M o z a ï e k

(detailed proposal) **Mosaic scheme 2004**

Application form (basic details)

1. Details of applicant

-Title(s), initial(s), first name, surname: Michiel W. Kauw-A-Tjoe
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2. Details of intended supervisor ('promotor') and mentor ('begeleider')

Intended supervisor ('promotor'):

-Title(s), initial(s), first name, surname: Prof.dr. L. Hardman
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Kruislaan 413, NL-1098 SJ Amsterdam
-Preference for English correspondence: yes
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Mentor ('begeleider'):

-Title(s), initial(s), first name, surname: Dr. J.R. van Ossenbruggen
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3. Host institution

(Options are EUR, UvT KUN, RUG, TUD, TUE, WUR, UT, UL, UM, UU, UvA or VU)
TUE/CWI

4. Title of research proposal

Artistic Expression Through New Media – Closing The Gap Between Science and Art

5. Summary of research proposal

Our goal is to develop a process model for creating electronic visual media, thus making the huge potential of new media technology available to a broader audience. Our target user group is video artists, since these pioneers push tools over their limits, while at the same time requiring highly intuitive interfaces.

Research proposal

6.Description of research proposal

- **6a. Introduction**

Television has been the dominant mass-communication medium for some decades now and has strongly influenced the way we live. Since the rise of the internet, new media play an increasingly important role. Computer technology is starting to provide a viable alternative to television. Whereas broadcasted audiovisual content is determined and created by a small group of people, *new media* can be created by the general public.

The function of the computer has shifted from purely an information processing machine to a tool which supports human tasks in many different application areas. An important area is the creation and communication of audiovisual media. Because of the availability of cheaper, faster and more reliable hardware, a single machine can provide the functionality of an entire studio. Nowadays, you can singlehandedly shoot and post-produce an entire movie with only a computer, a digital camera and the right editing software.

The important role of audiovisual media in our society, combined with the increased accessibility, has made artists realize the potential of new media for creative expression. Through recent technological developments, the electronic art community has experienced rapid growth. The tools available, however, have not developed at the same speed. The current state is that tools have been developed from the perspective of the technological experts and are not tailored to the requirements of the artistic community. One of our goals is to establish tools that facilitate the creation of electronic art that can be manipulated by the artist intuitively and real time, similar to the way a painter uses a brush or a musician manipulates an instrument.

Computers have been applied in different existing artistic contexts, such as music, design and architecture, with varying results. Our target domain is that of generative, interactive visual media. Digital media offer new aspects for the creation and manipulation of art that were unavailable before, most importantly *generativity* and *interactivity*.

Generative or *algorithmic* art is centred around the idea that the artist writes computer software which generates the actual artwork when the software is run. Algorithmic art can therefore be described as a form of *meta-art:* in contrast to most traditional art, where the artistic value of a work is ultimately defined by the end result, in the case of algorithmic art the creation process itself is also considered highly significant. According to the categorization of Scha developed at the ILLC [12], there are four basic approaches to algorithmic art:

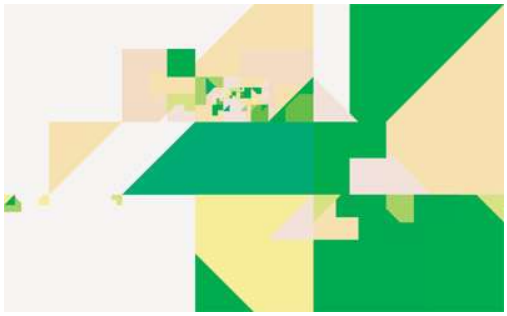
- the *structural* approach,
- the *optimalisation* approach,
- the *emergence* approach and
- the *data-visualisation* approach.

The structural approach is based on ideas of linguistics and logic. A set of graphics defines the *image language*, while the relationships between the graphics form the *visual grammar* or *algebra* [3,4]. The optimalisation approach defines a model for the desired outcome, after which the rules for constructing this outcome are specified. Often a model of the style of an existing artist, for example Mondrian, is used. Each time the algorithm runs, a new composition is constructed. Optimalisation lies in the fact that after several runs the best compositions are selected according to certain evaluation criteria (for example the taste of an observer), after which the construction rules are adapted slightly and the algorithm is run again. The emergence approach is based on an idea similar to that of Artificial Life (AL), a field which studies lifelike behaviour through the modelling of worlds with simple rules and relationships. In AL typically the dynamics of ant colonies and single cell organisms are modelled. It is relatively easy to translate emergent behaviour to visual output, resulting in a higher-level generation process which is not directly explainable by looking at the underlying

rules. Finally, data-visualisation is focussed on the translation of information structures such as databases or the internet to an artistic form. Data entities and the relationships between them are mapped to a dynamic environment, for example visually. The way the digital archive evolves is seen as symbolic for the structure of a society in which information plays an increasingly important role [2].

