Transformative Copy

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Submitted to the Program in Media Arts and Sciences,
School of Architecture and Planning,
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Abstract

The ability to create an unlimited number of identical copies is a privilege of digital documents. What if that would not be the case, if each copy of a digital file would go along with some sort of transformation? This thesis examines the implications of such a scenario on information ecologies and map out the design space for a new type of decentralized authoring applications.

The concept of the copy is inherently transformative, even if just as the transformation from *"the One into the Many"*. However, until the recent transition from analog to digital media, the perfectly identical copy was not possible, every reproduction resulted in transformation. While this transformation usually is associated with loss of information, it also creates new information, traces of an objects history. As a result of the ability to create of unlimited numbers of perfectly identical copies from digital files, this dimension of context information is lost - digital files do not have a history. In the course of this thesis, five examples were implemented that illustrate important properties of the concept of transformative copying, in order to propose a general framework for a sociable, transformative file format. They investigate two cases of transformation: First, transformation as a deliberate process by humans. A second dimension is transformation as an autonomous process, either in form of an imperfect copy or as a result of an objects age and usage, such as wear. Both points seem like independent cases, but in our scenario they are closely interconnected and inform each other.

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1 Introduction

"... yet the making of copies is essentially transformative – if not as the result of generations of inadvertent errors, then as a result of masses of copies whose very copiousness affects the meaning and ambit of action." [1]

The ability to create an unlimited number of identical copies is a privilege of digital documents. What if that would not be the case, if each copy of a digital file would go along with some sort of transformation? This thesis examines the implications of such a scenario on information ecologies and map out the design space for a new type of decentralized authoring applications.

The advance of digital media and digital networks has lead to the proliferation of all sorts of shared content. As a result, the dissemination of news, fashion etc. is vastly accelerated. A central reason for this is that digital media can be reproduced in unlimited numbers and without loss of information. In the world of analog media, perfect copies do not exist since the content can never be fully separated from its carrier. Every reproduction involves a modification of the content. Usually this transformation means a loss of information and degradation of its content. At the same time, analog media also gains new information: it acquires traces of past consumption, manipulations and signs of aging and wear. These traces are evidence of an objects history, or one could say biography. While digital media solves problems associated with transformation, it lacks this dimension. As it will be shown, the visible traces of an objects history is in many cases important for understanding its meaning and value. This thesis speculates about ways to incorporate the concept of transformative copy into digital media in order to make up for these shortcomings, and provides a framework for thinking about the transformation of documents.

Concerning transformation, we are interested in two different cases:

- Transformation as a deliberate process by humans. This involves practices like collaborative editing or annotating, or incremental modifications of information as it is passed around in a social network.
- Transformation as an autonomous process, either in form of an imperfect copy or as a result of an objects age and usage (such as wear).

Both points seem like independent cases, but in our scenario they are closely interconnected and inform each other. In both cases,

transformation can be seen as a mark that gives evidence of a specific event in an objects history. It could point for example to a documents being edited, a file being copied or propagated within a social network or a film being watched.

By focusing on transformation, the thesis offers a different view for thinking about social networks. Instead of a general, abstracted view on the issue, we propose an aspect- or situation oriented view. Classical social network analysis is concerned with the global structure of a community - the weak and strong ties among its members. Instead we are interested in the social structures that manifest themselves in the shared activities among its participants, how they interact in a social network. Looking at the social history of documents passed around within a social network could show a more meaningful picture of a community not visible in the global view. In the aspect-oriented model of a social network, every node makes decisions and has its own preferences and transformational power. In the light of we will review existing models for diffusion processes and discuss a simple model for disseminating messages in a network of nodes that have individual preferences and the ability to modify the message accordingly as it is passed through them.

In both cases the notion of fitness is also of special importance – there are different ways to determine whether a modification has been a successful one or not. In the course of the thesis, a number of applications have been developed for analyzing existing phenomena and implementing prototypical systems that touch different aspects of the topic domain.

Thesis Summary

The following paragraphs describe briefly the organization and methodology of this thesis.

Background

Here we identify and describe relevant theoretical foundations that illuminate the topic of transformational copy from a cultural perspective. Topics related to scope of the thesis will include:

- Communication theory - the history and social context of information
- Diffusion studies - how information moves in social networks
- Transformation and its constraints – memetics and resonance
- Secondary orality and practices of improvisational authorship

Related Work

In this chapter we review projects that illustrate issues identified in the background chapter and have influenced the course of this thesis. The projects fall into three different categories:

- - Projects that have the goal to enrich digital documents with socially meaningful context information.
- - Projects that investigate the diffusion of documents in a social network, and the transformation that occurs during that process.
- - Projects that implement mechanisms and fitness functions for controlling content transformation in a collaborative environment.

Aesthetics of Transformation

This chapter frames a typology of strategies of collaborative content transformation and illustrates them with examples from art and cultural history.

My Experiments

This chapter discusses the five prototypical applications that have been developed in the course of this thesis. The first example, *Comment Flow*, has the purpose of analyzing an existing mapping conversations in social networking sites.

The second application is a simulation of a diffusion process within a social network where every node has transformational power and a fitness function based on individual perferences. It determines structural parameters of by comparing the diffusion in different network types and based on different rules.

The following three applications are prototypes for authoring systems that incorporate different aspects of transformational copy. *Infinite animation* is an application for a popular social networking platform that allows users to author and continue animations, *roaming whistles* and *multitrack whistles* are applications targeting the creation and collaborative modification of audio recordings via mobile phones in public space. The chapter is concluded with an evaluation of the prototypes.

Conclusion and Analysis

Based on the lessons from experiments we extrapolate a framework for a sociable file format and describe the application space.

2 Background

In this chapter I will focus on three aspects that are relevant for the diffusion and collaborative transformation of information in social networks.

First, I look at the history and social context of documents as well as their impact on our understanding of the meaning resulting from this exchange.

Second, I focus on a documents behavior: how it moves and spreads within a social network.

Finally, I examine the conditions and constraints under which transformation occurs in a social network, and present a theoretical framework for thinking about cultural practices of improvisational authorship.

The Conduit Metaphor

This thesis will discuss properties of analog and digital media. As the notion of a medium is vague and in some aspects problematic, the first part of this chapter will attempt to clarify how the concept of a medium is understood in this thesis.

In our everyday understanding, ideas are often treated as "objects" that can be "transported" with different media. Just as the content of a letter and its envelope, information and its medium are seen as strictly separated. A message therefore retains its integrity, regardless whether it is printed on a paper, sent in an email or broadcasted over radio.

This common understanding is deeply rooted in everyday language and manifests itself in metaphorical expressions and common sayings. To describe this issue, the linguists Michael Reddy and George Lakoff coined the term *conduit metaphor,* which can be summarized as follows:

> *Ideas are objects. The medium is a container. Communication is sending. [2]*

In this metaphor, a speaker encodes thoughts into words, while the listener would extract the thoughts again from them. This model appears in a large number of common expressions, for example when we talk about *giving* someone an idea, *putting* it into words or when we say that words *carry* meaning.

The *conduit metaphor* can be also found in Shannon & Weaver's classical information theory model [3], published in 1948 under the

name *A Mathematical Theory of Communication.* It describes communication as a process of transmission: a source encodes a message into a signal, which is then transmitted through a channel (where the message might be altered due to noise) and decoded by the receiver. In sum, the model describes communication as a linear, unidirectional process.

While this might be an appropriate description of the technical process of information exchange, it is not very helpful for understanding of human communication. In this *transmission model*, the sender is active, while the receiver remains passive. Yet, every form of communication involves a bi-directional exchange—both sides simultaneously send and receive information. As the cultural theorist Walter J. Ong notes, communication is happening even before the first word is said. For example, we would address a child and an adult differently with the same request [4]. Even a message broadcasted over a one-way medium such as TV requires some anticipation of the audience's expectations.

Another problematic aspect of the transmission model is that the Shannon-Weaver model does not account for the context of the information exchange. However, context has a big influence on how a message is understood. A telephone call in the middle of the night will be received differently than a call during daytime. The information expressed in a message might be the same, but depending on the context its meaning might be understood quite differently.

Finally, the characteristic properties of the medium are important. Media encourage some forms of expression more than others. In human communication the medium is not, as the *conduit metaphor* suggests, the neutral entity "in the middle" that exists independently from the involved participants.

Interpersonal communication is primarily about the exchange of meaning, not information. Meaning cannot be simply extracted from a medium, but has to be actively constructed by the receiver, who takes many cues from a messages context during that process.

McLuhan's explanation of the medium as an extension of the human body and its sensory apparatus can be understood in that way—depending on its properties, a medium amplifies some senses and inhibits others just as the radio amplifies our sense of hearing.

The relationship between the properties of a medium and human perception is expressed in McLuhan's distinction between hot and cool media. Hot media, characterized by high definition and density of information, leaves less space for interpretation, while cool media, providing less information, requires more active participation by recipient to complete the missing parts.

The distinction between media and content is also not as clear as it might seem. McLuhan argues that every medium contains another medium rather than the content. The medium "book" contains the medium "text", which in turn contains "language" and "speech" [5].

