Phase(x) - Memetic Engineering for Architecture

http://kubrick.ethz.ch/phase/

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authors:
Florian Wenz, Urs Hirschberg
Chair for Architecture and CAAD,
Faculty of Architecture,
Swiss Federal Institute of Technology Zürich
CH-8093 ZURICH
Switzerland
email: wenz@arch.ethz.ch, hirsch@arch.ethz.ch
phone *41 1 633 2912
fax *41 1 633 1050
http://caad.arch.ethz.ch/

Phase(x) was a successful teaching experiment we made in our entry level CAAD course in the Wintersemester 1996/97. The course was entirely organized by means of a central database that managed all the students' works through different learning phases. This setup allowed that the results of one phase and one author be taken as the starting point for the work in the next phase by a different author. As students could choose which model they wanted to work with, the whole of Phase(x) could be viewed as an organism where, as in a genetic system, only the "fittest" works survived.

While some discussion of the technical set-up is necessary as a background, the main topics addressed in this paper will be the structuring in phases of the course, the experiences we had with collective authorship, and the observations we made about the memes (1) that developed and spread in the students' works. Finally we'll draw some conclusions in how far Phase(x) is relevant also in a larger context, that is not limited to teaching CAAD.

Introduction

At the chair for Architecture and CAAD, over the past years we have gathered much experience in using the World Wide Web as a teaching environment for our courses. The web's possibilities to communicate and to share multimedia-data have become an integral part of the way we teach CAAD.

While this has many administrative advantages, the main benefit in educational terms is the rapid

and intense exchange of ideas that this promotes between the large number of students that take our courses every semester. In the past we have achieved this by establishing the students' homepages as the place where they would present their coursework. We also developed means to get more of an overview of the work being done: WWW-pages that were generated by scripts that collected documents from all the students homepages and displayed them in a "panoptic view".

Goals

The positive experiences we made with the mentioned web-based means led us to the Phase(x) experiment. We wanted to further intensify the mentioned advantages, namely the exchange of ideas and expertise between the students. Forcing the students to take one of their colleagues' work as the basis of their design in every phase actually results in a shift of how individual authorship can be observed. In the traditional cultural model, individual authorship is dominant. The influences between different authors are often unclear and always debatable. (figure 1)

In Phase(x) the works themselves are the primary thread that is followed and the contribution of every author involved in the process can clearly be shown. So in Phase(x) we did not only intensify this exchange of ideas, we also made it absolutely transparent.(figure 2)

There is another problem we addressed with this set-up. As our course is an electoral class that students usually take parallel to design studio work, the time students can spend doing work for our class is limited. With the many different software-tools and concepts that are covered in our course, students always spend too much time overcoming operative problems, rather than concentrating on the intelligent use of the computer as a design medium. In reaction to this, in Phase(x) each phase consists of simple well-defined tasks. Doing the exercises gives instant gratification rather than prolonged frustration. Part of this is also the fact, that the students never had to start from scratch: they were faced with an object that one of their colleagues had prepared in the previous phase. So their creative energy was spent on finding an intelligent answer or reaction to this object. This is a more well-defined design task than starting from scratch, but certainly not a less chal! lenging one.