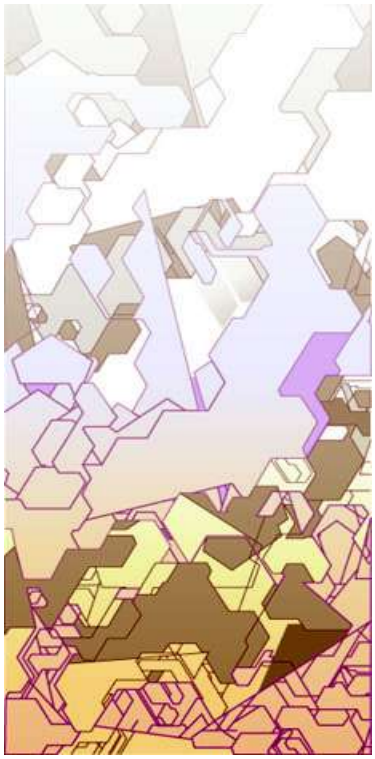
While an ideal theoretical model of visual generative art should be able to cover all these approaches, we will initially focus on modeling the structural and emergence approaches. The structural approach corresponds most directly to the candidate's master's research [10] (see figure 1a and b) and affiliated work (figure 1c), while the emergence approach is the next logical step from a structural to a more time-based model. We will incorporate relevant optimalisation and data-visualisation aspects later, concentrating especially on evolutionary computing and data-set manipulation techniques.

Next to generativity, interaction forms an important added dimension of new visual media over traditional visual media. By default, interaction with the computer takes place through the keyboard, mouse and screen. However, in the context of artistic expression it is often desirable to be able use the tools of expression more intuitively. Our model for interactive generation should thus also consider other, non-traditional input devices. The *MIDI* standard, for example, was originally developed for the communication of musical data. While available MIDI devices are usually aimed at making music, it is also possible to use them to manipulated graphics. This is done by mapping the keyboard to visual parameters such as colour and luminosity instead of tone and timbre. There is a wide range of available MIDI hardware (figure 2a) and some devices have been designed with this specific goal in mind. C*omputer haptics* enable interaction with a digital environment through touch [14]. By wearing so called data-gloves (figure 2b) or rotating a mechanical arm (figure 2c), it is possible to manipulate the items on the screen.



(a) isometric shape composition

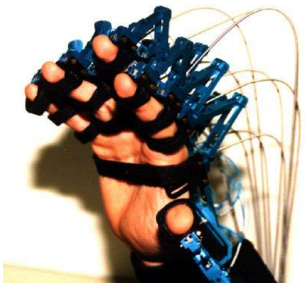
(b) shape pattern composition



(c) rendered composition

Figure 1: structural generative art


(a) assignable MIDI keyboard


(b) haptic glove

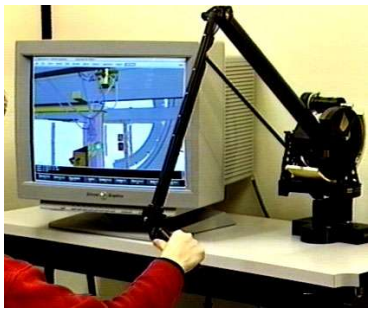

(c) haptic arm

Fig. 2: some examples of input devices

- **6b. Research question(s)**

Although much practical work has been done in the fields of new media and electronic art, little scientific research is available. This dichotomy between theory and practice is illustrated by the divergence of two types of tools used by artists in this domain:

1. those that are mainly developed from an artistic perspective, often for a highly specific art project and thus hard to reuse in a different context;
2. those that are mainly developed from a technological perspective, sufficiently generic to demonstrate the possibilities of the technology in a wide variety of contexts, but not capturing important features of visual art.

Our research aims at bridging the gap between theory and practice by answering the following questions:

– What are the important features of electronic visual art and how can we explicitly capture these in a conceptual model?
– How can we use this model to improve upon the current state of the art in authoring and media production and performance environments by creating more intuitive interfaces and expand the possibilities of expression in the visual arts through new media?