For meaningful communication to take place, effective media must contain as much context information as possible. In the following sections we will discuss differences of analog and digital media concerning this issue.

Immutable Mobiles

Documents blur McLuhan's distinction between storage and transmission media, combining aspects of both kinds. Documents store information, but since they are mobile they can also be understood as a transmission medium. In that sense documents are, in the words of Bruno Latour, *"immutable mobiles"*[6]. They can be distributed but also maintain a level of permanence. While word of mouth results in many different versions of the same story, a newspaper delivers information in a more stable form.

Mobility and immutability as characteristic properties of documents are also linked together[7] – high mobility often goes along with high mutability, while documents that are highly immutable, like a stone monument, are usually not very mobile.

In this model, digital documents have an especially high fluidity: they are easy to create, to duplicate and distribute. On the other hand, they are also highly mutable: their content can be manipulated without physical effort.

The concept of the *immutable mobile* is especially important, since it addresses the question of how documents spread and how they change during that process, which are the central questions of this thesis. However, mobility and mutability conflate a number of separate dimensions that are worth looking at more in detail.

For example, we must also consider a document's ease of distribution, portability, ease of production or reproduction, and the resources involved to create it in large quantities.

These dimensions are closely related to mobility: a newspaper is highly mobile not only because of its small physical weight but also because it can be created quickly and distributed in large quantities.

The concept of mutability also conflates several separate dimensions. On the one hand, it refers to a document's support for active editing and re-writing. For example, the contents of a whiteboard can be changed easier than those of a printed document.

On the other hand, it also refers to transformations that are caused by properties of the medium or by its imperfect reproduction. This includes for example the aging of paper, damage as a result of previous usage or translation mistakes. In the next section we will focus on consequences of this kind of transformation.

The Aesthetics of Transformation

Analog media does not permit perfectly identical reproduction, since the information can never be completely separated from its carrier. Every reproduction goes along with some form of transformation, usually this results in a degradation of the content in which artifacts and traces of usage are introduced and some of the original information is lost. The quality of a photocopy is influenced, among many other parameters, by the optics of the device, the resolution of photographic film by the film grain and the sound of the record player by dust on the record.

In many cases however, this degradation has been used in a creative way and helped establishing a characteristic aesthetic for a certain medium. The aesthetics of analog media is to a significant part an aesthetic of the artifact, of a media-specific "mistake".

The high-contrast style of coarse photocopies has become a trademark of DIY zines, and has subsequently been adapted as a visual language by the graphic design community. The grain structure of chemical film stock became a photographic style element and the imperfections of vintage electronic synthesizers like the Roland Juno or 303 are highly valued because of their characteristic sound.

All of these examples have been heavily emulated in digital media – the aesthetics of the photocopy led to "*grunge fonts*" with their jagged letter shapes, 3d rendering systems invest significant computational efforts to simulate imperfections of camera lenses and the artifacts of photographic film. A variety of audio software has been developed to emulate the distortion and nonlinear characteristics of analog audio hardware.

It seems like the aesthetic possibilities of the digital are unlimited only when it comes to the reproduction of analog limitations. Examples that exhibit a genuinely digital style, a system immanent aesthetics are rare.

Still, examples do exist. Digital formats also have intrinsic properties and limitations that have been exploited as stylistic elements by designers and artists such as the Belgian group *Jodi*. In the later chapters of this thesis we will argue that there is another dimension of a digital aesthetic beyond the sensory appearance: the intertextual aesthetic of the social context. In order to understand the humor of a viral video, it is necessary to be familiar with its references.

The Aura of the Physical

Digital emulations of physical media can never be perfect. In his essay "*The Work of Art in the Age of Mechanical Reproduction*" Walter Benjamin used the word *aura* to describe the totality of all physical properties, features and history of an object [8].

Since its extent is virtually infinite, no complete description or perfect reproduction is possible. Appropriately, he defined the term

aura as "the unique phenomenon of a distance, however close it may be". The aura is a quality that gives the original authority over its mechanical reproductions.

In our context, we are not concerned with metaphysical qualities that determine the value of art. However, the concept of the aura underlines the importance of the history of an object, the perceivable traces of its age and past usage. In Benjamin's view, this history is an integral part of the object and inseparable from its other qualities.

Unlike physical objects, digital ones don't have an aura in Benjamin's sense—their set of properties is finite, and perfectly identical copies are the default. They do not acquire marks and traces that account for their history.

Digital files can move through a population at a velocity not possible for physical documents, but this process remains largely invisible, since digital files bear no trace of where they have been before, how many people have passed them on.

As pointed out in the previous section, transformation can convey meaningful information, even when it is just the result of an imperfect copy. From Benjamin's perspective, physical objects contain a wealth of information that is missing in digital documents.

History and Social Context of Documents

When I borrow a book from a library, I take a look at the slip on the last page showing the stamps of previous borrowers, at least until they have been replaced by electronic registration. It is interesting to find, for example, that a particular book suddenly received a lot of interest in the past five years while it has been borrowed only once in the 30 years before.

The traces of a document's history are often crucial for understanding its content. They provide an additional source of information that is not directly connected to the document's primary content. They help estimating the age of a document, its authenticity, or the appreciation it received from people who previously handled it, as well as many other properties. In that sense, they are important for estimating the credibility of the document or creating a certain expectation. A letter of recommendation will not have the same effect if it is printed on cheap or stained paper.

Beyond the physical context, the wider social context around a document is also important. The history of a document reflects its social relevance. Documents are a powerful means of building communities. This is another phenomenon that is not directly connected to its actual content. *"People with shared interests use communications technologies (both hi- and low-tech) to help form themselves into self-created and self-organizing groups. To a significant degree, these are held together by documents circulating among members, each keeping each conscious of being a member and aware what others are up to."* [9]

New types of communication media create new communities that in return shape the format of the medium. TV brought us not only a live medium for moving images, it also created the community of TV consumers, a community that has not existed before and whose preferences and dislikes in return shaped the state of contemporary television.

Wikipedia and similar platforms did not only bring us accessible and fresh information, it also created a new community of authors, including the stereotypical image of the wikipedia editor, whose personality profile (enthusiastic, but also stubborn, picky about details) already has taken place in the collective imagination.

The Internet provides a rich social context for digital documents. It has also fostered dedicated social platforms for all kinds of media types that facilitate their sharing, rating and remixing. Flickr [10] is a good example for that: a platform for presenting and sharing photos within a rich social context—users comment on each others photos, organize them in thematic clusters and write testimonials for each other. Yet this does not affect the media files - once they are separated from their context within the platform, context is lost. The media file and its context are not fused together as it is the case in a physical medium.

Although the web has become a rich social environment, for digital documents the following is still true:

> *"Digital systems are generally opaque to social information. Most of our knowledge about people, most of our attunement to their interactions, most of our facility for improvising in a changing situation goes unused. In the digital world we are socially blind."[11]*

Social Context and Value Systems

Igor Kopytoff observed in "*the social life of things*" the tight connection between the economic value of an object and its social context.

Whether an object has value as a commodity or just an object is defined through a cultural process:

"commodities must be not only produced materially as things, but also culturally marked as being a certain kind of thing."[12]

In order to explain how this process works, Kopytoff compared the social history of an object to the biography of a person.

During its life cycle, an object passes through different phases of use and value in which its meaning is constantly being redefined. Biographies of things can show that whenever a community adopts a new object or idea, it undergoes a transformation of meaning, a fact that is often neglected in diffusion studies of innovation.

> *"The biography of a car in Africa would reveal a wealth of cultural data: the way it was acquired, how and from whom the*

money was assembled to pay for it, the relationship of the seller and the buyer, the uses to which the car is regularly put, the identity of is most frequent passengers and of those who borrow it, the frequency of borrowing, the garages to which it is taken and the owner's relation to the mechanics, the movement of the car from hand to hand over the years, and in the end, when the car collapses, the final dispositions of its remains. All these details would reveal an entirely different biography from that of a middle-class American, Navajo, or French peasant car." [12]

Diffusion models

When examining the ways in which information changes as it moves through a community, it is important to understand the mechanics of this movement. It makes a difference if something is distributed over mass media or emerges from a network of blogs. How information evolves depends on many factors, such as the number of people the information passes through, the nature of their interactions and preferences.

Diffusion studies examine how information spreads among populations in geographic space. It is a branch of research spanning different disciplines, such as social science, human geography, epidemiology and communication studies.

The field was pioneered by the Swedish Geographer Thorsten Hägerstrand who extensively researched phenomena of cultural diffusion and migration [13].

Human Geography distinguishes two main types of spatial diffusion, hierarchical and contagious diffusion. In the case of hierarchical diffusion, the information moves according to a spatial or social hierarchy. For example, innovations like radio stations expanded from one big city to another, bypassing rural territory in between.

In the basic model of hierarchical diffusion by Berry, The probability of an entity spreading is a function of population and rank of the place in the urban hierarchy [13], p230.