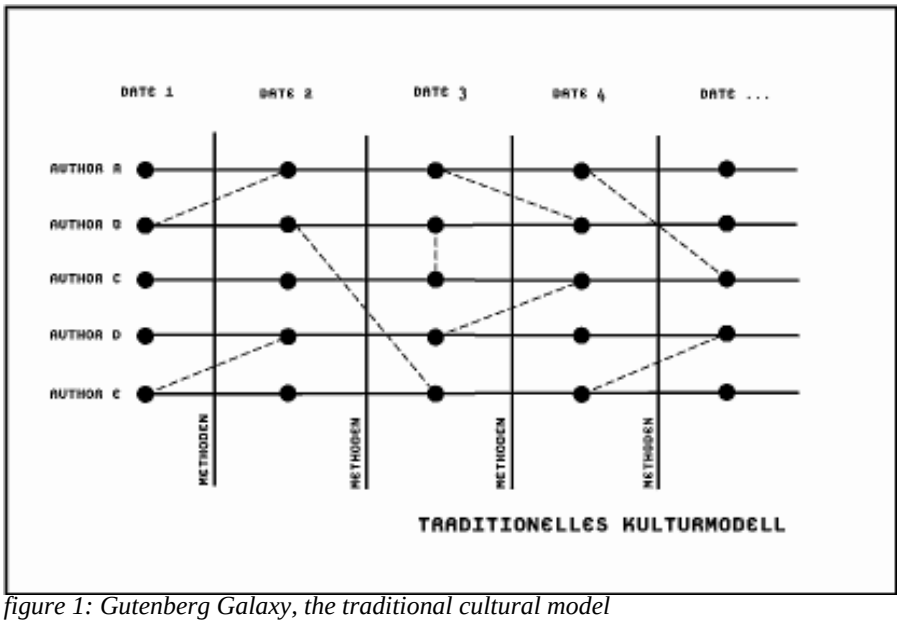

figure 1: Gutenberg Galaxy, the traditional cultural model

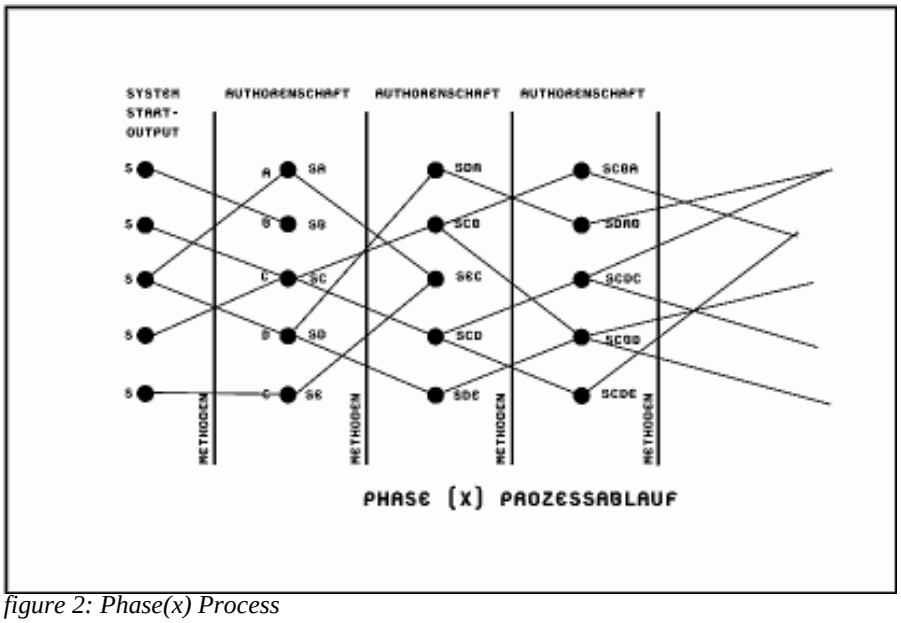

figure 2: Phase(x) Process

System

Students that take our course get an account in our workstation cluster. In these accounts they do their assigned tasks and store the results. They also have a homepage where they can put these results on display. In Phase(x) we made this use of the homepage optional, as the central database held the information about and all the documents of every work of every student and displayed them in various ways. This was realized by creating a custom www-interface to a Mini SQL database, that would manage all the data related to the course in two tables: one for the authors and one for the works.

To start working on a new phase, students would choose a result of the previous phase that interested them and request it from the system. To request a work, the users had to identify themselves with a password. Users registered this way could not request another work, until they had submitted the one they were currently working on. Upon requesting a work, a whole folder was placed in the students' accounts, containing a CAAD drawing file and sometimes other additional data. When the work was submitted, it became available for other students to work with in the next phase.(figure 3)

Using the database and the authentication it was not only possible to smoothly exchange the works between the students and prevent any student from using their own results. It also made it easy to store a lot of additional information with every work, like the amount of time that it was worked on, which authors had worked on it and when, etc. This information could later be used to analyse the whole course in various ways.