- **6c. Method/Approach**

More specifically, we will take as a starting point the dimensions interaction, generation and behaviour in space and time. We will look at their relevance and find out what other aspects could be important. By capturing the relevant dimensions into a theoretical model, we will see to what extent we can create better interfaces based on it, while striving for a balance between scientific research, technological innovation and artistic content. To achieve such a balance, we will cooperate with several research centers and institutions.

Our first step will be to get a better picture of the current electronic art environment. The electronic art community is global, but well organized. Artists keep up with the latest developments through mailing lists, events and institutions. To establish a firm embedding in the community, we will collaborate with *V2_* in the form of an internship. This organization, which is based in Rotterdam, specializes in *unstable media* and has participated in numerous national and international new media art projects. In addition, V2_ has its own laboratory at which a varying group of art students and scientists do research, both for ongoing internal projects as well as individual ones.

After we have a clearer idea of the possibilities and limitations of current new media art, we will make an in depth analysis of research areas related to electronic art in cooperation with professor Scha at the *Institute for Logic, Language and Computation* at the University of Amsterdam (UvA). We plan to take material from professor Scha's lectures on “Algorithmic Art and Artificial Intelligence” as a starting point to survey a wide range of relevant topics. Our first step will be to focus on relevant literature on electronic art [5,6,7,8,11,12,13]. However, because this is still a young

and unexplored domain there is not much existing work that directly relates to our topic. Therefore, we will extend our research to related areas such as human-computer interaction and related traditional artforms such as fine arts, film and animation [1,9]. This will result in the development of a theoretical model, which provides the formal framework to base our further research on.

We will then focus on the technological aspects of electronic art by designing an integrated software environment which can serve as a tool to create visual, time-based interactive art. The prototype should at least include graphic editing capabilities, access to important artificial art techniques and support for advanced physical interaction. To establish what technologies exist to base such a system on, we will research existing platforms and libraries such as MAX/MSP and Java 2D/3D. We will develop the prototype system at the INS2 department of the *Centrum voor Wiskunde en Informatica* (CWI) in Amsterdam. This group does extensive research on the application of new media technology in several domains, such as the semantic web and the automatic generation of multimedia presentations. Therefore it has the required expertise to give this project a sound technological background. Professor Hardman, who is head of INS2 and is a professor at the *Technische Universiteit Eindhoven* (TUE), will supervise this Phd project.

Finally, we will return to V2_ to evaluate our test suite. We will do this by testing our system on a group of experts and end-users from the community. Therefore we will have to design an experimental setup through which we can analyse how well the concepts of our model correspond to practice.

- **6d. Innovation**

This project is innovative on several accounts. It is by definition interdisciplinary. Relevant scientific domains include artificial intelligence and computer graphics. The time-based generation and interaction aspects are characteristic for a wide range of new media applications such as multimedia presentations and games. Formal time-based and narrative ideas can be found in other artistic disciplines such as music and traditional film and animation. The artistic value of electronic art is often related to other existing art movements, such as modern art and meta-art.

Electronic art by itself is innovative because state-of-the-art technology is applied in a creative way.
Artists, who are often not experts or scientists, explore the boundaries of what can be done with the tools available to them. This often leads to unconventional new approaches.

Practically, this research could push the scientific and technological state of the art to, or even beyond, its limits by laying a formal basis for a new area where art, science and technology meet. In addition, it could help us better understand the requirements of a specific group of end-users, the ones interested in creative production of digital content. Most research in computer graphics, multimedia and user interface design that is partly driven by artistic motivations tends to focus mainly on the expressibility of the models, the performance of the algorithms or level of realism created for three-dimensional interfaces. However, laying less emphasis on such practical criteria and more on artistic ideas would require a paradigm shift from an analytical design perspective to one that is based on expression and active involvement. The research of such a new paradigm could ultimately lead to the development of better tools for expression.

That art and technology are intrinsically related can be understood when one considers that the quality of electronic art is often determined by the extent to which the technology lends itself for artistic expression. Artists will exploit the available tools to their limits. Through new developments the limits of what one can do with the current technology are constantly redefined. This research should be situated at this front-line of innovation.