Contagious diffusion, on the other hand, depends on contact systems. Information travels from person to person based on their proximity, like a contagious disease. If dissemination through mass media works like hierarchical diffusion, contagious diffusion would be analogous to face-to-face conversation.

Most diffusion processes are mixed, combining elements of hierarchical and contagious diffusion at different stages. With the example of innovation diffusion, spatial diffusion often occurs in two steps. Innovations start in urban centers and move down through the urban hierarchy. After this process is completed, they start spreading out from the urban centers to their surrounding areas in a more contagious manner.

All diffusion models share the assumption that the disseminated entities – be it information, innovations or new practices – remain unchanged during the process.

However, there are many real-world examples of cultural diffusion where this is obviously not the case. For instance, the propagation of fashion involves many stages during which the latest trend is appropriated and reinterpreted. In the following sections we will present two models for describing the mechanics of content transformation within a community.

Memetics - Evolutionary Fitness of Ideas

From our everyday experience with mass media we know that not every idea spreads equally well, some have high *stickiness* [14] and remain in the collective memory while others are quickly forgotten.

Richard Dawkins compared this quality of ideas to the notion of evolutionary fitness, speculating that cultural evolution might follow the same rules as its biological counterpart.

"*cultural transmission is analogous to genetic transmission in that, although conservative, it can give rise to a form of evolution.*"p189 [15]

Just as organisms replicate and evolve, cultural information is also replicated as it leaps from brain to brain by means of imitations. Dawkins introduced the term *meme* for "a unit of cultural transmission" as a direct reference to *gene*. In order to constitute as a meme, its information has to be sufficiently distinctive and memorable to be abstracted from its surrounding. Just like genes, memes are subject to constant mutation: *memetic drift*. They change as they are communicated and replicated by each participant. *Memes* are also subjected to evolutionary selection; they have a certain fitness. Ideas that are rejected are not propagated and disappear over time, become "extinct".

Folklore – the Concept of Resonance

However, the notion of memetics has its limits when it comes to the description of cultural phenomena that involve a lot of interaction within a community, it offers no model for describing the shared experience within a group. The propagation of a *meme* from person to person is described as a hierarchical process with a clear distinction between sender and receiver.

There is also little understanding of what a "memetic fitness function" could be, in contrast to the notion of evolutionary fitness, which is self-evident. Survival or extinction is binary, but there is no reason to believe why this should apply for information as well.

Folklore theory offers an alternative model that is more centered on communities. Folklore is defined as "a self-organizing social system that helps groups of people reveal, experience, and extend their

commonalities and connections via the circulation of adaptive, resonant texts"[16]

Folklore focuses on social groups and explains the formation of ideas in some aspects better than memetics. Instead of the binary fitness function of memetics it uses the concept of resonance to describe the evolution of ideas in a community.

Borovoy defined resonance as the "experience of a shared understanding that results when a group of people realizes that they all identify with the presuppositions of a particular text".

In other words, a quality of a shared, synchronous experience is a requirement for the emergence of folklore, a quality that is also one of the main characteristics of oral cultures.

Secondary Orality – Practices of Collaborative, Improvisational Authorship

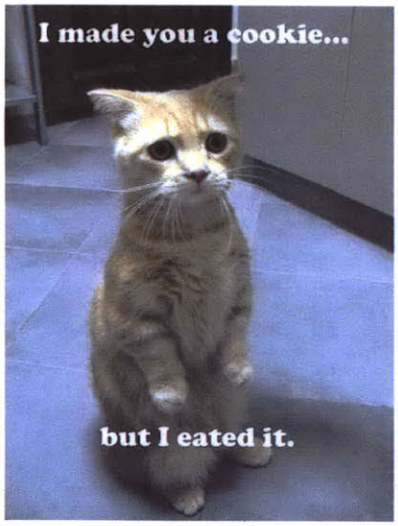
Our culture is literate; information and knowledge are passed on through written text rather than oral tradition. Nevertheless, communication technology and electronic media facilitate a kind of shared experience that reminds us of pre-literate oral cultures. In McLuhan's words, "*The nonspecialist electric technology retribalizes*"[5].

In "*Orality and Literacy*", W. Ong defined these phenomena as secondary orality, in contrast to the primary orality of pre-literate cultures. Secondary orality is entirely a product of modern telecommunication, the replacement of asynchronous written communication with instantaneous technologies, including text based technologies like SMS or Text Messaging or Instant Messaging.

Oral cultures have to structure their knowledge in a certain way. The tradition of *oral literature* depends on the shared experience of a speaker and a listener. In order to be able to memorize and pass on knowledge without too much loss of information it has to be structured based on formulaic thinking or orally patterned thought.

The language of oral literature is shaped by the economy of oral composition methods: verse metrics and a rich repertoire of memorized phrases form a system of building blocks that can be combined in many different ways. With orally patterned thought, perfect memorization is not necessary; the oral storyteller combines the pieces into a continuity that is never repeated in the same way. Medieval vernacular manuscripts of oral literature show a high variation across different versions, a phenomenon that Paul Zumthor described as *mouvance*[17].

Improvisation is an inherent element; modifications are done collaboratively through a process of gradual and evolutionary improvement. This stands in contrast to literate cultures where reading and writing is usually a solitary process.



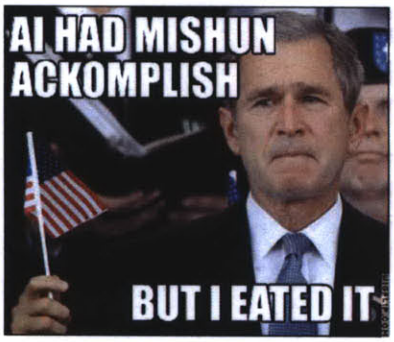


Figure 1 LOLcat examples and cartoon from xkcd.org (from top)

Internet Memes and Secondary Orality

Internet phenomena, or "*memes*", serve as a fitting example of secondary orality: a picture, video, document, a joke or simply a phrase that gains enormous popularity on the web. People who find it interesting pass it on to their friends, setting off a chain reaction that merits global fame often within a few days.

During its diffusion, countless variations and parodies are produced and distributed over the same channels. A new genre emerges, until the community get finally tired of it.

In the case of *LOLcats* [18] this process can currently be observed in a living and thriving form. What started as a collection of pictures of cats with captions in Internet slang quickly evolved into a self-referential system with its own distinct language and style. Like in many other Internet subcultures, LOLcats created a form of deliberately deviant, idiosyncratic language with its own vocabulary and grammar.

What we said about the characteristics of oral literature can be observed here as well, including a rich repertoire of normative phrases. Cultural references to other popular topics shared within the community are frequent and often necessary to understand the message.

With thousands of pictures circulating on the net, some similarities can be observed that constitute the genre. In order to qualify as a proper LOLcat picture, it has to make use of the characteristic dialect, phrases and references.

One of the most interesting thing about memes is to observe how they mutate and branch into different sub-genres, such as LOLrus, featuring a walrus instead of a cat. The LOLcat meme has reached a stage where its original central element, the cat photo has become optional, as long as a reference to the genre is present.

A recent example is LOLcode, a working programming language using LOLcats idioms and grammar. The funny cat pictures have disappeared completely, but their language has emancipated itself: the commands and syntax reads like a canonical manifestation of the LOLcat vocabulary. The HAI WORLD program in LOLcode reads:

```
HAI
CAN HAS STDIO?
VISIBLE "HAI WORLD!"
KTHXBYE
```

Collaborative Artworks and Copyright

The concept of copyright is in many ways orthogonal to transformational copying – it tries to preserve the authors voice by making it immutable.

The concept of ownership seems unambiguous and common sense as long as applied to a unique physical object.

Industrial mass production complicated this matter by separating the physical and immaterial parts (or the *informational good*) of an object. One might own the physical object, but someone else might own the idea that is expressed through it, limiting the rights of the physical object's owner. Still, the physical medium and the information are tightly coupled: in today's copyright regime, an idea can only be protected by copyright as soon as it is fixed into a tangible expression, a physical medium. A conceptual idea, which does not manifest itself in an "original" physical form, is therefore not protected. For example, Duchamp's readymades like the fountain or the bottle dryer are conceptual works not covered by copyright protection [19].

For collaborative artworks [20], today's legislation uses the term "*joint authorship*". The key criterion is whether the individual author's contributions are not clearly distinguishable from each other, in which case a joint authorship is present. If this is not the case, it is a collection or anthology of individual authors. All rights of an individual author also apply to joint authors, who are legally defined the same way

However, the form of collaboration that is possible under current copyright law is fairly limited. An open collaboration of an unspecified number of authors who do not know each other, and who contribute to the work at different times would require a different legal model.
The creative commons license handles exactly that case: It provides legal tools that make it possible to share, remix, and reuse content in an open collaborative setting while allowing the authors to maintain certain rights of their own choice.