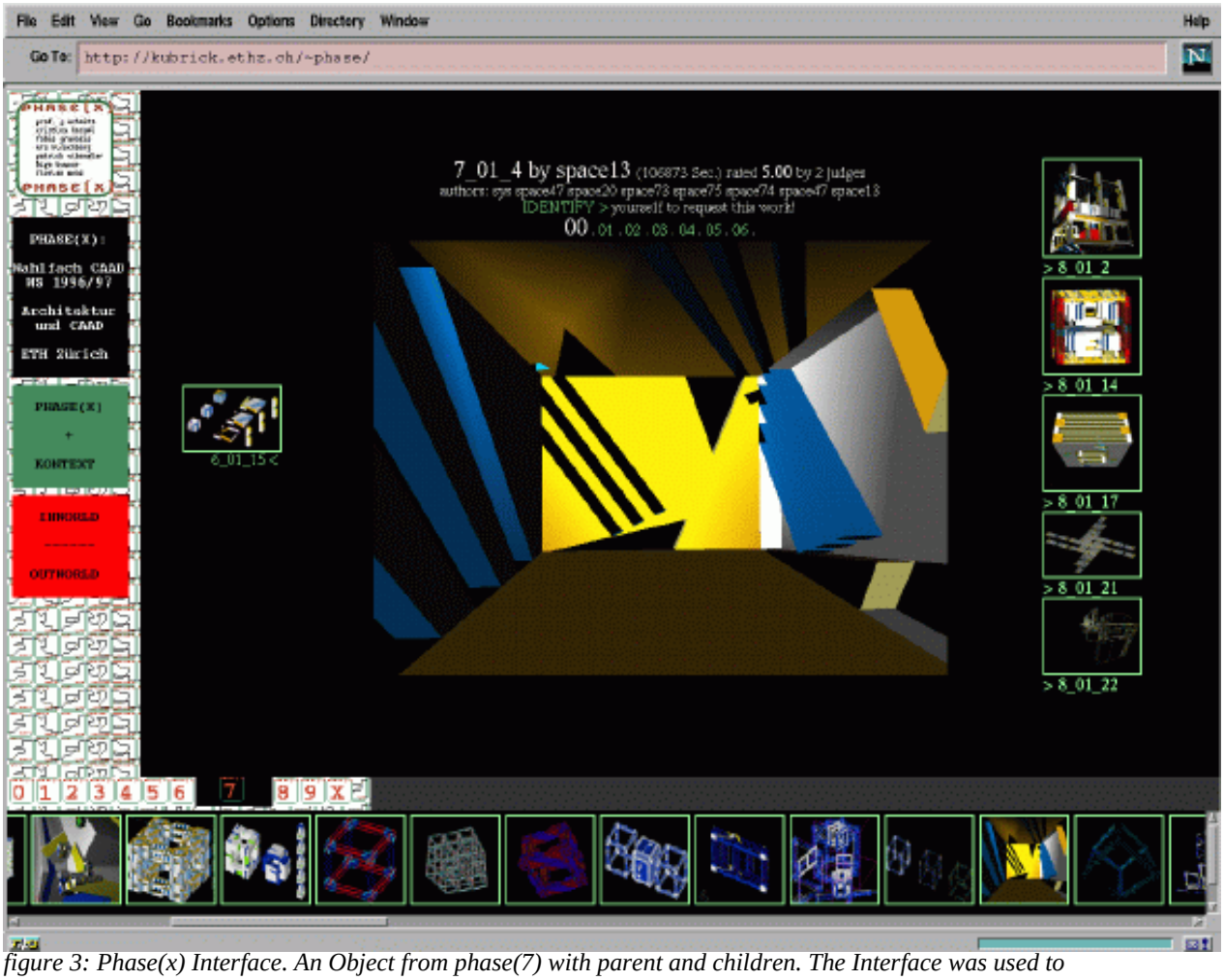

figure 3: Phase(x) Interface. An Object from phase(7) with parent and children. The Interface was used to navigate through the database, as well as to request and submit works