- **6e. Relevance for science, technology or society**

Over the past century, technology has had an increasing influence on almost every aspect of society. As was pointed out before, the role of the computer has steadily shifted from purely a "number-crunching" machine to a tool which supports human tasks in many different application areas. However, there is still a mentality gap between the computer science and the creative community: computer experts tend to approach art in a formal, exact way, while many artists find it

difficult to adapt to the rigid, procedural nature of machines. As we discussed in section 6d, changing the research focus could lead to a paradigm shift in which active involvement and creative expression are emphasized. However, to realize such a shift one requires participants from the scientific, technological and artistic communities that really understand each other's language and respect the different goals and agendas involved. This research will be centered right in the middle between these three groups, thus providing ground for an active cooperation between experts from multiple disciplines and different institutes.

Visual arts are but one example of a domain where creativity and technology meet and are obviously part of a larger context. Generalizable results of research of this particular domain will also contribute to the understanding of other fields, including commercial applications such as advertisement and web site design.

Although this research is strongly focused on supporting creative ideas, it is also scientifically founded and relevant. The underlying theoretical model should be sound: on the one hand, it should be general enough to cover the relevant dimensions of algorithmic art systems. On the other, it should be detailed enough and the scope should be clear so it can be used to build concrete implementations. It should be possible to test such a prototype tool in an experimental set-up with a target group of experts and end-users to see if the ideas on which it is based correspond to reality.

6f. Literature references

[1] Bordwell, D., Thompson, K., *Film Art – An Introduction*, fifth edition, The McGraw-Hill Companies, Inc., ISBN 0-07-006634-5, 1997.

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[4] Chase, S.C., "Representing Design With Logic Formulations of Spatial Relations", *Workshop Notes, Visual Representation, Reasoning and Interaction in Design*, Fourth International Conference on Artificial Intelligence in Design, Stanford University, June 1996.

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[7] Fleischmann, M., et al., "Digital Sparks - Ein Wettbewerb Studentischer Medienprojekte", Konferenzband EVA, Elektronische Bildverarbeitung & Kunst, Kultur, Historie, Berlin, 2003.

[8] Holzman, S.R., *Digital Mantras – The Languages Of Abstract And Virtual Worlds*, The MIT Press, Cambridge, Massachusetts, ISBN 0-262-58143-4, 1994.

[9] Kandinsky, W., *Point and Line to Plane*, Trans. H. Dearstyne and H. Rebay. New York: Dover, 1977.

[10] Kauw-A-Tjoe, M.W., *Generation of Abstract Geometric Art Based On Exact Aesthetics, Gestalt Theory and Graphic Design Principles.*

[11] King, M., "Computers and Modern Art: Digital Art Museum", *Proceedings of the Fourth Conference on Creativity & Cognition*, Loughborough, UK, pp88-98, October 2002.

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Jochem van der Spek. Curriculum "New Media", Faculty of Humanities, University of Amsterdam (Fall 2001, Fall 2002, Fall 2003), http://iaaa.nl/cursusAA&AI/.

[13] Snibbe, S.S., Levin, G., "Interactive Dynamic Abstraction" in *Proceedings of Non-photorealistic Animation and Rendering (NPAR 2000)*, ACM, Annecy, France, 2000.

[14] Srinivivasan, M.A., Basdogan, C, "Haptics in Virtual Environments", in Computer Graphics Vol. 21, Nr. 4, pp 393-404, 1997.

6g. Plan of work (2004-2008)

Year	Research activities	Applicant (.. fte)	Assistant (..fte)
2004	Internship at V2_ to get experience in artistic environment. Collaborate with different artists that make use if computers to see how they apply existing technology and overcome or surround the problems they face.	0,25	-
2005	Literature study at the department of Remko Scha for scientific embedding of project. Topics will include artificial intelligence, computer graphics, modern art, kinetic art, music composition, animation, semiotics, multimedia and games. Make first conceptual model for visual electronic art with focus on the dimensions generativity, interactivity and time-space behaviour.	1,0	-
2006	Do research on equipment, such as haptic interfaces, MIDI-devices and computer software. Study of existing Max/Jitter and PD environment and Java Media, 2D and 3D libraries. Research the state-of-the-art of new media developments. Design and development of prototype system to find out constraints and problems. Development prototype tool based on the detailed model.	1,0	-
2007	Finish implementation of prototype software environment. Make experimental set-up to test model through the implemented tool on a group of expert and end-users. Collect test data. Write down the basic structure of thesis.	1,0	-
2008	Round up technical development and extract experimental results. Write Phd thesis.	0,75	-

Cost estimates

7a. Budget

	2004	2005	2006	2007	2008	TOTAL
Staff costs: (in k€)						
Applicant						
Assistant	0	0	0	0	0	0
Non staff costs: (k€)						
Benchfee (standard)	1134.5	1134.5	1134.5	1134.5	1134.5	5672.5
Equipment	3500	0	2000	0	0	5500
Consumables	0	0	0	0	0	
Travel	1500	1000	500	500	500	4000
Other	0	0	0	0	0	
TOTAL	6134.5	2134.5	3634.5	1634.5	1634.5	15172.5

7b. Have any other grants for this project been requested either from NWO or from any other institution? no.