There are many examples where a creative work that originated from an open collective of authors resulted in commercial success, as in the case of the group operating under the persona *Luther Blissett* [20]. The identity is a multi-user name or an „open reputation" shared by hundreds of artists and activists. Everyone who wants can use the name can do so without restrictions. A bestselling novel by the open collective, „Q" has so far been translated into thirteen languages. The novel was released under a copyleft license using a share alike policy similar to the creative commons license: „The partial or total reproduction of this book, in electronic form or otherwise, is consented to for non-commercial purposes, provided that the original copyright notice and this notice are included and the publisher and source are clearly acknowledged. [21]

3 Related Work

This chapter suppliments the theoretical topics discussed in the previous chapter with examples of relevant prior work.

- Projects that deal with the history and social context of documents
- Projects that analyze or facilitate viral diffusion phenomena
- Strategies that capture fitness of information – value, popularity, or reputation
- Projects that deal with the transformation of documents, either in collaborative environments, or through generative / evolutionary processes

Social Translucence and Computational Wear

How is it possible to record the social context of a document without compromising the privacy of contributors?

The IBM researchers Thomas Erickson and Wendy Kellogg proposed *social translucence* as a design principle for systems that deal with social history [11].

Unlike transparency, translucency allows light, but mutes details as it passes through a material. A closed translucent glass door still allows us to estimate whether a room is used or not, and modulate our behavior without disclosing information about the actions and identities of the people inside.

The goal is to enable social awareness by giving significant cues while respecting an individual's privacy. Erickson and Kellogg identify *visibility, awareness* and *accountability* as three interconnected fundamental principles of socially translucent systems. Visibility relates to the preference of a direct representation over a description of what happens, which in turn leads to awareness, which tells the user what information is recorded and how it is communicated. As a consequence, this facilitates accountability („I know that you know").

An early application illustrating this principle is the system presented by Hill et al. in their "*Edit-wear and read-wear*" paper [22] which proposed a representation of object centered interaction histories

within word processors. In their example system, the scrollbars of a modified EMACS editor displayed histograms representing the extent to which different sections of the document have been viewed or edited.

By using the metaphor of "computational wear", the project establishes a direct link to a familiar property of the physical world – every usage of an object leaves wear that tells us something about its history. The analogy of wear seems appropriate – it is a slow and gradual process, whose results become clear after some extended usage. As a byproduct, wear happens automatically and unavoidable.

Building on the foundation of Hill's paper, "Footprints" by Alan Wexelblat and Pattie Maes [23] presents a conceptual framework for applications that work with interaction history. They describe the application space by identifying a number of characteristic properties that are important for interaction history systems. They differentiate between *active* (editing) and *passive* (consummation) interaction, *personal* (the actions of a single person) versus *social* (accumulated interaction) information and between *proxemic* (familiar) and *distemic* (opaque) interaction spaces. Their prototypical system adapts the concept of computational wear to the context of the Internet. A representation of a local website displays different popularity measures that are recorded by the system and stored in a database. Using the metaphor of "*footprints in the snow*" the application collects information about the user's navigational behavior on a website and offer different metrics for its organization and analysis.

Fuzzmail [24] by Hayes Raffle introduces a humorous take on the representation of interaction history. It is a web based email system that records the process of typing in real-time, as the users compose and send emails. Instead of the final version of the text, the recipient sees an animation replicating the act of writing, revealing all writeovers and edits that happened during the composition of the email. It is easy to imagine how intrusive and revealing this extra information can be. Writing turns into a performance that unveils the author's process of thinking.

Metadata. Practices and Ethical Issues

Generally speaking, the history and context of a document falls into the category of metadata, or data about data.

File-system store only the most basic interaction history, such as the date of the creation of the file, the date of its last modification and access, the name of its owner and the files access permission settings.

Additional metadata is usually stored inside the individual documents. For example, mp3 sound files commonly use ID3 tags [25]: a small chunk of data appended at the end of the sound file. The tag includes information such as title, artist, genre or duration. Similar metadata formats exist for digital images; EXIF

(Exchangeable Image File Format) [26] metadata contains information useful for the interoperability of photographic documents across different imaging systems and platforms. Their attributes include color profiles, camera make and model, resolution and focal length and copyright.

Metadata in Microsoft word documents include a wide variety of information such as revision history, previous authors and storage locations of the document.

The "Track Changes" functionality in Microsoft Word controls tracking and storing of documents revision histories as metadata. The functionality is designed to enable collaborative writing and highlights the contributions, changes and deletions of all involved authors. These changes are displayed as color-coded revision marks that have to be approved individually.

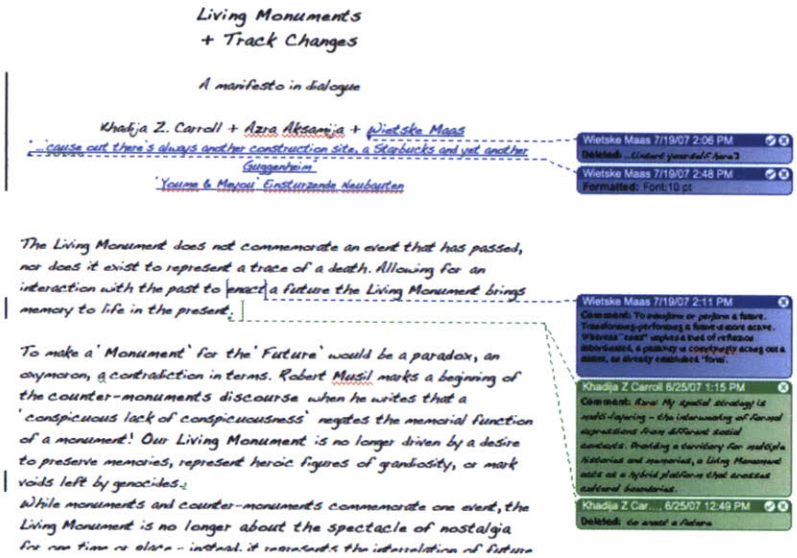


Figure 2 *Living Monuments + Track Changes* is a "collaborative manifesto" utilizing the track changes feature of MS word. Art project by Khadija Z. Carroll and Azra Aksamija, https://www.people.fas.harvard.edu/~kzcarrol/

All systems that store document history are potentially problematic from an ethical point of view, especially if it is not obvious to users that metadata is being recorded. Through data forensics it is possible to extract personal information that was not intended for disclosure by authors. The track changes feature has resulted in many cases of involuntary and unintended disclosure of private information, from in a press release of Alcatel's customer service to an Iraq dossier released by the British government.

Especially important in legal cases the question of how to handle metadata is highly relevant, leading the New York Bar Association Committee on Professional Ethics issue an opinion on the matter, proscribing the voluntary access to confidential metadata in legal documents[27].

Viral Diffusion

The diffusion of information in social networks is a well-studied field. At the same time, diffusion processes are not easy to generalize since the way information spreads depends on the milieu by which it moves. In the following section I will review existing research of diffusion phenomena in online environments and physical space.

In the context of this thesis, Cameron Marlowe's work on media contagion in online environments is especially important. Marlowe studied the social structure of the world of blogs by examining how readers and authors are connected. In the classical distinction between the hierarchical diffusion through the influence of mass media and the contagious diffusion through interpersonal communication, blogs are somewhere in the middle sharing characteristics of both. In blogs, the boundary between reader and writer is often blurred. He found that the social network of weblog authors and readers to be not as well connected as one would expect it to be. Instead, the blogosphere is a fragmented space of many separated "islands" sparsely connected through "bridges". Although not the main focus of his thesis, Marlowe's work offers many insights in the structure of online environments, its different subcultures, each culture characterized by their own interests and preferences.

Rick Bovoroy's work on what he called "*folk computing*" was most influential for this thesis. He examined the improvisational collaborative authorship of content within a community (folklore), analyzed and mediated by computational means. Bovoroy studied how folklore (which he defines as everything that is circulated orally within a community, such as jokes, games and rumors) is passed on, modified and extended within a community.

On a physical level, Bovoroy et al. developed a number of different devices for editing, displaying and tracking shared information. An early instantiation was the *meme tag*, a textual display to be worn like a nametag that can show a short phrase of textual information, such as a quote or a greeting. Wearers initially pick a "motto" from a pool of existing phrases, and when two persons wearing meme-tags meet at close range, the devices let their owners choose if they wanted to copy the other person's phrase (overwriting the own one) or keep their existing motto. The system facilitated the observation of diffusion processes over time: one could see which memes were more successful then others in different communities (i.e. "*sponsors*" vs. "*medialabbers*"). Since the content is a simple line of text, improvisation and modification were easy to accomplish using dedicated kiosk stations.

The I-Balls formed the next iteration of this set-up with more complicated content – small animations composed of pre-made elements. It was powered by small commercial LCD game devices running custom software.

One guiding principle was to minimize the personal and social cost of participation. Still, the act of sharing information had to be deliberate and explicit by having to physically connect their displays to make an exchange.

This illustrates a delicate balance – by making it too easy to participate in the process, people don't feel connected to the content they are displaying, lowering participation. Making it too hard, on the other hand, has the same effect.

Determining the Fitness of a Contribution

While the above projects focus more on the community as a whole than the individuals, the following section deals more closely with the individual, in how her preferences and decisions influence the evolution of shared content.

