increasingly common day-to-day activity for many people in the technonomies of the world, and a preferred form of leisure time engagement. So much so that the sign systems (the languages) of the interactive are among the most commonly used languages.

Reminding ourselves of this difference in meaning, and rehearsing that difference, will establish an essential characteristic of the interactive which plays upon all subsequent discussion of it, and will return us to the main point of the discussion which is the way in which the language of Mouse operates and how it contributes to the aesthetics of the interactive, the defining qualities of the experience of the discourse that is the *interactive*, in this specialised sense.

Here, the aesthetics of the interactive is about the experience of experiencing the interactive. It is not about judging the interactive in any terms of beauty derived from arbitrary

histories or beliefs about how things should be. The aesthetics of the interactive is about enabling an effective discussion of the experience of the interactive in all its diversity, in all its various forms. It implies that there is a cognate thing, or set of things, that share enough characteristics to be classed together and labelled as the interactive – including such things as web based search engines, medical record databases, word-processors, text adventure games, image editing software, online tax returns, shoot'em'up games, interactive installation artworks, spreadsheets, digital camera photo-album software, soundtoys – and that there is a commonality to the way in which the can be described, discussed and analysed.

Small Fish [8]

DIFFERENTIATION: HERMENEUTICS, SEMIOTICS, SYNTAGMURGY

There is a general sense of the word interactive, a common place meaning, which is a truism – everything is interactive because we interact with it. A painting, for example, is interactive because in looking at it we are in some form of discourse with it. This can be represented as a simple diagram in which two entities exist separately and overlap mutually.

In this diagram the area of overlap stands for the 'moment of discourse', and we would generally identify the two entities as (something like) a text and a reader. Identifying, usually, a set of signs (the text), and a receiver/processor of those signs (the reader).
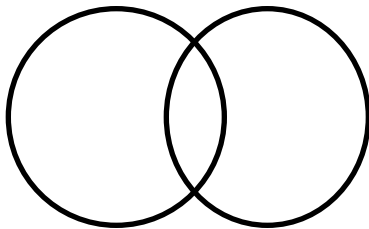

Figure 1

And it is this sense, initially, that all things are interactive because to 'know' some thing is to somehow have experienced a shared discourse with it (or, of course, more accurately with the signs that make it up, or, more accurately still, to have experienced the sensation of the perception and cognition of those signs and to have related that sign system to more or less shared cultural conditions of meaningfulness). In each moment of discourse there is a making of meanings. Those meanings are contingent on the moment, they are fickle and shift from and between each moment of discourse as the meanings play through transient syntagmatic:paradigmatic states. Our reading at any one moment of discourse is dependent on that moment and quite possibly differs markedly from other readings and the readings of others, which are themselves the experience of other moments of discourse.

"*By tradition, the relationship between audience and artwork has been analysed as an active one characterized by "interpretation". According to traditional notions, interpretation changes the artwork (e.g., the reader*

"*acquires" the text, thus changing its meaning into something different). ..... the relationship between the audience and the artwork is "hermeneutic"... this particular form of observational relationship between an audience and the sign object in which the interpretative observation changes the meaning of the sign object. From here stems the notion of a circular process constituted by artwork and observer, the so-called hermeneutic circle.*"

Qvortup [2]

Our general understanding of the continuity of the physical world requires that the text, a painting, say, or a sculpture, is much the same between our moments of discourse, and is, itself unaffected by those moments of discourse – the text has a fixed materiality (which is the paradigm of signs that constitutes all the sign needed to 'read' the text;object), remaining consistently the same for different viewers and for a viewer's own, individual moments of discourse. Unless the text is physically changed in some way, damaged, vandalised, reworked – in which case, as it is different and no longer the (original) text so the discourse is necessarily different – it is understood to have a consistency and fixity across and between viewings. We have no great troubles with this in our quotidian existences. Indeed, the very basis of social worlds can be understood as requiring a clear and certain acceptance of the continuity of the physical world, of the fixity of the materiality of things.

This experience of (or belief in) the material fixity of an object (the text) seems initially to be at odds with the idea of the hermeneutic experience. The fixity of the object contradicts the supposedly 'subjective' nature of the interpretation, and one or the other seems counter-intuitive.

The material fixity of things is bound in, at an existential level, with the signs that make them up – the paradigm of the text. There can be no signs that are not material, and there can be no signs of the text:object beyond its materiality where materiality is bounded by and defined as the presence of the object:sign in the (human) sensorium – I have discussed this previously and elsewhere, and will return to it here, later. Viewed from the perspective of semiotics the 'hermeneutic' process can be described as the making of a selection from the broader paradigm of signs that constitutes the text to form a selection, or syntagm of a particular 'reading', 'interpretaion' or, viewed the other way round, 'utterance'.
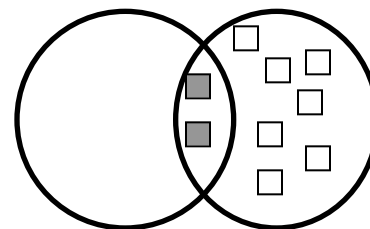

Figure2

In this diagram the 'text' (to the right, my humanist acculturation through European print conventions requires me to place the most important thing to the left, here the 'reader' (individual, human, being, living) is more important that the

text (inanimate, reproducible)) is made up of a paradigm of signs – rectangular blocks - and the hermeneutic process includes only a selection (syntagm) of those signs for its interpretation (the greyed blocks in the area of overlap).

This selection, this forming of the syntagmatic sub-set from the paradigm which is all the possible signs (and materiality) of the text will feature in this discussion severally, I will use the term syntagmurgy for it (see note 1). In hermeneutics this syntagmurgic process is one of reception and interpretation, the reading of the (current and continuously changing) syntagm of signs from the text:object.