Phases

In each phase, a new CAAD concept was introduced and applied. Starting from 2D compositions on the plane in phase(1), they got more and more complex, covering solid modelling as well as different object-oriented principles, like parametric or hierarchical modelling. AutoCAD (and to some extent Inventor, resp. VRML) was the tool used for most phases, except for phase(9), where sculptor, a Virtual Reality modelling program developed at our chair was used and phase(10) where light-simulations were created with the program Radiance.

The phases were prepared in such a way that the design-tasks could be fulfilled with only a few macro-like commands that were assembled on a special menu. Complexity was introduced by the mere fact that many different authors inscribed their personal ideas into the same objects. As in previous semesters, the time students spent for a task varied greatly. Those with previous CAAD experience or determined to get a more in depth knowledge of the tools, could easily use all the standard AutoCAD commands as well. But for the ones more interested in the concepts than in the nitty gritty of the software, the macros made it possible to concentrate on the design quickly.

All phases dealt with geometric modelling in a very abstract, almost hermetic way. Only in the last phases questions of architectural space became somewhat relevant. There is a tradition for this approach at our chair (Schmitt 1993). The software tools and methods we introduce allow to concentrate purely on the principles of composition. The results are never taken to be representations of something but are always the - though intangible - thing itself. The ideas or memes each object contains are entirely expressed in terms of color, proportion and geometry, the

language of computer graphics. That there is indeed such a language and that it is established enough to make the Phase(x) experiment meaningful, was the hypothesis at the outset of our experiment.

Analyzing the whole body of works at the end of the semester we generated analytical charts of the development (figure 4, 5). One amazing fact we came to realize then, was that only four out of the over 120 different 2d-compositions that were created in the first phase had any descendants in the tenth generation (figure 5, 6). We hadn't expected the natural selection taking place to be so drastic.