One of the central design problems in community platforms is to develop a mechanism that allows the individual to assess and express the value, or *"memetic fitness"*, of shared content. How does approval or rejection work, and how can the users decisions facilitate improvement of the same content?

In the world of social web applications often labeled as Web2.0, a catalog of common practices can be made out. For sites with a high volume of user-contributed content, it becomes crucial to separate the "signal from the noise" and relay the right content to the right communities.

A large part is dedicated to the organization of contributed content, its classification and contextualization, often by the process of tagging and social filtering. Contributions associated with meaningful tags have an increased visibility, because of its higher interconnectivity within the total volume of content, and also because of its higher visibility to a specialized user community.

Another common element includes rating/voting systems, either used for determining the popularity of content or the reputation of a user. These are often called *"karma systems"*. Highly rated content is generally associated with better placement and visibility. For example in the highly popular disscussion pages of collaborative news platform *"reddit"*, users comments are sorted by approval rating. As most users only read the first one or two pages, quickly gaining high ratings from the other users is crucial for the visibility of a particular comment. *"Reddit"* also keeps track of each users accumulated karma points as an overall measure of reputation and credibility.

"Flipbook!" is worth mentioning because it is a close relative and influence of the infinite animation prototype later described. It is a social web-application by Juan Ospina of FABRICA, allowing users to draw frame-by-frame animations and publish them. The platform offers a basic rating system in form of an "I like it" button.

Collaborative work or remixing existing animations, however, is not supported [28].

Scott Goulders thesis project "*webbed footnotes*" uses a similar approach. It is a system for shared annotation of arbitrary websites using a web browser extension. In Goulders system, each annotation has to pass a social threshold. Annotations have to be approved by another user to prevent deletion.

Instead of explicit approval, other approaches attempt to glean approval implicitly by observing the consumption behavior of the users. *RadioActive* by Aaron Zinman is a persistent audio-based asynchronous chat system for mobile phones. It keeps track of how much time each user invests listening to a contribution, which is then presented as visual elements. The underlying rationale is that if most users only listen not more than to the first five seconds of a recording that is much longer, it can be safely asserted that the contribution is not worthy of attention.

In a similar fashion, consummation behavior can be tracked for other types of content, often represented in form of a *heatmap*, especially if the data has a geographic component [29].

Applications observing the user work like mirrors, showing the individual user how her behavior relates to the behavior of all users. This can lead to the phenomenon of "the rich getting richer", by implying that the hottest areas are also the most interesting ones.

Figure 3 Danyel Fisher's *Hotmap* shows the most popular areas in Microsoft's online mapping service. The bright star in the Atlantic is the 0,0 lon/lat position.

For visual content, the analysis of a user's consummation is less straightforward when compared to a time-based medium such as audio. Gaze tracking is one approach often employed by marketing experts.

Transformation through the System, Guided by Participants

In the following section I will discuss prior work where the user's choices are directly linked to an actual transformation of the content.

A direct approach is to start with the users behavior as a source of automatic transformation. Examples can be found mainly among interactive artworks. Joachim Sauter's installation "*Zerseher*" ("de-

seer") uses the observer's gaze as a transformative force, affecting the appearance of a picture. After determining the user's point of attention through eye tracking, a projected portrait is distorted [30].

"World Skin", a virtual reality installation for CAVE immersive environment by the French artist Maurice Benayoun, equips the users with photo cameras and places them into a landscape composed from documentary photographs of the Balkan wars. As the virtual tourists take pictures, their content is removed from the world, leaving a white surface where the camera was pointed [31].

A second approach involves the application of automatic transformation in order to generate a variety of options from which the users can choose. The user's decisions are the fitness function in a simulated evolutionary process. A fitting example is *Evolving Logo* [32], a corporate identity design based on the game of life for a cellular biology research institute. Each instance of the logo is unique as a result of a semi-autonomous generative process, but users can direct the process by rating and selecting interesting configurations.

The project is especially intriguing because it challenges the concept of the corporate logo as the undisputed constant in a company's visual communication - the one "sacred" element that can never be touched.

Christine Liu's *Urban Hermes* links transformation to notions of value and extends the concept of fashion to the realm of abstract information. The project's setup is very similar to the meme-tag project, but with an interesting twist. Liu designed a messenger bag equipped with an embedded display for displaying arbitrary images. Just like in the meme tag project, the system allows two persons wearing such bags to trade their content when they meet in public space. However in this case, the quality of the traded images degrades with each exchange through blurring. After a certain number of exchanges the image expires, limiting its spread. This has two relevant consequences. First, it introduces a notion of rareness that could make images more valuable by limiting the number of their "siblings". Second, because of its limited ability to copy, an image can help identify the social group it originated from. Wearing a "fresh" image signifies that the wearer has personally interacted with the "source" or author of the image.

Transformation through the Participants in a Collaborative Environment

Remixing is a central topic in social software, however very few platforms actively support the authoring process. Most sites offer some form of contextualization, that allows users to create links between contributions and label remixes, for example youTube's "video answers".

A few platforms address the topic of remixing in a more explicit way. The web portal for the Scratch project [33], a programming

language for children developed by the lifelong kindergarten group, is a social place allowing children to exhibit their work with scratch and share the source code with the public. The developers of scratch actively encourage remixing as a means of learning from the work of others and sharing results. After many children complained about plagiarism - other users reusing the code of their projects - the group developed a mechanism that could detect derivative work and label it as a remix while attributing the original author. Remarkably, this simple attribution of original authors resolved the problem for most users [34].

Perhaps the most consequent example of remixing is *jumpcut.com* [35], an online video portal for user-generated contributions. *Jumpcut* not only actively use the notion of remixing, it provides a full web-based non-linear video editor for editing and remixing of other people's videos. In the terminology of *jumpcut*, the videos uploaded by the users are "clips", while "videos" refers to compositions consisting of a set of clips, a music track and effects/transitions. A user can grab clips uploaded by other users or re-edit their video composition. The system keeps track of the remix history - original authors are automatically credited on all subsequent remixes. *Jumpcut* assumes a certain generosity of its contributors, however, video owners can also lock their clips in order to prevent remixing of their content.

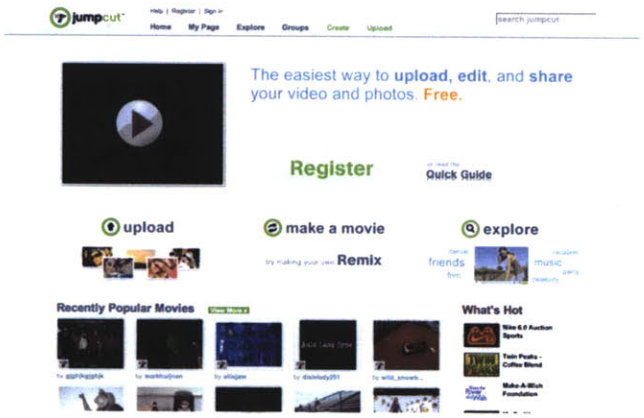


Figure 4 The Flash based video editor of Jumpcut.com allows remixing of other user's videoclips.

Peer to Peer Social Networking

It is sometimes problematic to store personal information and media on a central server of a company, especially given the variety of social software that exists.

As a response to these privacy concerns it might make sense to store social context information offered by social networking platform in the files that are exchanged. In theory, peer-to-peer social networking sounds like a promising approach.

Peer-to-peer offers the advantage of decentralized storage of social context and shareable media files: the media stays on the users

computer, where it is secure and only accessible for the personal network - no central infrastructure is needed.

Stored locally, the user has full control over his data and the levels of access and privacy. Access to personal data and shared files may be granted and denied on a per connection basis and on different levels. Current social networking platforms offer less control for adjusting such properties.

No global network graph would exist, only personal egocentric networks. Every participant sees what is important for him/her – the social network.

A few attempts have been made to implement peer-to-peer social networking, with different levels of success.

A company called *Imeem* started its social network service initially as a pure peer-to-peer service, advertised as "*A supercharged instant messaging service that lets you share personal media & stay connected with friends*". The only way to participate was through custom downloadable p2p client software. However, after only a year of operation, *Imeem* switched to a traditional central server model and presents itself today as a social networking platform to "discover new music, videos and photos". Similarly, other peer-to-peer social networking services such as *tribler.com* or *krawler[x]* stopped their activities.

4 The Aesthetics of Collaborative Transformation

There are many ways in which content can evolve through collaborative and improvisational authorship. The following section will briefly discuss different strategies and approaches to collective authorship by providing examples from artistic and cultural practice, thus allowing for a better understanding of the nature of content transformation.

The conversion of consumers into producers, a longstanding utopian thought, now seems to materialize itself in the contemporary culture of the user-generated web. Within the creative collectives in the web, a new form of "amateurism" manifests itself through many forms of creative products. This amateurism has already a tremendous influence on popular culture. On the one hand, current trends and innovations are more likely to emerge from various web cultures, rather than from professional production environments. On the other hand, there is an enduring criticism of amateur production regarding its imitation, repetition, and creative banality.