It is clear that we experience things severally and differently, they differ from moment of discourse to moment of discourse for ourselves, and the interpretation varies. This can be accounted for in one way by changes in ourselves between viewings – psychological changes, life events, present concerns, the transient effects of diet, intoxication, fatigue, the mood of our companions, whatever…… In another way this can be accounted for by different bodies of prior knowledge, varying skills of viewing between different vieings and, between individuals…… Concentration, modified and manipulated by all those thing that affect us, is syntagmurgy, and even though the text is fixed, the discourse is dynamic as the reader continuously shifts and changes within one moment of discourse and between others. In this the reader constitutes a specially fluid text and the signs included in the syntagm of perception (and so, what the text is understood as) vary during and between moments of discourse.

The conditions of the reader create a dynamic process of syntagmurgy. The 'internal' signs of the reader (their knowledge, associations, concerns, interests, etc) all influence and modify the syntagmurgy, and the syntagmurgy modifies the reader by becoming part of the 'internal' signs.

The important point, here, is that the location of syntagmurgy is within the reader. The object:text exists materially, and as a complete paradigm of all the possible signs that can be read as the text:object but not as all the signs that can make up the discourse for the reader, too, brings a body of signs to the discourse. And it is in this sense that we 'interact' with everything, and that interaction is 'hermeneutic'.
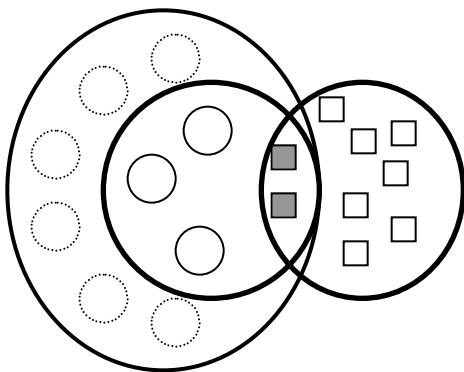

Figure 3

Represented in this diagram by the leftmost ellipse and the circles it contains, several factors influence the syntagmurgy of the reader. The 'hermeneutic' interpretation of the text is dependent on how these factors inform the act of reading the text, which signs from the paradigm that makes up the text are noticed and in which order. These are such things as preoccupations, obsessions, associations, concentration and the mental skills of the prepared or trained mind.

The syntagmurgic process of reading a text necessarily varies from reader to reader as their conditions are particular to them. Although acculturation means that the members of a given community will have a shared general reading of a text (the process of acculturation prepares the mind for all acts of readings, puts in place prepared syntagmurgic processes), individual readings will vary, and cultural readings will vary across time. In this way the material text holds polysemy, its meanings vary even as all its signs are fixed because syntagmurgic processes render signs into readings. All readings then become aberrant readings because there is no one reading which is more definitive or more privileged than any other.

Syntagmurgy is not only a reception of signs. While the reading of text can involve an active searching for signs (an active viewing of an iamge, say, where the eye:mind searches the image, tracks between areas to resolve a discrepancy in the sign systems such as a visual pun where a sign functions indexically for one meaning and iconically for another) in another form, the process of selecting from a paradigm creates utterances. These two syntagmurgies go side-by-side, and turn-by-turn, reception leading to creation leading to reception. In some instances such as conversation, dance improvisation, jazz jamming, performance art, the two forms of syntagmurgy flow across and through a rich interpersonal understanding, fusing the syntagmurgies of reception and creation into one. And in this sense a number of artforms are interactive and often are characterised by an emergent and ephemeral paradigm of signs.

The other meaning of *interactive*, the specialised meaning, and the one which is central to this text and discussion is about the discourse with a particular class of text, ones which are, usually, mediated by digital computing technologies. The thing that marks out this specialised meaning is the particular and peculiar nature of those texts. Where a painting or sculpture, a chair, crab or trumpet are taken to have physical continuity (that is to say they embody the paradigm, and stay the same across time and between viewings and viewers) these texts have no such continuity, or no guarantee of such continuity. Much of what notionally constitutes their paradigm of signs is not material, and that which is material is not necessarily the same for and during any moment of discourse or between viewings. That is to say that much of what will constitute the signs exists as 'coded' information, held, stored, located beyond the human sensorium and although having a physical form (as pits on a CD, or the charges that make up bits in planes of doped silicon or ferro-magnetic particles) they are not material. Even if we could sense the pits on a CD the resulting sensation would not be the same as the sound that would come from the same stream when passed through CODEC hardware and software and through loudspeakers, nor the image that might be made of it. This is the quandary of materiality as it effects the interactive. The encoded data is retrieved, used to generate displays and in that it takes on materiality and meaning. In the interactive that process is, of course, contingent on the reader's actions in the moment of discourse. Literally brought into being by the discourse the *interactive* text is ephemeral and has an emergent syntagmurgy of display which becomes the

paradigm that the hermeneutic syntagmurgy entrs into discourse with . While its paradigm exists at a physical level it only takes on materiality in the moments of its display.

Where in the general sense, the dynamic qualities of the interactive come from the syntagmurgy of a reader's cognition, perception or position in relation to a fixed text, a paradigm of signs embedded in a materiality; in the specialised meaning that same syntagmurgic process of cognition, perception, etc relates to a text that does not have that fixity, it is itself a syntagmurgic instance drawn from an otherwise unknowable paradigm of signs, that only take on materiality in the instance of display. In the interactive syntagmurgies of reception and creation merge in a way which is unlike that of other sign systems and the discourse can not be reframed by moving through or around a material text because it ain't there.
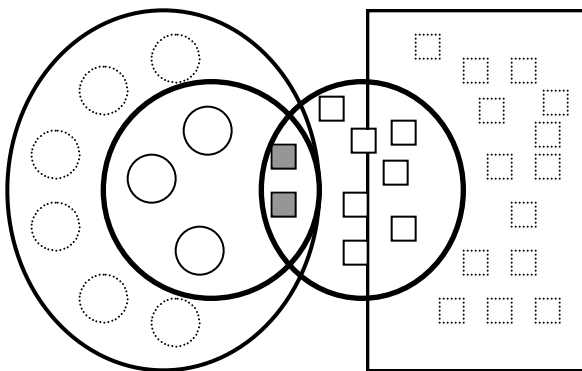

Figure 4

In this diagram the bounding rectangle to the right and the objects it contains represent the data paradigm of the text – the information that can be used to construct a display – the display itself being the material signs of the text, which are represented by the solid line boxes in the right circle. This selection of display sign from the data paradigm is syntagmurgic. It comes about through the overlay of reader's actions with the algorithmic rules of the system. The data paradigm can be thought of as the database that for Manovich is 'traversed'. In interactive artefacts the invocation of elements of the data paradigm as parts of the display syntagm comes about as a consequence of the user's actions, decisions, choices, and in this is Aarseth's idea of the 'ergodic' – the outcome of 'non-trivial' actions in traversing an underlying database.