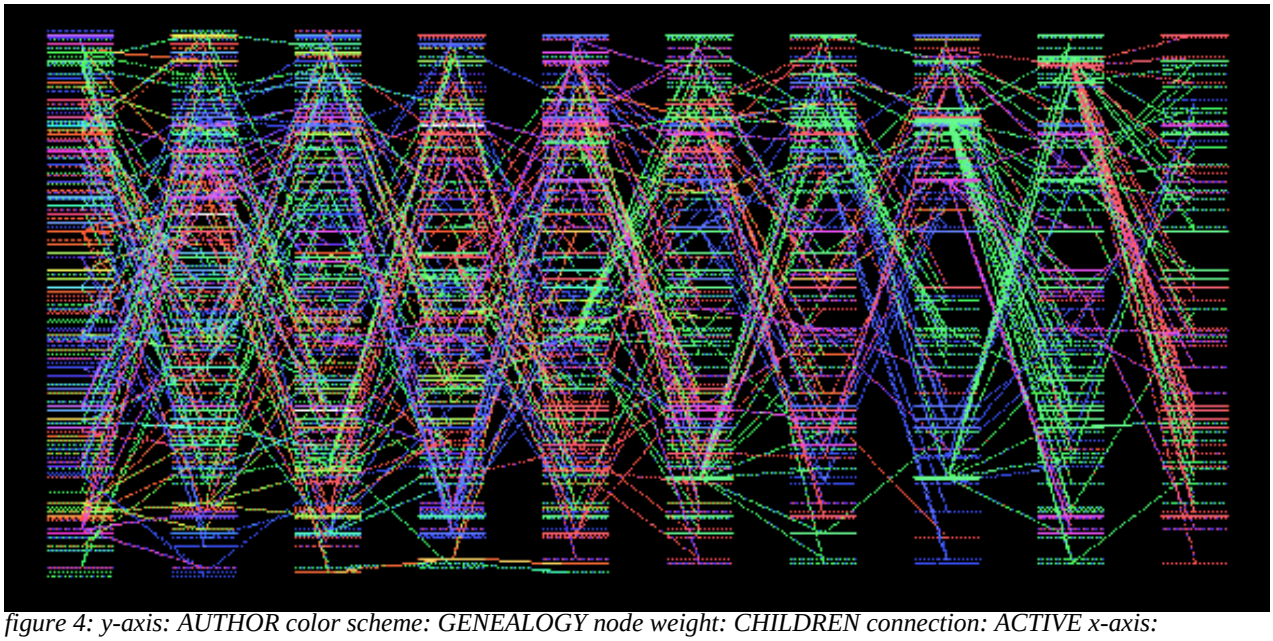

figure 4: y-axis: AUTHOR color scheme: GENEALOGY node weight: CHILDREN connection: ACTIVE x-axis: PHASE

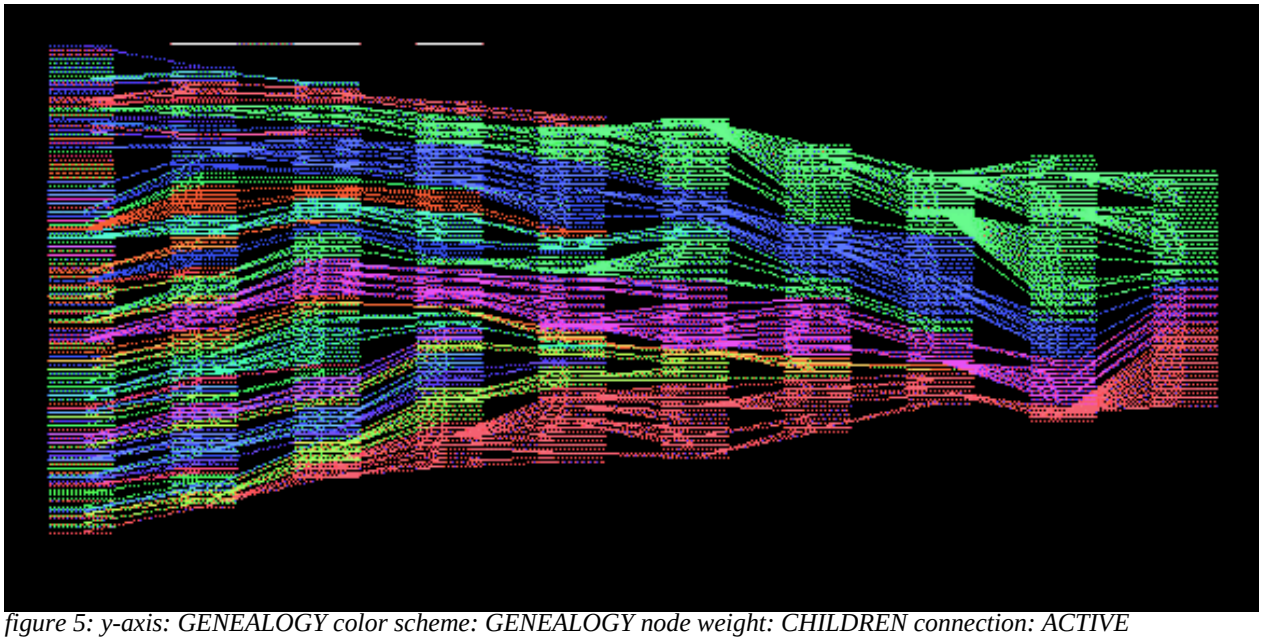

figure 5: y-axis: GENEALOGY color scheme: GENEALOGY node weight: CHILDREN connection: ACTIVE x-axis: PHASE