Figure 5 "chocolate rain" and one of its remixes

Consider, for example, a popular amateur video like a remix of "*chocolate rain*" found on the youTube platform [36]. If judged by its production values, the video might be criticized on similar terms. Yet, on a bigger picture, the most important contribution of the current culture of social software is possibly the shift of attention from the individual piece to the creative ecosystem from which that piece evolves: a video that seems derivative appears more meaningful if understood as an element of an improvisational dialog among many authors.

In creative collectives, commons based production implies the continuous modification and reinterpretation of a shared idea.

This brings us back to the phenomenon of secondary orality, already described in the second chapter. Arguably the best example for secondary orality in the 20th century is jazz and its influence on culture in general. Jazz sets emphasis on performance, or the "voice", as opposed to the score. Its main principle is improvisation through a dialogic process between musicians. After all, jazz is not about reading music, and many of its influential protagonists were not able to do so. As Hartman noted in his book "Jazz Text", "*improvisation is to orality as composition is to literacy*" [37]

Communication as Art

Improvisation and Collaborative Production depends on the abandonment of the classic-romantic concept of the author. Early in the 20th century, the Dadaists and Futurists shifted their attention to the act of communication as a form of artistic practice, and experimented with the postal letter as a medium. The genre of *Mail Art* emerged as part of the *Fluxus* movement during the 1960'. *Fluxus* embraced the idea of collective and democratic creativity: in Mail Art, everyone who participated in the correspondence could contribute to an artwork evolving with the process.

In the late 1970's, many artists influenced by fluxus got interested in communication technologies, and started experimenting with a wide variety of DIY transmission technologies such as timesharing networks, Fax or Slow Scan Television. Eric Gidney wrote in 1984 in Heidi Grundman's book "*Art Telecommunication*":

"Slow Scan TV, like mail art, is a sharing activity. It cannot be passively viewed like TV or Video or a painting or a performance, it demands a reply, a dialogue between producers." [38]

The global communication project "*la Plissure du texte*" initiated by the British artist Roy Ascott, was an exploration of networked authoring processes, its title is referring to Roland Barthes "*plaisir du texte*" (the joy of the text). The project took place in 1983 as a *"collaborative story telling project using a computer timesharing network of artists located in Europe, North America and Australia"*. The project was set up as a "planetary fairytale" between fourteen nodes in cities around the world. Each node had an archetypical character assigned, such as the "magician" (Paris) or the "princess" (Vancouver). All generated text was collected online, where it could be accessed and further developed by the different participants. The result was "*an interesting narrative which was very non-linear, was developed through the telematic media. At this point, I decided to commit all my work to it.*" (Roy Ascott) [39].

Figure 6 Hank Bull, Vancouver in Roy Ascott's *"la Plissure du Texte"*, 1982

There are many examples of similar projects and experiments, employing different strategies to mediate individual contributions and construct meaning for the common outcome.

in the following sections I will take a closer look at various aesthetic devices a collective of authors can utilize.

Reinterpretation

It sometimes takes very little in order to radically change the way a message is understood. There is always ambiguity; every message can be understood in many different ways. A small hint can be sufficient to suggest a different interpretation, subverting the intentions of the original author. Often the content does not even

have to change at all - a change of the context in which the message is presented can lead to a different interpretation.

Marcel Duchamp's Readymades are a fitting example to illustrate this strategy - taking an existing object, applying small changes and putting it into a new context. Duchamp about his fictional artist R. Mutt under whose name he produced the "Fountain": *„He took an article of life, placed it so that its useful significance disappeared under the new title and point of view - created a new thought for that object."* [40]

Figure 7 *„L.H.O.O.Q."* Readymade by M. Duchamp

The bubble project [41] by the art director Ji Lee is a collaborative annotation project aimed at outdoor ads. Frustrated with his job in a New York advertising agency, Lee set out to attach stickers in the shape of comic book speech bubbles on the surfaces of outdoor ads in public space – bus stops, telephone booths or subway platforms. These empty speech bubbles turned out to have great disruptive power. By inviting pedestrians to take a pen and fill the bubbles with what the person might have to say, they caused people to stop and see the otherwise often invisible elements in public space with different eyes. Lee's aim was *"to create a simple device that would instantly transform the way people see ads, giving them the power to respond"*. Without any addition of initial content, the speech bubbles gave access to latent meanings of the ad, and sometimes transform it completely.

Another popular example is the weekly competition for captioning cartoons, held by the *New Yorker* magazine [42]. The remarkable thing is the transformation the initially obscure and incomprehensible cartoons undergo when a reader comes up with a particularly witty caption for them. After that, we see the cartoon with different eyes – the newly assigned meaning seems irrevocably inscribed, like a powerful optical illusion.

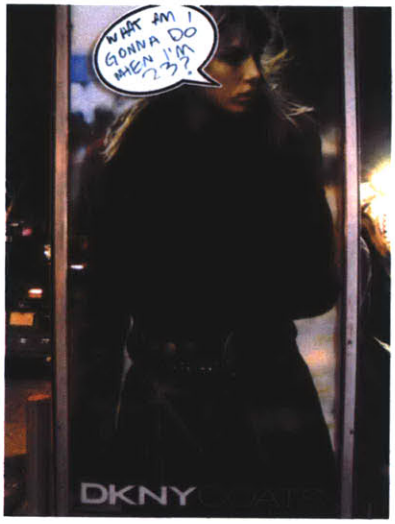


Figure 8 The Bubble Project by Ji Lee

Translation

Almost everyone who spent idle time on the internet has probably tried the following experiment: taking a paragraph of text and generating an automatic translation using one of many available online services, and repeating the process with the result and different languages until translating it back into a original language. Ordinary texts turn into elusive automatic poetry.

Translation means the migration of content from one medium to another. A photograph could be seen as a translation of a three dimensional scene onto a two-dimensional surface.

Playful translation is part of many games. The *"fax machine game"*, for example is a popular party game closely related to *exquisite corpse* games.

In the fax machine game, a player starts with writing down a sentence on a piece of paper and passes it on to the next player, who

has the task of translating the sentence into a drawing. The next player has to convert the drawing into a sentence again, and so on. The paper is folded after each step, so that just the last contribution is visible.

Translation can be interesting when the source and destination media are seemingly incompatible. The Swiss deconstructivist architect Bernhard Tschumi took an attempt to translate cinematographic techniques into architecture. In his *Manhattan transcripts* Tschumi developed a notation system that linked architectural elements of space, movement and event to the cinematic concepts of frame, montage and sequence [43].

Permutation

"All writing is in fact cut-ups. A collage of words read heard overheard." W. Burroughs

Permutation means a change in the organization of the elements that constitute a whole, just as a text is composed of paragraphs, or on a deeper level, words and letters.

Permutation in connection with randomness has a long history as a device for automatic composition. In music, generally known as *Ars Combinatoria*, aleatoric composition such as the musical dice game date back to the 18th century. Permutation has also a prominent place in the compositional rules of serial music and dodecaphony.

An example from literature is the *Cut-up technique*, introduced by Brion Gysin and made popular by William S. Burroughs[44] was directly inspired by montage techniques in painting and film [45]. It is a mechanical method of random juxtaposition, involving literally cutting up the paper containing the printed text and then arranging the pieces, resulting in random, sometimes interesting non sequitur seams. While a cut along the lines of the text is less disruptive, a vertical cut through the text body changes every sentence. Later Burroughs and Gysin used applied the same method with audiotapes and film.

Permutation is also a collaborative technique. Within a framework of existing elements, participants can rearrange, change a composition or recombine its parts. Brainstorming techniques often involve jotting down ideas on sticky notes and afterwards rearranging and -organizing them collaboratively into meaningful clusters. See also the sections Recombination and Modulation.

Accumulation

Accumulation means the transformation through appending – each individual contributing new elements to a growing corpus.

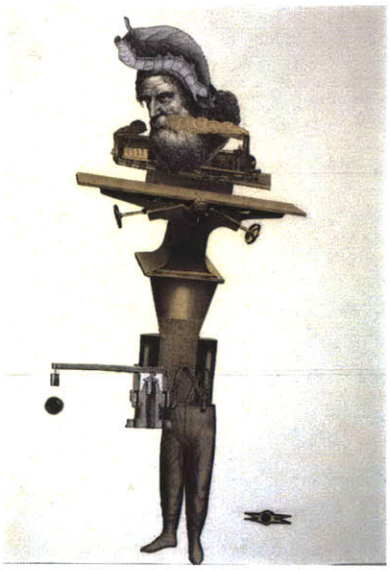


Figure 11 *Graphical Exquisite Corpse* by Max Ernst

Figure 9 "*Versions of Under the Bridge*", Oliver Laric.