Taken together, the hermeneutic interpretation that is acts of reading, and the contingent, 'ergodic' process whereby display is formed, constitute a dual-syntagmurgy which characterises the interactive and is unlike other media forms and experiences. It is in this dual-syntagmurgy that the *interactive* (in its specialised sense) is differentiated from the interactive in its more general sense. And with this comes particular experiences and concerns that taken together define the discourse of the *interactive*, and its aesthetics. This dually-syntagmurgic relationship is a kind of two-way hermeneutics – the user experiences a text/system and interprets it, the system experiences a text/user and interprets it. The actions of one provoke the display of the other. The displays of either are the actions of the other. And this describes the loop of communication and control that sits at the heart of all cybernetic systems.

Obsession [7]

INTERACTIVITY, SEMIOSIS, CYBERNETICS

Interactivity here is understood as a 'cybernetic loop' in which actions and displays are irrevocably linked as instances of communication and control, and through which a semiotic process runs (see figure xxx, below). That process is inextricably bound up with spatial and temporal juxtapositions, with real or apparent cause and effect, forming the changes in pattern and of energy that are the basis of semiosis, that create the differences and relationships which are pre-requisites of signification.

In this cybernetic loop user and system mutually modify the display of one and the actions of another in a dynamic dance of syntagmurgies. Cause and effect sweeps clockwise, and while the sweep may be erratic and irregular, it is characterised by the continuity of the semiotic process in which meaning is made, derived, sustained, confirmed, replicated, denied. That process runs along an axis protruding from the page. Viewed sideways on, the cybernetic loop moves, helically, bolt-thread-like along that axis. Actions prompt changes to display, and changes in display prompt actions, and in the moments of action:display signs come into being, meanings are made. Within the loop, display and action blur in the form of rollover images, cursor movements, the tap of a PDA stylus. They spin away in a melee of other feedback loops spawned by acts of display and the display of actions, by sensations and meanings.

In this cybernetic loop display is both communication and control, and action is both control and communication. Although there exists a clear separation and differentiation of states within the loop, within the user (perception, cognition and decision) and within the system (event/conditions, data retrieval/calculation, assembly) there is no clear differentiation between display and action, both are communication both are control, and both are syntagmurgic. The signs of action made by the user, the rolling of a mouse, the tap of keys, the press of buttons, are in fact the display:text viewed by the computer. The computer's actions are in fact the flickering signifiers of light, sound and vibration in and on monitors, loudspeakers, trembling feedback devices, the display:text the user reads.

Here, interactivity is understood to be inherently 'narrative' in that it is time-based and driven by events. Structures of cause and effect, the modification of meanings by juxtaposition in space or sequence, connect the instances of action:display within larger structures of meaning, and those larger structures, themselves, have semiotic function.

Semiosis is located in the moments of action and display, in the 'manners' of the devices in which juxtaposition and cause and effect take place. Signs are patterns of energy, or changes in patterns of energy which are both and at once signs of signs and signs of their meanings which are derived in part from their difference from other signs and from their juxtaposition along with other signs. So, on rollover an area of the screen changes colour. The sign is bound up in changes of energy, in changes of the frequency of light, in changes of the electrical

current which controls the state of a range of cells in the matrix of a TFT display. This area, and not other ones which appear similar, changes. This area, and the ones around it have features of colour that make them appear, quite illusorily, to be embossed, to stand above the plane of the ground on which they apparemtly rest. Shaded darker below and on the right, and shaded lighter above and on the left, the illusion of standing proud from the surface is both perceptual (iconic/indexical) and forms a conventional sign (symbol). On rollover the colours change, darker above and left, lighter below and right, as if the surface recessed (the optical illusion now confirmed by an impossible instant change of state, no transition, no restraints of material form or gavity, no resistance or momentum)……………… and so we could detail the semiotic processes of display, and much work does so. The concern here though will be less with the display (that is the text) presented to the reader than with display (that is the text) presented to the computer, that is with the devices through which the reader acts – the mouse, keyboard, joystick, etc..

Each instance of action:display constitutes a sign and carries a literal denotative meaning ('the mouse has moved forward, and the cursor has moved proportionately across the screen vertically') and a connotative meaning that relates the sign to the larger scale semiotic processes of the work ('the relationship of mouse movement to cursor movement is much the same as it has always been, the system is working, the system is reliable, the information the system displays is believable'), and to underlying cultural myths about how the world and the things it contains relate and work together. Denotation, connotation and myth work together to form affect, they way the signs work on and within the user's experiences, forming an aesthetic of the interactive. These sign processes are embedded and embodied in the 'materialities' of the system, the places where the signs are present in the human sensorium, in the devices of display and the devices of interaction. The possibilities of signs are constrained by the materiality of those devices, by their 'manners' of operation and display. The word 'manners' is used carefully here. It relates to both the 'manner' of operation of the devices as physical constructs, and also to the 'manners' of the devices in the sense of conventionalised and constructed behaviours, in a sense like that of behaving properly, of being well-mannered, or ill-mannered. And by inference this suggests, perhaps, a normative state for those devices, a body of expectations and performances that is to be thought normal. Possibly even 'the way things are'. Myths of the natural embodied in mouse, monitor, action, display, action.

