VARIETY in DESIGN

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ABSTRACT

It is argued that creativity might be amplified through the co-operative sharing of brain power (in contrast to Ashby's amplification of intelligence by restricting attention to the problem). This argument is extended to the act of design (seen as the making of the new), where it is proposed that the nature of the computer is to encourage co-operative sharing because, by making perfect copies, it denies ownership. This, in turn, underpins the processes of collaging and transformation that so suit the computer. A means of using the computer is proposed in which both sharing and distortion are encouraged, so that the new may be made while the individual's sense of creation and of origination is respected. Possible questions and difficulties are raised. Some are resolved.[1]

VARIETY

Ross Ashby (1) invented the concept of Variety to help discriminate the number of states that a system takes from those that it might take. He showed that a control(ling) system, if it were to control the controlled system properly (ie, without inhibiting the potential of its activities) had to have at least as much variety as the system to be controlled (2). More recently, I have shown that the controlled and the controlling systems must in fact have the same variety (8).

Ashby applied his understanding of variety to the amplification of intelligence (1). Since, he argued, the brain has limited (albeit large) variety, its effectiveness in solving problems (for that is how Ashby discussed behaving intelligently) can only be improved by restricting the problem area. He did not mean in the manner of optimization algorithms etc, but in the sense that distractions would be removed—distractions ranging from false trails to interruptions. Thus, more of the brain's variety could be focussed on the problem in hand, leading to a better

[1] I would have liked to include examples of work carried out using the methods and devices described in this paper, but space ruled against this. Nevertheless, I can confirm that there are examples of such work, and that the ideas described in this paper have been met with enthusiasm and creativity when they have been used in trials. There is now, I believe, enough practical evidence to support major funding. The development of much of the intellectual background and context for the work presented here was made possible through my role as advisor on the OOC Programma, Centre for Innovation and Co-operative Technology, University of Amsterdam, particularly its Director, Gerard de Zeeuw.

outcome. Intelligence amplified. Ali Irtem (15) suggested an analogous means for the amplification of happiness: remove the sources of unhappiness, and we can all concentrate on being happier (enjoying more happiness more). Yet, although these arguments may be true, they can be seen to be limited, perhaps even a little silly.

However, Mike Robinson took Ashby's understandings about variety, and in a masterly paper (20) applied them to the situation in a classroom. He showed how the arrangements in a traditional classroom reduce the variety of the schoolchildren (often in very crude and literal ways, such as prescribing the wearing of a school uniform), so that the possible states of their brain are reduced to being less than the states of the teacher's brain. Thus, the classroom situation acts precisely as an intelligence de-amplifier. If a teacher has n states that his brain may take, the argument goes, then 20 (for instance) school children with roughly similar brain powers will have n^{20} possible states—an extremely large and almost inconceivable variety, quite out of the teacher's control (where control is seen as teaching, or at very least a teaching strategy)

It is not important that these numbers are accurate: it is a ball park, and Robinson hopes we will accept the ball park as indicative and valid: the quantification and terminology are simply illustrative. He goes on to indicate how more recent classroom strategies, including group learning and teaching, and reductions in formality make it possible for the school children to teach themselves and eachother, with supervisory guidance rather than instruction from the teacher. This increases the variety of the control system, thus requiring less de-amplification of each child's intelligence in a classroom learning situation.

I, also, am not concerned with the detailed accuracy of this depiction. I am only concerned that it "feels right", for I wish to propose a way of amplifying the (potential) creative ability—by which I mean the ability to create the new—of each of us through increasing our ability to "borrow" the brains (and the ideas) of others. Nor do I wish to enter into arguments about the source of creativity: it is not important that we talk of brains per se, but only that our talking of brains helps us establish a preliminary understanding.

SHARING

A feature of the conventional classroom is a lack of sharing. This is enforced by devices such as silence and competition. Silence prevents (much) communication: the school children may only participate actively when chosen to do so by the teacher, and then only within (teacher) prescribed limits. Only one may speak, and he may only speak to the teacher. When you cannot communicate you cannot share, you cannot give.

Competition prevents sharing in another way. It makes ownership central and exclusive. In a limited supply "economy", if I have something, you may not have it. If I have more, you have less. Competition mitigates against generosity (which action lies at the heart of design (9, 10)). Competition in the classroom leads to exclusion, a breakdown in communication, selfishness and closedness and secretiveness; and makes co-operation hard to initiate and to maintain.