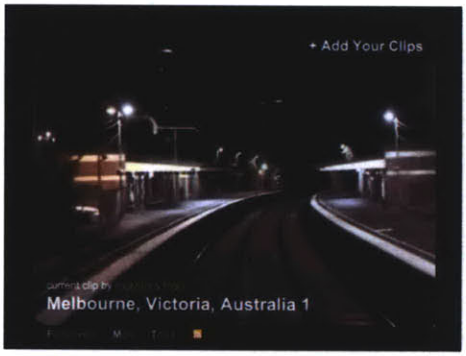


Figure 10 James Tindall, "*Passing Through*"

While this is the most common case of collaborative transformation, it includes many different, sometimes orthogonal strategies. The character of the result depends on different questions:

- What is the shared element – a common topic (like in a wikipedia article) or a common syntax?
- Is the process guided or not – does the result grow without boundaries and direction or is there a fitness function?
- Is it a random juxtaposition or are there dependencies among the elements?

A widespread additive technique is known as *exquisite corpse*: It was a creative device of the Surrealists, a method for pooling mental resources, and creating chance associations. The method could be characterized as "*the deliberate staging of incongruous encounters*". The original name *cadavre exquis* allegedly originates from a sentence formed by words picked randomly from a dictionary: "*Le cadavre exquis boira le vin nouveau*" [46]

Every game used strict syntactical rules, text-based *corpses* used a formula that allowed the assembly of "*collage texts*", replacing the conscious creative input by an automatism. In one example the formula was a dialogue of questions and answers, where the contributor of the answer would not know what the question was. In another version a sentence was collaboratively assembled by passing around a sheet of paper, with the paper folded in a way so that only the last words of the previous contribution were visible.

In graphical *corpses* the human body was used as a framework, with each participant contributing its body segments without seeing the whole. The final result was a collage of an anthropomorphic figure whose body parts were made from arbitrary elements, for example photographs of household equipment cut out of newspaper ads.

The aesthetics of the method lies in the tension "*between normative syntax and a semantic derive, between rule and transgression*". The effect is the strongest when the pieces do not fit together, but follow the same rules.

In a collaborative setting, the individual contributions are often strictly separate and do not necessarily reference or influence each other. James Tindall's video project "*passing by*" is a good example: the web project presents "*a never-ending video journey assembled from brief travel glimpses from around the world*" [47]. The individual video sequences are automatically collected from the youTube website. The only criterion for a video to be included in the project is a tag specifying the direction of the view, for example "*passingby-looking-left*".

In this setting, meaning does not have to be negotiated, it emerges in the view of the observer through the common syntax framing the otherwise unconnected elements.

Modulation

Modulation means alteration through a change in proportions. It does not involve drastic changes, rather small adjustments that shift the emphasis. Modulation in connection with repetition is the main principle of improvisational, oral composition.

They manage the problem of persistence - a film can be stopped and the frozen frame observed in detail, but with sound this is not possible. Oral literature has to rely on repetition, and is constantly modulated, never identical. Oral literature is an open system in homeostasis, a dynamic equilibrium. New elements are introduced, other elements removed. What is considered important is reinforced and updated. Preservation is managed through constant transformation.

The aesthetics of modulation can be illustrated through Gertrude Stein's poem *"If I told him – a completed Portrait of Picasso"*. The effect is depending on performance, it unfold its power through the voice of the reader, as illustrated through her own readings [48].

Modulation can either e used to aimlessly explore the space of possibilities or converge towards an endpoint, such as in a process of degradation.

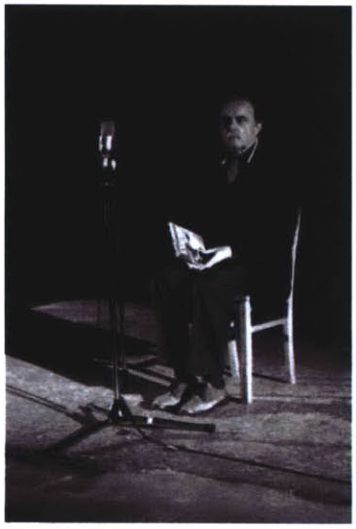


Figure 12 Alvin Lucier performing *"I am sitting in a room"*

In Alvin Lucier's classic sound-art piece "*I am sitting in a room*" the composer recorded himself reading a text, after that playing the recording back into the room and re-recording it. Lucier repeated the process multiple times, until the resonant frequencies of the room were the only perceivable sound remaining, making the features of speech unintelligible.

The visual equivalent of this effect is video feedback, especially popular in early video art, as in the work of Skip Sweeney [49]. A contemporary example of an audiovisual artwork using a closed circuit system "*Tempest*" by Erich Berger - employs the principles of the "*Van Eck Phreaking*" technique, used for eavesdropping on the contents of a CRT display by analyzing its electromagnetic emissions.

The effect relies on the rhythmic or musical quality of repetition together with the continuous transformation that goes along with it.

Recombination

Today's popular culture knows many words for this type of transformation: remixing, sampling, cross-over, mash-up or, less friendly, creative stealing.

Around the end of 2003, Los Angeles based DJ "Danger Mouse" combined parts of the Beatles' "White Album" and Jay-Z's "Black Album" into what he called the "Grey Album", which was

distributed entirely over file-sharing networks and downloaded over 1.3 million times.

This strategy is perhaps the most dominant phenomenon on current social software platforms. The pervasiveness of the phenomenon can be illustrated through a simple search on youTube for "under the bridge (cover)". The search term delivers over seven hundred cover-versions of the Red Hot Chili Pepper's song performed by amateur musicians. A recent experimental film by Oliver Laric shows them all playing simultaneously, synchronized through the score of the original song in a multifaceted universe.

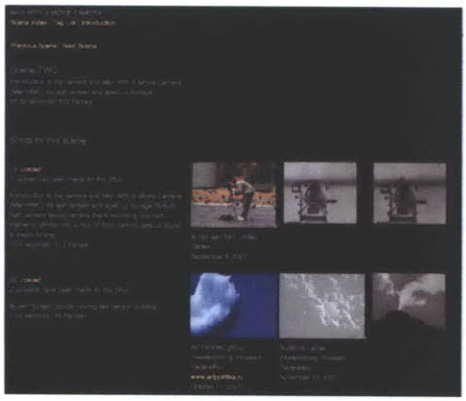


Figure 13 "*Man with a Movie Camera*", Perry Bard

For the idiosyncratic amateur music video "Chocolate Rain" youTube lists more than 1000 "video responses", including parodies, spoofs and re-enactments that often involve exchanging the video track while keeping the original audio [36]. Among many others, both Big-Foot and Darth Vader have been seen performing the song.

A recent art project, "*Man With a Movie Camera*" by Perry Bard [50] refers to the classic constructivist movie of the same title by Dziga Vertov. The project could be seen as a collaborative remix of the original using the model of youTube's video responses.

It uses the actual scenes of Vertov's film as a reference framework and invites the audience to annotate / juxtapose the original shots with their own video sequences.

5 My Experiments

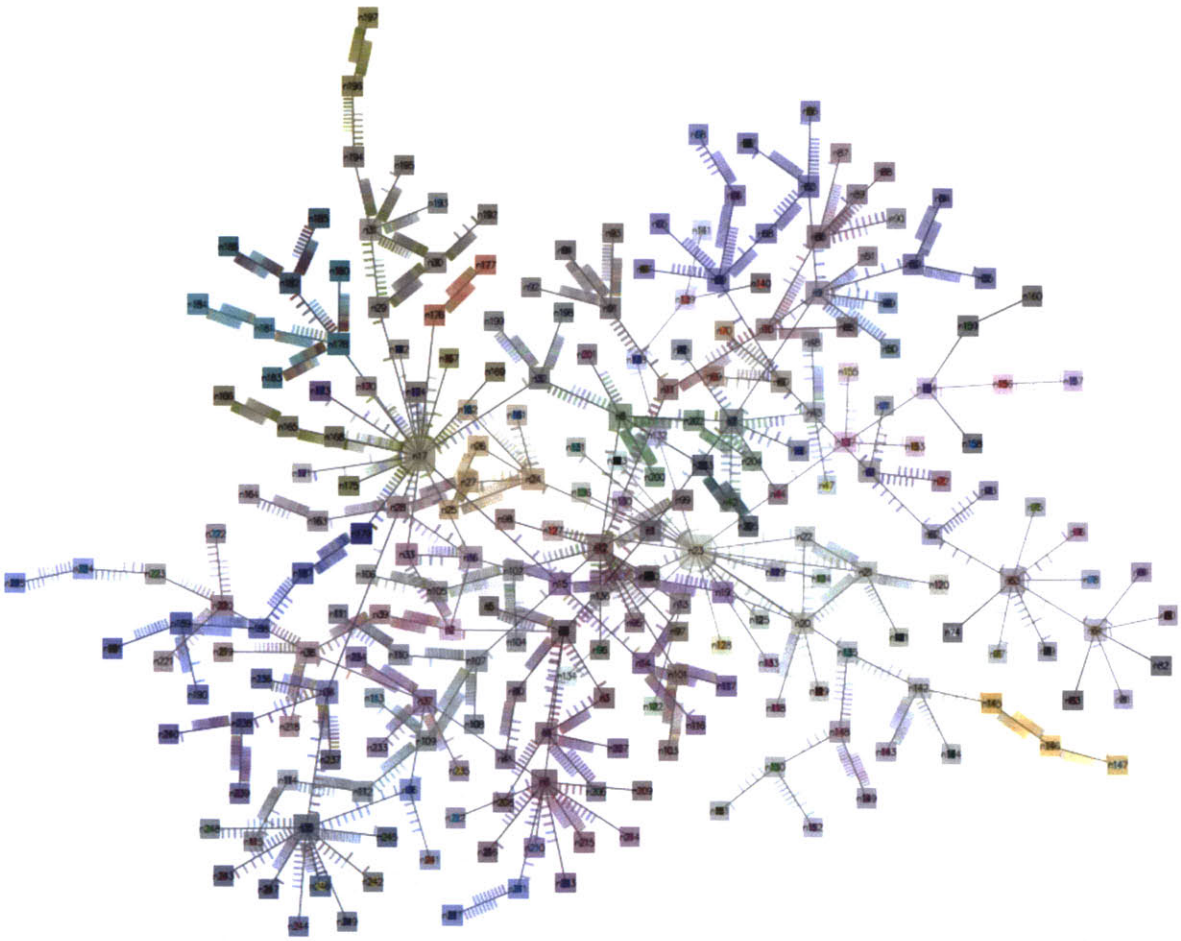


Figure 14 Screenshot of the simulation

Diffusion Simulation

The main objective of this thesis is to investigate how information, media and ideas change as they move through a social network.