These 'manners' can also be thought of as grammars of use, or codes of use. Associated with those terms are paradigms (of possibilities), and syntagms (of utterances). These ideas refer also to concepts of langue and parole, competence and performance – ideas about a range of potential states articulated into a (necessarily) smaller range of actual states. The paradigm includes all the possible 'signs' that constitute the language of the device. It does not include all possible states of the device as some states may not constitute signs within the (currently normal) language paradigm.

The form, nature, grammars, codes, the 'manners' of devices, flavour interactivity, exist as affect. Medium becomes message in the movement and touch of a mouse and the transient signifiers of the monitor or loudspeakers. Display prompts action, communication contains the possibilities of control. Algorithms of materialisation massage data into syntagmatic instance drawn from the paradigm of all possible displays of that data. Actions evoke instances of display. A syntagmatic utterance of action, of using the mouse in a particular way translates into a selection from the paradigm that is the moment of discourse, and the syntagmatic display
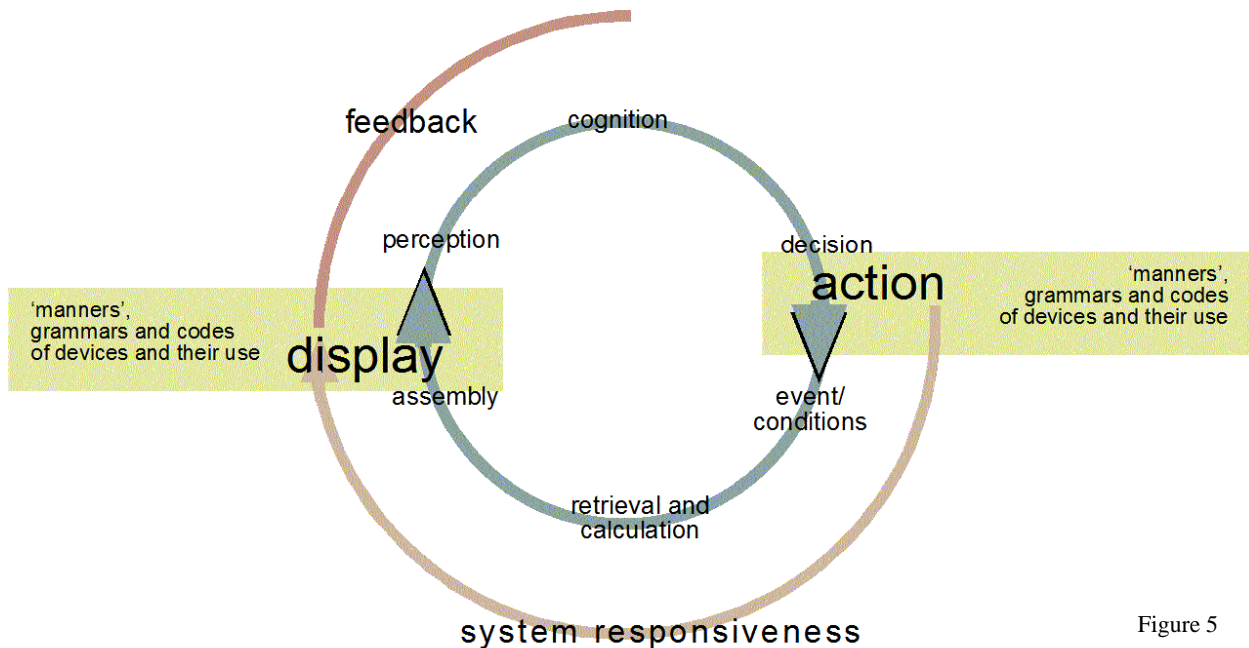

Figure 5

of that selection then forms the paradigm in which using the mouse operates. Along the semiotic axis, where denotation and connotation merge in message and meaning the qualities of interactivity, the 'manners' of the devices, function connotatively. Data brought into being as display takes on meanings both literal and associative.

Audiorom [5]

mouseSigns

Understanding the use of a mouse through the structures of cybernetic loop and syntagmurgy enables a discussion of mouseSigns at the nano-scale of a cursor moving across a screen pixel by pixel, increment by increment, and at the scale of grander narratives of myth, the larger scale semiotic processes that form the aesthetic experience of the artefact as a whole.

The primary significations of a mouse relate to movement and to change, by which is meant the operation of a button and the consequences of that act. It is important to differentiate the signs that come from the use of the mouse and the signs that represent that movement on screen. The hand movement of the mouse is noticeably smooth. While the screen display may be visually differentiated and may sign changes in level, texture and even 'limits' to the extent of the current display syntagm the common mouse provides no haptic equivalent of bumping over a line, ascending a buttonised edge, or being constrained in area. The display representation of movement is entirely the outcome of algorithmic operations. The appearance of the representation as a cursor on screen, the way it moves, how it relates to the movement of the hand, whether it jumps five pixels to the right when running over a buttonised image, whether it stops at a certain screen position, are all determined in code. The interplay of algorithms is a syntagmurgic process which leads to the instants of display. The arbitrariness of display then should make more clear the rather limited and conventionalised languages, the manners, that we employ. The possibilities of algorithms are effectively unlimited, the infinity of the paradigm of display is the play of the human imagination.

Similarly, what the system registers is only movement (and that is usually relative rather than absolute) and button actions. It rarely registers the emotion with which the mouse has been moved. And so the signs that are embodied in movement become denatured. Refined into a reading of numbers by the circuitry of mouse and computer the signs we make moving a mouse are rendered as denotation only, their materiality removed, the connotations of the signmaking disregarded a discarded. And yet, of course the sign still works towards ourselves.