Yet it is by sharing that we have the possibility of transcending the limitations of our (individual) brains, of increasing our power, by "borrowing" the power of others. This is precisely the obverse of the point that Robinson made about the classroom. It is conceivable that the class of 20 could co-operate, communicate and so share, thus working together to increase the variety available in the collective brain. n^{20} possible states. A worthwhile increase in variety. A worthwhile aspiration.

We know, through common experience, that teams do work together. There is no guarantee that a team will perform well, of course. Artists rarely work in teams. But architects—and other designers—do, in a variety of ways. Informally, in the studio. Formally (but normally with little hierarchy) in design teams. And in the building process, with contractors, engineers etc. But the making of a team removes individuality and individual contribution/recognition: the individual is largely submersed into the team. Artists like to maintain their individuality. So do most thinkers. For them, a team is not the answer. But an answer may be to provide a means by which they may share while remaining individual and being recognised uniquely for their individual contributions.

DESIGN

Design is a word—in English—of many meanings, some mutually contradictory and exclusive. It is therefore necessary to clarify what is meant in this context (see (7, 9, 11)).

Design, as interpreted here, is a (the) process of making the new. (Newness need not be universal but need only be to the maker: the wheel may be re-invented. In the extreme, it can be argued that making is always of the new (4).) In its most visible manifestation, it may be characterized as taking the form of a conversation held by and between the self via (normally) a piece of paper and a pencil[2]. A process of eternal feedback. I would argue that it is a (the) basic human activity, that through a process of design we learn to assemble our thoughts, etc, but not here. However, consideration of the work of George Kelly (16) and Jean Piaget (19) will, I believe, make it apparent to the reader.

Thus, design is concerned with the mystery of the new. By definition, we can only explain the truly new after it has been attained and recognised, in a process of post-rationalization, for, if we can predict it, we have only a projection, an extension of what is already, and is therefore not new in any profound sense. (Given how we think, we will find that, when we post-rationales the new, we can usually fit it into a predictive pattern. But this is, as so often, wisdom after the event.)

The means by which we make this new may be explained through a metaphor. We start wandering, purposelessly, in the countryside. We get absorbed, lost. We sense the environment and the events in it. Probably we have a lovely time. At some point, we find ourselves in some particular place where we are caught by a sudden realization: we recognise that we've arrived, we're here. Now we can make sense of our wandering, the events en route: the wander has become a walk. The process is quite magical, beyond our ability to explain as a logical, mechanistic process. If we could explain it, we would not have newness.

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[2] I am reminded by John Frazer (5) that this characterisation first comes from Gordon Pask. I had thought it was mine, and am glad to correct this error. Pask's influence must have been very deep. See also Nicholas Negroponte's grant application "Graphical Conversation Theory" (17), in which Pask participated and which he, in reality, formed.

COMPUTERS

The Use of Computers in Design, Today

The use of computers that is of particular concern here is CAD (variously Computer Aided Design or Computer Aided Draughting), which is what is generally meant when the use of computers in design is discussed.

CAD is best characterized as illustration. In part because of the (relative) lack of speed of the (desktop) computers mainly used in CAD, an early promise made for CAD, that it would lead to great flexibility for the designer, an ability to almost instantly change a design and see the effect thus increasing the designer's ability to test, try out and develop alternatives, has failed to materialize. In fact, CAD, far from encouraging exploration currently encourages conservatism. This is for at least two reasons:

- The (long) time taken to compute images of the building project, and in seeing the effect of a proposed change (sometimes complicated by an uncongenial—ie, inflexible—data structure), and

- The failure of CAD to handle that area of the design process known informally as the "back of envelope" stage, the area where basic and strategic ideas are initially found and developed.

Thus, in general, CAD leads to confirmation and is illustrative. Although it can be used in visualization exploration, it is not used in the generation of design ideas. It is not, in essence, exploratory. It has not (yet) delivered its initial promises (11, 12).

So that the normal use of the computer, through CAD, in design (architectural or otherwise) is to provide an "automated draughtsman" that will draw the building, generate views from the drawings, and create (exclusively visual) images of the proposed objects—seen as objects and rendered photorealistic, collaged into a recording of their visual contexts.