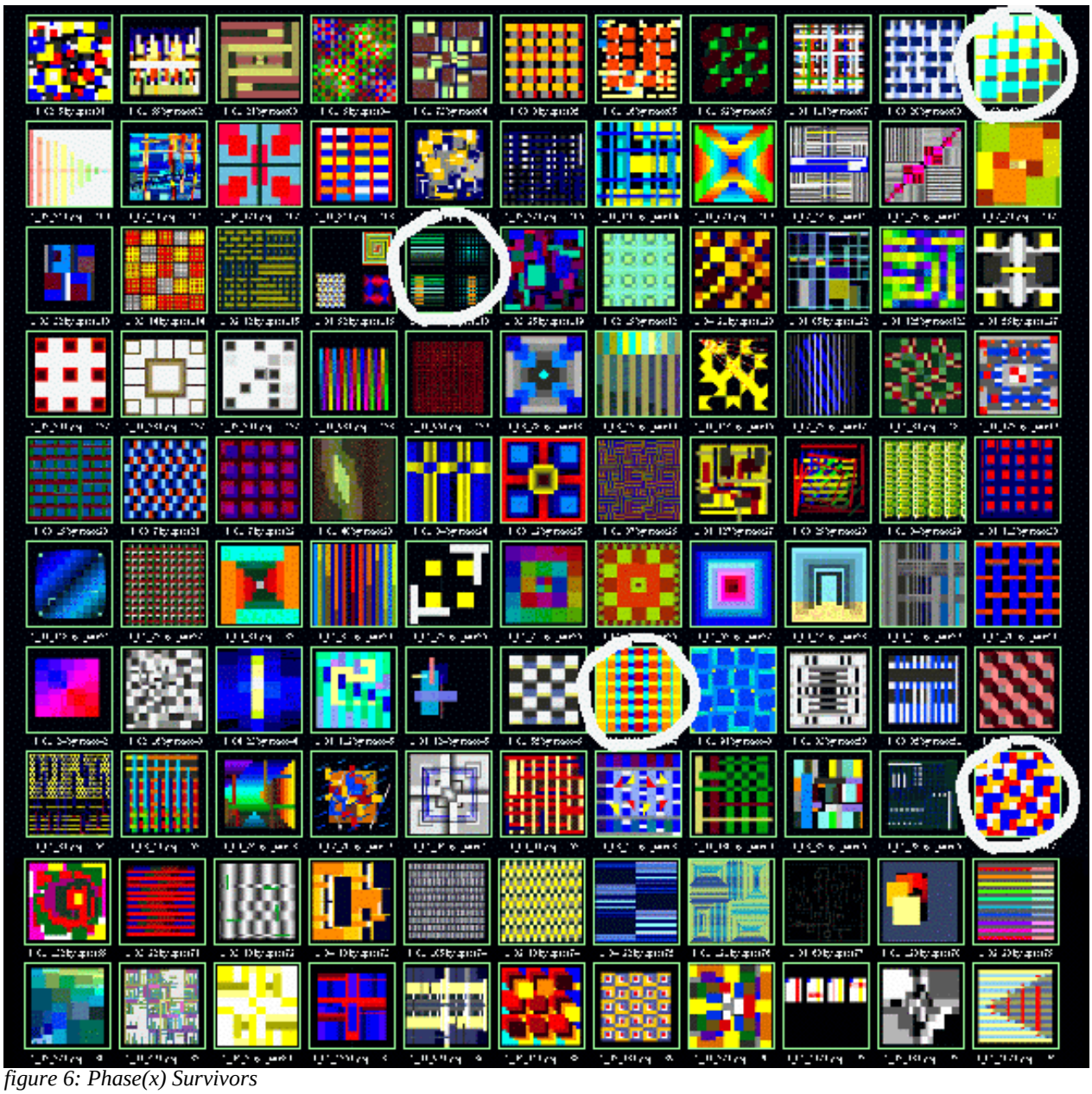

figure 6: Phase(x) Survivors

Memetic Engineering

Beyond the scope of an academic educational experiment, Phase(x) addresses issues that touch the core of the networked society, currently under construction. As we can tell from the development of the Internet, an environment where individual ideas are basically everybodys freeware generates a very rapid evolution of the system itself. The British scientist Richard Dawkins first suggested in his book "The Selfish Gene" (Dawkins 1976) that cultural evolution is based on similar mechanisms as biological evolution. Ideas or memes, as the smallest units of memetic evolution tend to replicate by separating themselves from their authors and being picked up by the public. This is especially true in the digital realm, where anything can be sampled and reused by such simple operations as "Copy" and "Paste".