The sign-making process of using a mouse is complex – it is, like all sign systems, two directional – it communicates as much to the self (the reader, here) as to the other (the text:system). In the act of making a sign is a feedback loop about making and having made the sign, a sign of the sign itself as a sign. Holding a mouse, and moving it while watching the screen cursor track across is a syntagmurgic act, in which the path of the mouse:cursor is selected from all possible paths (the paradigm) in a series of nano-scale cybernetic loops constantly signifying both the position of the cursor, the relationship between the cursor and other display elements, the relationship between the cursor and its conjectured destination, the modification of action by display

display semiosis
visual, sonic,
force-feedback

action semiosis
para-haptic,
proprioceptive,
para-gestural.
sonic

reader:text
processes of
perception,
cognition,
decision,
action

system:text
processes of
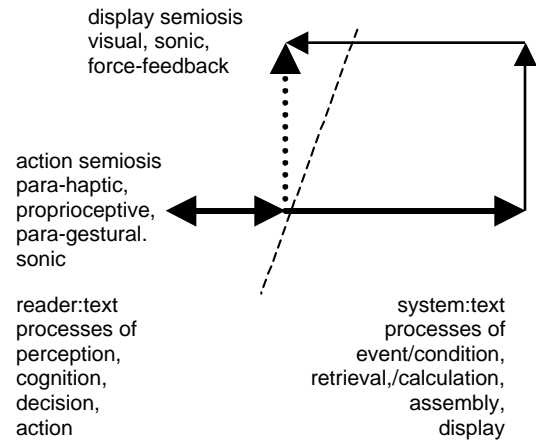event/condition,
retrieval,/calculation,
assembly,
display

Figure 6

and display by action. Signs about signs and signs about signs that do not yet exist. The reading of these signs is predominantly denotative, but the mode of transit and the texture of the syntagmurgy carry connotative values also. Mouse movement and screen cursor movement are usually integrated together and happen within a time frame that convincingly links action with display, display with action, and connotes values about cause and effect and the reader's 'agency' within the syntagmurgy of the text:system. Such connotations are implicit in the 'manners' of the mouse in the sense of normalcy and myth. A smooth continuity of movement, of unproblematised nano-loops, denote the system functioning normally (a form of phatic communication) and connote certainty, reliability, trustworthiness, not only as an operational process, but also a quality of the experience and of any knowledge gained during it.

The 'manners' of the mouse:cursor are complex, the signs that make up the sign system exist in several imbricated modalities. To use a mouse is to enter into a sign system that is in part

visual
the movement of a screen cursor, rollover effects and other visual feedback cues, the general semiosis of the visual proprioceptive – *muscle tension and the rotation of joints in wrist, fingers, shoulder, back, these sign location on screen as much as the visual does*
haptic, or para-haptic
in that the shape, texture, resistance and yield, smoothness and regularity of the devices movement over surface, the press pattern of buttons, both signify the presence of the mouse and sign values of interactivity
gestural, or para-gestural
because the hand using the mouse takes on particular shape and position within the semiotic process repeatedly and consistently and in this it resembles signing languages
auditory

including the click of buttons, display sounds, the inherent issues of sonic spatiality an the general semiosis of sound.

The signs of mouse read through the various modalities of their signification are about movement and change and these function as signs both within the syntagmurgy of creation and in the syntagmurgy of reception. The signs of mouse function as meta-signs signifying the nature and status of the signs themselves, modelling as moulding the hermeneutic process, embedding mind process in screen display as the wraiths of Sapir and Whorf wander across our discussion.

Using a mouse involves the syntgamurgic processes of reception and creation, and these overlay display semiosis (which includes any way in which data is given material and sensory form) and action semiosis, (the 'self-reading' signs of operation). Usually integrated together and happening within a time frame that convincingly links action with display and so signifies cause and effect, the two co-dependent syntagmurgies of reception and creation spin the cybernetic loop along its semiotic axis. The integration of reception and creation, and the experience of those processes, signs nothing so much as dialogue, responsiveness, agency. In the way that display changes are evoked by action (the signs of cause and effect) and in the way in which this happens at many scales and not only in moments of 'decision', creates a sign field in which the apparent 'coming alive'ness of the display signs the text:system as having attributes of autonomy and intelligence, willingness and resistance, truthfulness and decption.

Because the movement of the mouse and the movement of the cursor map across both the action semiosis and the display semiosis, there is a rich play of how the use of the mouse relates to signifying processes. Using Peirce's categories we can describe and discuss the movement of the cursor on the screen, that is in the display semiosis, as indexical, and in the action semiosis as iconic. Indexical because the cursor is a sign that is existentially linked to the movement of the hand but is not the action itself (much the same as the commonplace smoke:fire analogy, the cursor does not move unless the mouse is moved and the feedback of the movement does not equate to the feedback of an illusory visual surface – the mouse does not bump when the cursor crosses a line). Iconic because the action of moving the mouse itself signs moving the mouse, the sign system of the para-haptic and proprioceptive integrating with the visual. The semiosis of action is a sign of action itself.

The movement of the mouse also signs symbolically. The reader understands through the sign of the cursor, its movement, relative to other signs, and the visual signing of its shape, something about agreed processes of action and cognition. The reader has acquired and uses arbitrary signs of movement (rarely do mouse and cursor track on a 1:1 scale), click, drag, double click, rollover – which seems iconic in the integrated overlay of display and action but is more properly understood as an arbitrary language, acquired and assimilated, made invisible through mastery and familiarity, hidden in myth.

The mouse sign system separates movement and action and in so doing it signs something about the process of thought itself. The cursor is directed to a place and then the button is pressed down, sometimes held down, sometimes released quickly, sometimes double clicked, it does not matter. In this separation of continuous movement and discreet decision cause and effect are structured. The almost idling nano-scale sweeps of the cybernetic loop that are the signs of cursor travel around the screen as the mouse is moved around give way to clicks and decision and the cybernetic loop lurches along its semiotic axis, larger scale changes of display happen, patterns of energy change, temporal and spatial juxtaposition create difference, syntagmurgically form meaningful instances of display, give material form to data retrieval or algorithmic operation.