(This is not to deny other uses of computers related to design. There is the obvious—and valuable—use that deals with technical and quantitative matters, such as the calculations of materials strengths and quantities. Also, the interesting and potentially powerful use of rule based—eg genetic algorithm—form generators (3, 6). However, these are beyond the scope and intention of this paper.)

The Particular Strengths and Abilities of Computers

Computers are devices which, if they are not processing, are hardly doing their job. However, part of the problem with the use of computers in CAD is that, while they are being used in some very powerful computational processing, they are not being used in a manner that is particularly sensitive to their strengths.

(Some of) these strengths may be considered as being:

- the making of perfect copies

- the seamless collaging of elements from different sources

- the processes and actions of image transformation

The first of these (the making of perfect copies) has a peculiar property that can inform the other two. If copies are indistinguishable from the original because they are identical (and not simply so good that we have to look hard to find the difference), then the idea of uniqueness and hence of ownership (possession) becomes untenable. If an item can be perfectly copied, the "copy" is as good as the "original", so that the original acquires the status of a "so-called". Equally, if an "original" can be cloned, ownership is in doubt. For either ownership is diluted as copies are made, or (and more forcefully) ownership ceases to apply when anyone can make a copy that has the status of the original. We may originate things, but we can no longer own them in the possessive sense[3].

The consequence of this removal from significance of the ownership criterion (while allowing origination), is that any part of anything copied from any image (not necessarily visual) that originates with anyone may be collaged and transformed with any part of anything else copied from any other image that originates with anyone else. It is all free, and the only course of action is to permit sharing and co-operation.

A Worthwhile Use

We may consider, then, that not only is the computer good at a number of particular actions (as detailed above), but that the very function of a computer is to remove ownership from the equation, thus allowing potentially positive and constructive sharing.

This returns us to the matter of the amplification of creativity. Following, particularly, Ashby and Robinson, it has been established a condition in which creativity might be increased is the condition in which there is access to more brain power (in its creativity form) than exists in one brain—ie by sharing in such a manner that the separate brains co-operate (but without loosing their "artist's" individuality). This can be done on a computer. Indeed, it is a genuinely worthwhile use of a computer, one for which computers are ideally suited by their nature. But the conditions under which it might be successfully engineered have still to be described.

Computers, Software and Distortion

Before that, however, we need to consider whether the computer can help in the creation of the new. For that is at the centre—is the kernel—of how we have described creativity.

In arguing (13, 18) that computing is a medium (something that acts on and forms our actions separate from and independent of our wishes and intentions), and should not be thought of as a mere tool (something that helps us carry out our intentions), I have put forward the notion that we may recognise a computer working as a medium, at least on occasion, when we find it producing bizarre results and/or when we use it (meaning, essentially, its software) in an "incorrect" yet productive manner. Thus, we may look for distortions. But distortions, the

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[3] We already recognise that some things, such as ideas, cannot be owned. Hence the limitation to copyright law, which reflects the common experience that ideas come to and through us. Of course, we none of us like to admit that" our" ideas aren't really ours at all.

unexpected, the unexplained, the unanticipated, the random are all more-or-less interchangeable terms that, in indicating surprise may also indicate novelty, the new. It is not a guarantee, but at least if the unexpected is not always the new, the new is always unanticipated—in terms of what it is. (That it is new is, of course, an anticipated and hoped for outcome of the design process as described here.)

Thus, the computer not only demands sharing, in so far as it allows perfect copying, it also encourages collaging and transformations, and it shows itself to be the medium it is when it fails to work as expected either through the abuse (or unusual and unanticipated use) of the computer/software, or through a process being carried out in which the outcome cannot be anticipated or guessed.

MAKING THE NEW

I have argued for a role for the use of the computer in making the new as an essential part of the potential amplification of creativity, through the generation of surprising and unanticipated changes by means of the intervention of others and the "abuse" of computer software. What is being talked about is, of course, a variety of Computer Supported Co-operative Work, using a graphic shared workspace. It does not help us distinguish the good. It does not guarantee creativity, but it does increase the range of possibilities and likelihoods. (Details of an arrangement encouraging the above to occur are presented in (13, 14).)

In the following some examples of ways of doing this will be presented.