Phase(x) assumes this is also true for architectural content and is designed around the principles of memetic evolution. By splitting a rather complex design process into clearly defined units, compatible memes are generated. These memes are first stripped from their authors by being placed into the public realm of the database and can then be copied without loss of substance as digital files to the next author. In fact, the total number of memes by a single author was the only

way, that the system measured the performance of students (figure 7). Phase(x) was thus developed as a showcase study for architectural memetic engineering and we expect that similar mechanisms will be used in the professional realm in the future.(Heylighen 1996)

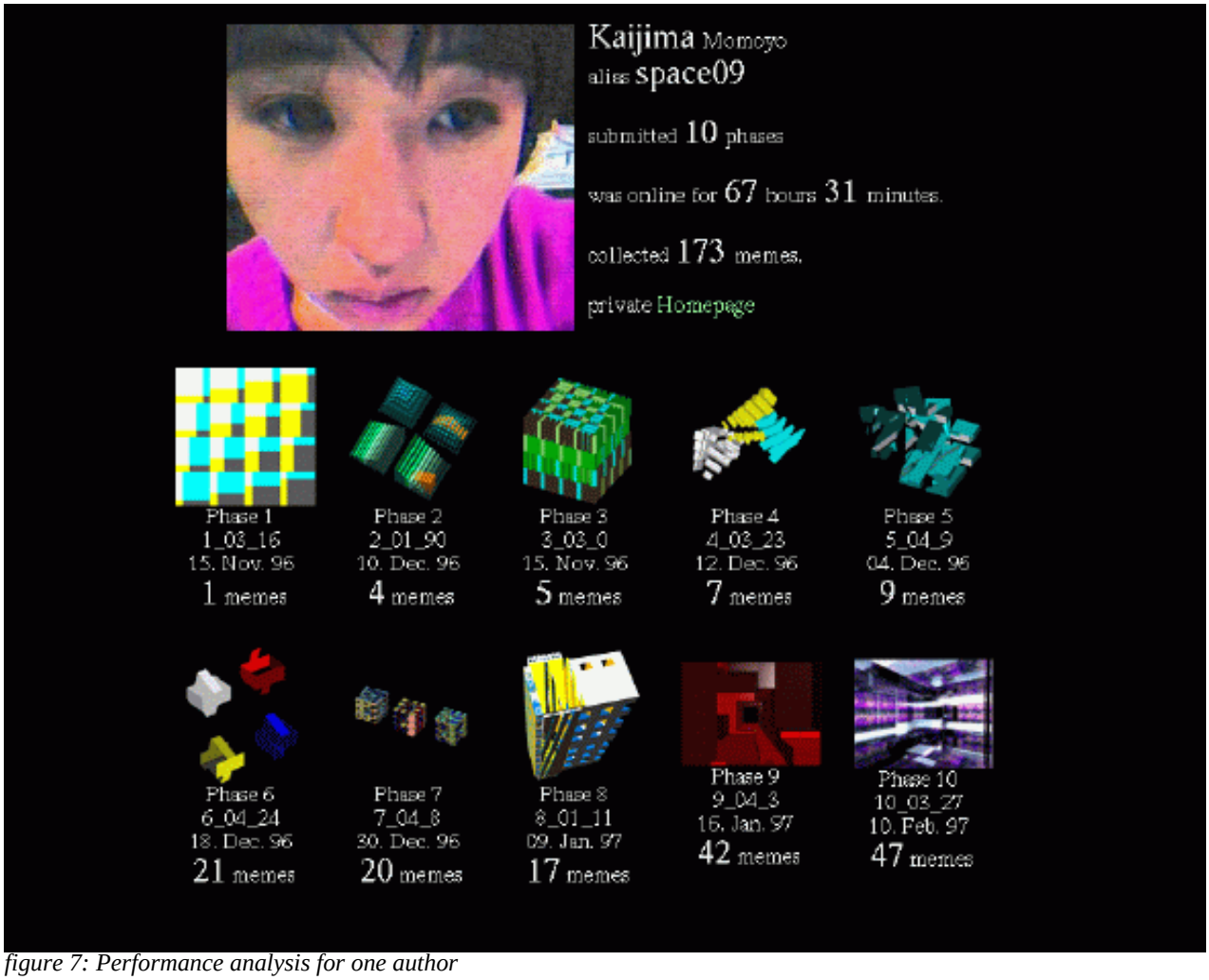

figure 7: Performance analysis for one author

Collective Authorship

One major unsolved problem with memetic processes is, that the traditional concept of authorship, which relates an object to a single author and a single point in time (figure 1) does not make sense any more. In fact, the notion of single authorship does in no way record the mutual synergies of collaborative creative work, that is predominant on the Internet and leads to very complex legal implications in the economic system.

Phase(x) replaces single authorship through collective authorship (figure 8), because all relations between works, authors and timeline are recorded in the database and can be rendered and evaluated. In Phase(x) authorship is a variable entity that is relative to it's