Placing the hand on the mouse is a formal declaration of entering into a signing relationship. The position of fingers, the rotation of the wrist and forearm, the touch sensations on palm and fingers – these are the first sign of an action semiosis. It is a sign of the signing process that has been initiated. Movement then, scale mapped between mouse movement and display is a sign not only to the system (your action: its reading of a display) but also to the reader. A sign of a process taking place, and that sign denotes the process and connotes its values. The process signed by moving the mouse is a process of searching around, looking around, enquiring. While often metaphored as spatial it is usually undertaken while sedentary. In its sweep of wrist and integrated tracking of the eye, it resembles cognitive acts like purposeful recall, like studying a scene, like the active syntagmurgy of hermeneutics. In Gregory Bateson's image of the blind man and his stick, the mouse is our extended probe by which we get to know about this other world, this representational space. The sign system shifts from looking around to action by, bringing the mouse to halt and changing from free fluid movement of wrist to press action of finger. The action of the finger here is a formal language of operation, arbitrary, almost like alphabetical signs, but where they exist as patterns of light the signs here are muscle actions bounded by time. The duration of a click is a parameter of its signedness and meaning, a means of markedness, difference, affordance. The shift from wrist action to finger action itself signs a difference in mode of operation, denoting decision in place of observation and interpretation. This move – locate – click sequence signs different cognitive states and differing stages on the cybernetic loop and in syntagmurgy.

The move – locate – click process of mouse use becomes a sign for a mental model of decision making and even thought itself. It signs think – decide – act and requires this of the reader. Without this process, meta-signed in the use of the mouse, then, much of the time in the interactive nothing happens. This sign of process is not merely denotative, it does not simply sign the process as process. It is connotative of that process, signing the process with the values of rational mind, decision making, trustworthiness, agency, presence, power. The process of signs and of syntagmurgy means that mouse use, the movement of cursor on screen and the hand behind it, becomes a kind of embodied probe for our thinking process. The movement of the mouse signs mental processes, the cursor becomes the point of our concentration, an outbodiment of the hermeneutic syntagmurgy.

The common mouse process – move-locate-click – deals with one issue at a time. It signs thought as a serial process quite contradicting the structures of associational thought which underlie Ted Nelson's idea of 'hypertext'. This pattern of mouse use is prevalent, dominant, and functions as a myth of normalcy about both the systems and ourselves. It signs up a

number of values about the system and its operation, and about the values of the experience and any knowledge gained from or through it. Now among the most common languages used, and that in many diverse cultures and communities, it functions as a powerful myth of normalcy both of system operation and responses to the world. The implicit power relationship of point-and-instruct that has us form unambiguous sentences from menu selections, the look-click-and-its-done operation, are powerful language models for the world. The signs of agency and effectiveness in the dual syntagmurgy of the interactive, where reception and creation overlap, become ways in which we believe the world itself works. All languages become ways of understanding the world.

But it need not be so. Mouse is a distinct and markedly artificial language. Although there is an accustomed normalcy to its use, the nature of the language as being a product of algorithms is open to a poetic exploration and the works of artists and authors can extend, subvert and problematise that normalcy both as a form of explorative enquiry and as a comment on its mythic structures and, ultimately, political values.

<div align="right">Peacock [11]</div>

Within the wide sign systems of the interactive, Mouse is one contributing element to the holistic experience of the reader. Rarely does any one contributing element stand alone, usually they all work together to form the signs which inform the aesthetic of the discourse.

It is important to locate mouseSigns within that holistic. Both in their denotative operational functions and in their connotative and mythic values.

<div align="right">Juvenate [10]</div>

AESTHETIC DOMAINS

Taken holistically interactivity resembles nothing so much as it resembles story-telling because it binds together the syntagmurgy of reception and creation in an act of communication which is inherently 'narrative' in that it is time-based and driven by events. Structures of cause and effect, the modification of meanings by juxtaposition in space or sequence, connect the instances of action/display within larger structures of meaning, and those larger structures, themselves, have semiotic function. And it is in the functions, effects, and affect of that semiosis that the aesthetics of interactivity may be examined and discussed.

The narratives of the *interactive* are of many kinds and it is important to distinguish among them. The main distinction being drawn between those narratives which are predominantly concerned with information and those which are predominately concerned with the experience of interactivity itself. In the first group are narratives of the interactive where the concern is to give access to an underlying database of information which is understood to be more important than the experience of the interactive itself. This kind of activity is characterised by designs which seek to make the interactive 'transparent', by screen design metaphors that converge with or replicate as on-screen image, a user's 'real world' experiences. Where the word 'functionality'

trades alongside 'efficiency' and 'workflow' in a kind of latter day Taylorism.

Of the other kind are interactive artworks and games where the concern is with the experience of the interactive, where the narrative of interaction is the thing in itself. Here there are divergent metaphors, problematised interfaces, toys in the sense of things that are played with for the purpose of playing. This difference is described by Bolter and Gromala as Transparency and Reflectivity and discussed in detail in *Windows and Mirrors.* "*Contemporary culture"* they say*, "is receptive to transparency (the window) and also to an alternative, self-reflective style (the mirror). This latter style, which was truly avant-garde in the early twentieth century, has become the aesthetic of rock concerts in the early twenty-first century. So digital designers and the growing world of digital entertainment need to master both styles. Digital interface design needs to master both styles as well."*

<div align="right">Bolter and Gromala [3]</div>

and they go on to comment "*We might be tempted to think that transparency is for "serious" digital applications, such as productivity software, while reflectivity belongs exclusively to art and entertainment. But it is not that simple*." Making the point that the experience of most users is an oscillation between the two modes, that is to say that the discourse moves from transparency to reflectivity as the user's purpose, task and concentration changes. The oscillation between the transparency of a word processor application contrasts with the reflectivity of the graphic user interface as the user changes from that application to another, as the user's concentration moves from application to system operation, as the syntagmatic processing of interaction proceeds.