Novelty Generated by the User, Himself, through Using the Computer

It is possible to convert images from one form to another, by applying the logic of a program to make the change. For instance, a bit-mapped image in a "paint" program may be "auto-traced" to become a series of vectors in a "drawing" program. Thus, a scanned image can be converted into a collection of lines. However, these lines are neither predictable by the user (how and where the program will decide to continue the making of its outline is quite unclear), nor need they generate continuous forms. Experience shows that quite unexpected forms are developed: forms that are outside (beyond) the normal formal vocabulary of most users, and which, even if they are in a user's vocabulary, seem to be handled with more conviction and subtly that the user normally manages. A range of (convincing) potential forms may be generated by the program based on some decision making procedures the user does not understand and cannot predict.

A verbal rough equivalent is the use of a spelling checker to force words from mistakes (in the extreme, from randomness)[4]. This produces images of a freshness, unlikeliness and novelty that is far beyond what a conscious actor might manage, in a manner similar to Burroughs' cut-

[4] In as far as I am aware, this use of a spelling checker was made first by Geoffrey Broadbent in discovering the true nature of the staff of the Portsmouth School of Architecture. The randomness of "action" typing comes from the artists Anne Hayes and Glenn Davidson (ArtStation), who use it to teach wordprocessing. My claim to fame is to have put both together.

ups (eg the original—and extremely rare—cut-ups in “Minutes to Go”). Not all can be used, but some can, while others provoke.

Novelty Generated for the User by other Users through Using the Computer

Any user can make the new using computers in manners similar to the above (and in other ways). What is indicated in this section is (using the figurative participants you and I) that if I use material originated by you and somehow transform it, making my changes available to you, what I do with your material will (probably) surprise you, going outside your expectations. As long as you have an open mind, and as long as we both share constructively and co-operatively, you may find a desirable new in what I have done. Thus, your range may be increased, and you may find what I have done new (and acceptable) to you, or that it generates responses in you that lead to the new. Thus, the lack of ownership can lead to an increase in creativity through shared work.

Novelty Generated through Context Shifts in the Computer

Central to the generation of the new by others is the notion that work can be traced and found, ie, that there is an effective filing system. However, in any filing system, any piece of work will have neighbours, and the benefits of browsing through neighbours in a filing system is well understood (consider the use of libraries). Computers are wonderful at cross-referencing and using multiple filing criteria in a manner quite impossible with physical objects—that is, computers make hypermedia. Decisions made about what will appear next to what in filing systems are made by the systems themselves, which systems are set up by their designers. Having access to the name of an item allows its location. Having access to criteria, some given by other users, allows the creation of the item's context. The use of more than one set of criteria means that more than one grouping will exist. In this multi-dimensional web of connections and neighbours, surprising proximities occur. In these proximities—ie, in the locational context of each piece of work—there are surprises that may create new links. (Details of such complex and multi-dimensional filing systems may be found in (14). Also in computer databases and in HyperMedia in general.)

WARNING LIGHTS

An argument has been put forward and aspects of a system described that are intended to encourage greater creativity through sharing work and the making of the new. Yet, nothing guarantees creativity: not a proven track record, not a wonderful teacher, not a challenging work-area, not an amazing opportunity… What is proposed and reported here does not guarantee creativity, let alone an increase in it. It just ups the odds at one particular stage in designing: commonly referred to as the "back of the envelope" stage.

But the "back of the envelope" stage is marked by other characteristics, and these the computer cannot, at this time, aid. The quality of the paper and pen (its very scruffiness), the fact that humans recognise shape rather than geometry. Drawing as if in 3 (even 4) D. And there is a social dimension: as a student, I and my colleagues met in a cafe where the tables were topped with formica, where we drew on them in felt-tips. Each table became a record of the day's thought by the quasi-random succession of occupants, with prompts coming (as in the system described above) from the serendipity of finding the already drawn (the filing context). Each was wiped clean at the end of the day: tabula rasa.

Nor does increasing opportunity and range necessarily guarantee all that much. The human problems (the problems of human factors) remain as strong as ever. And there are questions that can only be answered by a long, large-scale and thorough study (now that the initial conditions have been sorted through). Will designers use this way of doing things (yes, so far)? Is it better than traditional ways (and how on earth do we assess this when we can (should) have no experimental controls—a question for the methodology of the new Cybernetics)? Is it a pleasure to use such methods? Will it become possible for the user to predict outcomes, will it become habituational, could (should) a machine take part not as an instructed processing medium but as a participant in the conversation?

Big Questions for Big Science.

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