current significance in the system. A single submission might thus start off having very little impact on the system, while at some later point, its significance will suddenly increase, because of actions of other authors that relate to it. As authorship equals identity in Phase(x), a single author finds himself being constantly redefined by other coauthors and subject to a dynamic model of personal identity.

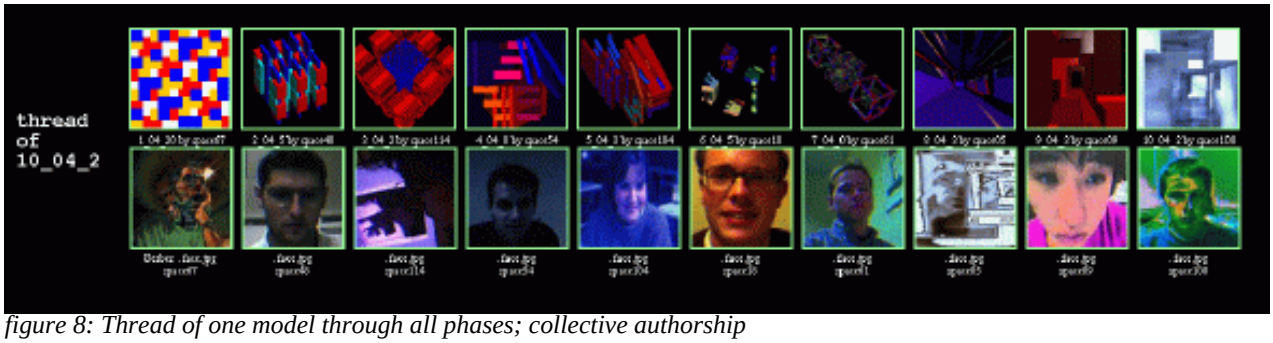

figure 8: Thread of one model through all phases; collective authorship

Implications

Without its architectural content, Phase(x) is a social experiment that can be applied to a wide variety of collaborative creative processes and if we are to define cultural evolution as such a process, systems like Phase(x) can be very effective cultural engines.

Applied to for example architectural competitions with authors from different disciplines, the results could be viewed from different angles and preconditions and could be further developed at any later point, a concept which is far superior to the current practice of selecting a single contributor as the winner. Phase(x)y is thus only an early testbed for such solution oriented systems and must be followed up by similar experiments that provide different angles and goals.

Notes

(1) The term "meme" was first introduced by Richard Dawkins in 1976 (Dawkins 1976).In analogy to genes allowing the replication of life, the meme is, in Dawkins' theory, the basis of cultural replication processes.

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