Curriculum vitae

8. Personal details

Applicant
-Title(s), initial(s), surname: M.W. Kauw-A-Tjoe
-Nationality: Dutch
-Date of birth: 26 July 1977
-Country and place of birth: Amsterdam, The Netherlands

Parents
-Country of birth father: Surinam
-Country of birth mother: The Netherlands

9. Bachelor's degree (or 'Propaedeuse')
University/College of Higher Education: VU
Faculty/discipline: FEW, Artificial Intelligence
City and country: Amsterdam, The Netherlands
Date: 1998

10. Master's degree (or 'Doctoraal')
University/College of Higher Education: VU
Faculty/discipline: FEW, Artificial Intelligence
City and country: Amsterdam, The Netherlands
(Expected) Date: March 2004
Title Master's thesis (if applicable):
Generation of Abstract Geometric Art Based on Exact Aesthetics, Gestalt Theory and Graphic Design Principles.

11. Brief summary of your present research

The knowledge domain of abstract expressionistic art is analysed formally by considering the disciplines aesthetics, gestalt theory and graphic design. On the basis of this analysis a framework is designed for an art-generating system that makes use of artificial intelligence techniques. A prototype is built using Prolog and Scalable Vector Graphics (SVG) that generates static visual compositions consisting of geometric vector images.

12. Relevant work experience

1999 - 2001

Cistron Internet Services B.V. at the web design department (part time) as part of a team. Responsibilities included graphic design and communication with the client about design decisions. Mainly assignments from industrial companies.

2001 - 2003

Freelance web designer as part of v.o.f. Defekt (http://www.defekt.nl).
Main assignments:

- Channel Three

Adaptation of corporate identity. Design and implementation of new website that

releases video-manipulation software under the name SVD-1.

- We Dare/Next Element

Design and implementation of intro-animation of the We Dare homepage. In collaboration with Next Element (formerly We Dare) did the graphic design of an educational system for the Center of Education in The Hague (HCO). A short description (adapted from http://www.next-element.nl/):

In collaboration with HCO Next Element an E-learning platform was developed, with the goal of providing elementary school students with a set of didactic methods that are specifically adapted to the level of that student. The platform registers how well the students handle the assignments and the teacher chooses new or repeated assignments based on the results. Both maintainers (teachers) and users (students) have a clear overview of the system through several management facilities.

2003 - recent

- Naked

Returning event that specializes in electronic music and visuals. Organized in cooperation with a partner from Defekt and Pop and Culture-platform Het Kasteel in Alphen aan den Rijn. Several short films and animations are shown both by well known artists as well as by multimedia and art school students. Besides this, musicians who play live electronic music perform regularly. Own contribution consists of management and communication with the participating parties as well as editing, converting and arranging video material. On average around 200 visitors.

http://defekt.nl/naked

- VJ/DJ team

Cooperation in which electronic music records are mixed, while the output audio is manipulated with software and new rhythms are added at the same time. Tempo information is passed to video-generating software through MIDI to let the visual rhythms run in sync with the audio. We make use both of existing software (for audio) as well as software that was written by one of the team members. Through the modular and distributed nature of this program, several beamers can project data created by several computers at the same time. Still highly in development.

- Programming

Knowledge of and training in Java, Prolog, OpenGL as well as several types of mark-up languages including SVG and VRML. Followed courses in software engineering, machine learning and multi-agent systems.

- Art

Work includes collages, computer renderings, graphic design, web design, animation, murals and paintings. Mainly interested in (sub)urban society and electronic art. Style can be described as a combination of figurative and abstract geometric elements. Knowledge of and training in Photoshop, Illustrator, Flash, Premiere, as well as several audio and video-editing tools. An example website consisting of a collage of several graphic design and typographic experiments can be found online at:

http://www.concretejungle.nl

List of publications

I hereby declare that the present form has been completed truthfully

Name: M.W. Kauw-A-Tjoe

Place: Alphen aan den Rijn

Date: May 7 2004

Please, submit the application to NWO in electronic form (pdf format is required!) using the Iris system which can be accessed via the NWO website (www.nwo.nl).