<div align="right">Small Fish [8]</div>

We can think of these two kinds of the interactive, the ones concerned with information and the ones concerned with experience, characterised as transparency and reflectivity by Bolter and Gromala, as being points towards the ends of a domain, or two-dimensional field.

information	**the interactive**	experience
transparency		reflectivity

The discourse that is the experience of the work is located within this domain with a tendency towards one end or the other. "Each design," say Bolter and Gromala, "is a combination of these two strategies – perhaps with more elements of one or the other". So, productivity software, tends towards information and transparency and digital artworks tend towards experience and reflectivity, but both have elements of the other, also. This tendency is the affect of the sign systems operating within the discourse. Transparency is an affect, an aesthetic experience of the interactive, of the dually-syntagmurgic discourse. Reflectivity, likewise. Both derive from a reading of the signs of the essentially dualled-syntagmurgy of the *interactive*, signs which, collectively inform the experience of the interactive and define the aesthetic experience of it, and which are framed by the 'manners' of devices.

The paradigm of an interactive text is unknowable. Because it has a physical rather than material form its extent and structure can never be seen directly and only parts are ever

seen at any one time (syntagmatic display). And there is no guarantee that those parts will be seen in the same juxtaposition of sequence or space more than the once of a particular instance. This has a number of consequences which will be discussed here through the notion of domains or two-dimensional fields. A domain represents a condition in the potential experience of the interactive, a sign of the quality of the experience, and is marked at each end by differentiated forms of the experience of that condition. Domains, as thinking structures, relate to but are not the same as binary oppositions in structuralism. What is located within a domain is the discourse of the reader and the text, (although of course it is easier to think of these domains as being features of the text as that mode of ascription is prevalent in the way we think of the world culturally). The domains, or rather the reader's experience of what these domains deal with function within the semiotic processes of the reader:text discourse as signs about the text and the properties of the text.

A primary domain addresses where the reader stands in relation to the text itself. This domain (*the locus of interactivity*) relates to actions of the reader which generate instances of the text (the syntagmurgy of action:display) and is marked at one end by the term *deliberate* and at the other *inadvertent*. The actions of a person entering text through a keyboard characterise the *deliberate* – their actions are purposeful and are directed towards the interactive through a device of interactivity they are aware of. The *inadvertent* is characterised by an artwork installation in which a sensor registers the presence of a person without their knowing it and this triggers an event. A work perhaps like Susan Collins….. banana, or the warrington museum.

deliberate   **locus of interactivity**   inadvertent

A reader who has inadvertently interacted with a text may work out how the installation operates, say by recognising a PIR detector, and then proceeds to step back and forth into and out of the field of the device causing the installation to respond. In this the reader can be said to have moved through the domain from the inadvertent to the deliberate. Similarly, an inexpert typist………………….
This points out the inherently dynamic nature of the domains and also that within them the location of any discourse is most properly thought of as a generalised tendency. Within any discourse there will usually be a range of locations within the domains (perhaps much the same idea as Bolter and Gromala's 'oscillation' between transparency and reflectivity), and the particular tendency at any one time is an outcome of the dual-syntagmurgy of the discourse.
 The first encounter with a text, the initial moment of discourse, is likely to tend towards the inadvertent as the way of engaging with the text is established. Familiarity with similar texts means that the discourse soon relocates towards deliberate. If the discourse includes the unfamiliar object, or unfamiliar processes then such a movement may be slower. If an object at first appears familiar but proves to work in unexpected ways (keystrokes are remapped to an alternative layout, the screen cursor moves erratically, say) then the discourse is abruptly relocated to the inadvertent. Across time, all discourses will drift towards deliberate.
In this domain the mouse:cursor device when operated within its 'normal' manner tends towards the deliberate. It is

markedly less demanding of accuracy than the keyboard (the screen cursor generally occupies an area rather than a precise location) but when used as a point-click device it is clearly 'deliberate' and connotes values of control, action, decision. However the mouse:cursor device is relatively easy to subvert through reframed algorithms that, perhaps map horizontal movement of the mouse to verticalmovement of cursor, and/or vice versa, or translate vertical movement to the rotation of a visual display element. These relocate the (discourse of) the device towards the inadvertent, but with the general drift of learning that presses things towards the deliberate. Hidden hotspot areas drifting around the screen, their movement dictated by randomised increments and their direction dependent on the chaos of collisions with sounds triggered by rollover events – such a thing would be inadvertent and could well maintain its tendency long after the general principle is 'understood'.
This domain of deliberate and inadvertent provides an initial classification of instances of the interactive, and, along with other domains which are imbricated within the overall discourse, will direct our attention to the signing pliaces where the discourse happen – to the devices of display and action.
As an interactive text is not materially embodied it follows that all users face a potential uncertainty about what they have seen or missed, how much of the whole they have seen, or missed, how what the have seen realtes to the whole, whether they can find any of it again. An uncertainty quite unlike that of a book or painting which can be 'scanned' or surveyed quickly across or through their material paradigm.
This aspect of the interactive is addressed through two domains. The first is labelled 'missingness' and the second is lablelled 'tmetic anxiety'. This term, tmesis, is derived through Aarseth and Barthes from Aristotle, where its general meaning is to do with an author never knowing how much of a text a reader may have skipped. It clearly relates to the idea of missing-ness, but here it applies not to the author's experience in constructing the text (for there is an important difference between the privileged maker's view of a text and the reader's discourse) but to the experience of the user, reader, player whatever you want. These domains are interconnected. One is about how much the user experiences a sense of missingess in the text, a sense of not having seen important material, of other options or opportunities not taken or followed. The other of these domains is about the user's response to that sense of missing-ness, the state of their anxiety.

incompletedness   **missingness**   completedness

low   **tmetic anxiety**   high

Forms of the interactive map across these two domains differently. An information-purposed (transparent) text will necessarily want to locate towards 'completedness' on the 'missngness' domain, and towards 'low' on the 'tmetic anxiety' one because such a pairing is about an affect (the experience of the aesthetic) which includes an acceptance that the information that comes from the system is believable and dependable.
A text adventure game (tending to reflectivity), with its many twisty little passages, would locate towards 'incompleteness'

in the 'missingness' domain and could well move around variously within the domain of 'tmetic anxiety' at times tending towards the low end , and at others towards the high end as this is about an affect which includes dramatic tensions, which motivates further exploration, and this can be seen to equate with Bolter and Gromala's 'oscillation' between transparency and reflectivity.

Many information based systems include, as a designed feature, a representational overview, plan or 'site map' of the constituent parts, and many adventure gamers draw up maps of the worlds they explore. In information based systems such 'site maps' are a mechanism for reducing tmetic anxiety and bringing a tendency towards completedness – advantaging 'transparency'. The affect is reassurance, confirmation, valorisation, 'if you have missed something, you can find it again, this whole thing can be understood'. The user is made less anxious because less is experienced as missing. The gamer's map drawn out as she explores has the affect of taking ownership, building mastery, dynamically relocating the discourse within the domains towards both 'completedness' and 'low' while demonstrating the extent of the task that has been undertaken, shifting from reflectivity to transparency and back again.

<div align="right">Juvenate [10]</div>

The amount of work required during the syntagmurgy of the discourse of using a mouse may have a good deal of effect on the domains of missingness and tmetic anxiety. Tracking the mouse:cursor back and forth across the screen creates a density of decision of process within the nano-loops of action:display, and the repeated cohnitive focussing on different areas may sign the possibility of having missed something.

Those domains of missingness and tmetic anxiety tie in with other domains, mostly clearly with ones which locate the user's experience of the discourse (although we may describe some of these features as if they are properties of the work they are of course only ever features of the user's experience) within domains of 'cursality' and 'causality'. Cursality is about the pathedness of the text – about how many choices are to be made, how many paths may possibly be taken, howmany paths have been taken and remain untaken, how the various paths interconnect. As a domain 'cursality' maps the user's experience of complexity of structure, and that experience connotes affects such as reliability, certainty, trustworthiness. But the mapping is not simple – a complexity that is 'understandable' is more reassuring than a designed 'simplicity' in which the user feels lost. The measure is how the user experiences the connotations of complexity or simplicity within the discourse which is the interactive. Cursality may be a product of the number of choices the user has faced, or the depth of decision they have had to make. Resolving ambiguities, for example, may markedly increase the cursality even though there are few choices. The density of decision making acts as sign for cursality

simplicity	**cursality**	complexity

An information based system will usually locate towards low cursality. Reducing the number of options speeds operations,

creates a relatively uncomplicated map of operations in the user's mind. And from that comes a 'belief' in the trustworthiness of the system – a defining characteristic of what is usually required of 'transparency'.

Causality, or the consistency of the consequence of actions, is about the way cause and effect operate in the discourse. Actions and displays are bound together through cause and effect and create spatial and temporal juxtapositions of elements from the paradigm of the work. The experience of Causality connotes values such as certainty, understand-ability, trustworthiness, consistency. It is a domain that is marked at one end by redundancy – a clear almost ritualised affect – and entropy. Between the totally predictable and the entirely chaotic, between the transparent and the reflective.

entropy	**causality**	redundancy

It is doubtful if any discourse can ever locate at the extreme of entropy. That which is truly, deeply, or very entropic is accommodated rapidly by the human mind and its own unpredictability becomes expected and so redundant. Discourse located towards, or tending towards the entropic, is exciting because of the unexpectedness of potential juxtapositions and because of the thrill of the oscillation between states, within the domain. Redundancy brings predictablitity, stability across time and instance and so an affect of reliability, believability. Entropy brings the thrill of the unexpected. Games rely on a tendency towards entropy and employ elaborate mechanisms to maintain it, to counter the dynamic tension of experience leading to redundancy. Randomising sequences, apparent artificial intelligences, simulator models with chaos engines, these strategies of game play ensure a location towards entropy. Mastery of the game moves the discourse towards redundancy and an aspect of the ritualised predictability is the reward of mastery.

Cursality may be signed in the mouse:cursor syntagmurgy through the density of movement and variation in the requirements of movement and, as with causality, in the consistency of cause and effect structures and relationships within the nano-loops and macro-loops of the artefact.

Conclusion

Working together these domains (and others not discussed here) form from the signs of the discourse a 'view' of that experience itself. That view is inherently connotative in that it is value laden and mythic in that it signs grander narratives of how the world works. The signs which communicate the view are many and varied, they include visual sign systems, acoustic ones, environmental ones, and ones tied in with the operation of such things as mouse, keyboard, joystick, drawing tablet, etc.

There are well established critical approaches to the discussion of the visual and the sonic. Approaches to the semiotics of graphic design and visual imagery, and to music and sound, which address features such as colour, composition/layout, typographic elements, modes and styles of representational imagery, genre of music, the timbral qualities of non-indexical sounds, the languages of symbolic sound that are brought into play, a reasonably well-established and function much the same across many media. It is important that we develop ways of discussing the relatively

new sign systems that also play within the interactive and which make it so very different to other forms.

Peacock [11]

Notes

1: syntagmurgy – with no apologies for this neologostic act – this is a compound word bringing together *syntagm* (in its sense of a set of signs drawn from a larger paradigm) and the *–urgy* of English words such as dramaturgy, metallurgy, liturgy, which is rooted in the concepts of 'work' – in the sense of bringing forth through labour. So *syntagmurgy* is the act of bringing forth a selection (grammatical in terms of the language paradigm, or not) from a larger set, either unconsciously as part of perception/cognition (as in hermeneutics) or more consciously and deliberately (as in the use of an interactive menu) or inadvertently (triggering a sensor). This term relates to, and resembles, Aarseth's ergodic but grounds the act of selection in bodies of signs and the discourse of readings. The concept of *syntagmurgy* is one of process not of act, the 'bringing forth' is never completed nor does it finish while discourse continues.

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