My first step was not an experiment, but an articulation of a diffusion model though a simulation. This model allows for an observation of a diffusion process within a network of nodes containing transformative power. It also illustrates the effects of different changes to the model's initial conditions – as messages are passed around within the network, they become simultaneously transformed. The content of the message in this model is simply a color value. Every node involved in the process has its own preferences and the

power to transform the messages exchanged according to that preference.

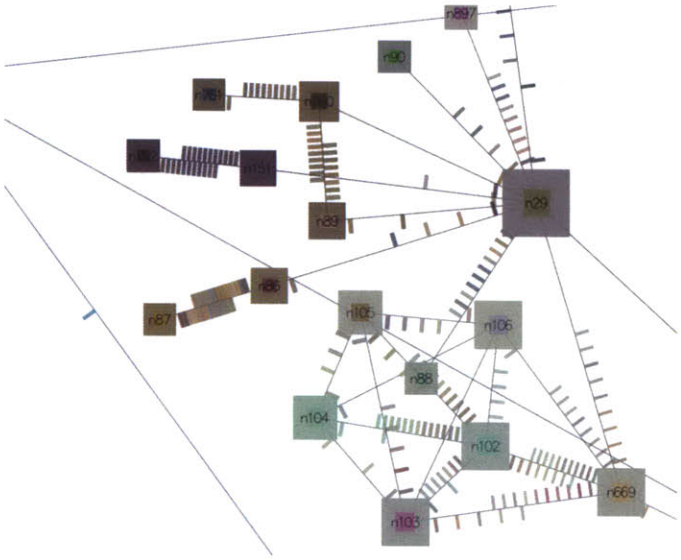


Figure 15 Preference Color is in the center of the node, the transactions as colored marks along the edge, the current node color around the center.

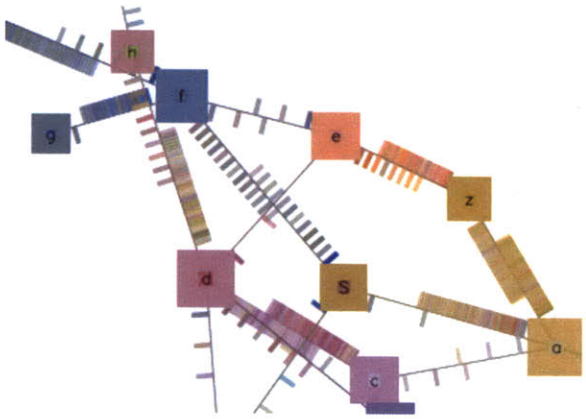


Figure 16 Colored marks along the edges show the transaction history of the connected nodes.

The process starts with a single node distributing a color to its connected nodes, which, in return, pass it on to their neighboring nodes. In addition, every node has the ability to generate new links to existing nodes or to new nodes in the network. As a result, the network also expands as it transmits information,

During the process of propagation, each node can modify the received color to a certain extent, yet controlled through its individual properties: every node in the network has a preference for a specific color, assigned randomly at the process start. When a node

receives a color value, it modifies it to a certain degree according to this preference.

Yet, the preference changes over time as well - a received color value modifies the preference of the node towards that received color. If the received color is very different from the node's own preference, the latter might also be rejected. This is controlled by an adjustable threshold value.

The visualization renders the network as a force directed graph, whereby each node displays its most recently received color, as well as its color preference. Depending on direction, each color transmission is marked as a colored stripe on each side of the edge. The stripes are lined up chronologically, showing the transaction history between two nodes for both directions along its shared edge. Based on chronology, the display can be filtered in order to allow for an observation of the network evolution.

The simulation described above aims to address several questions:

- What are the relevant parameters in a diffusion process of transformable media?
- How do different rules for propagation influence the sturcture of the resulting network?
- How important are the color preferences compared to the network topology?
- Under which conditions do color values in the network converge, and an "agreement" among the nodes can be reached?

The behavior of the simulation is controlled by a number of parameters. The first set of parameters controls the message propagation in an existing network:

- **Contagiousness**: the probability that a received message is actually forwarded to its neighbors in the network.
- **Multiplicity**: when a node receives a message, how many copies of it can the node distribute?
- **Single visit vs. multiple visits**: May a node accept a message if it has received a previous instance of it before?

A second set of parameters controls the evolution of the network itself:

- **Rewiring** – the ability of a node to add a new edge to an existing node within the network.
- **Adding nodes** – can a node establish a link to a new node previously not in the network?

A last set of parameters controls the transformation that occurs during the transmission.

- **Mutability**: the extent to which a node's preference can modify the transmitted color.
- **Adaptability** of the preference: the extent to which the received color value affects the preference value.
- **Threshold for acceptance**: a value that determines whether an incoming color value is accepted and forwarded based on the color difference between message and preference color.

Observations

The model has been tested in two different ways. At first, I used the model to generate networks and compare the results of different model conditions. In a second step, I used the external network data as a milieu for dissemination.

1. Network types of generated by the model

The following examples represent a network typology that describes the spectrum of phenomena generated by the simulated diffusion process. A number of distinct network shapes emerge by varying the model conditions:

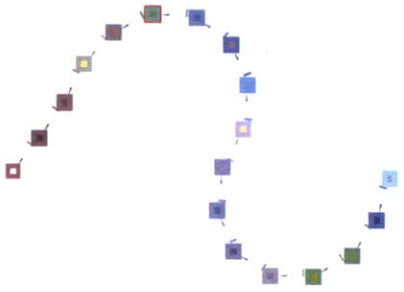


Figure 17 **Chain**: every message can be forwarded, but not copied. Every node can receive a message only once. Chains of different length are generated based on the contagiousness.

Figure 18 **Chain with loops**: if the constraint of one-time visits is dropped, the chain will contain loops.

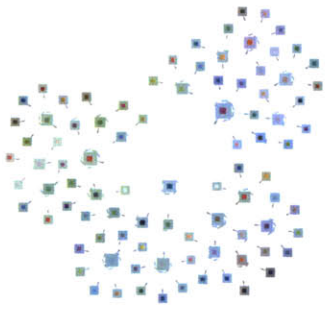


Figure 19 **Tree:** a message can be copied, but not sent to previous recipients.

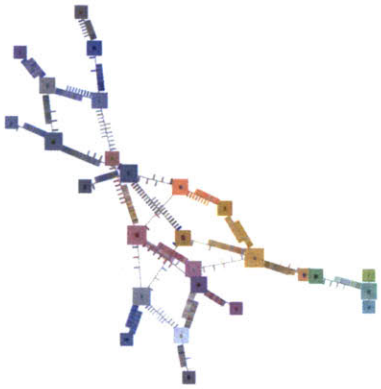


Figure 20 **Network**: same as tree, except that previous recipients are allowed to receive messages.

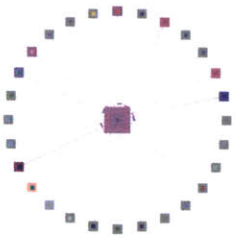


Figure 21 **Star**: a high number of messages with very small contagiousness.

2. Diffusion in External Network Data

The second step entailed the testing of the simulation on different types of existing network topologies. The experiments involved both real world network and generated datasets.

Sparse networks (sparse random graphs and real world data such as HIV networks) replicate the random distribution of color preferences and converge very slowly.

Dense networks, such as near-complete graphs or dense small-world networks quickly converge to a single color shared by all nodes in the network.

These results are different if the graph of a social network is used. For example, I used two exemplary datasets: the first, a generated model of a social networks using the *social circles* model [51]; the second, a standard dataset for testing tools of social network analysis (a dataset of the co-citation network of academic authors from the infoviz community). The simulation shows that if convergence occurs, it does not cover the whole network equally, and different clusters of stable color emerge. Generally, these color clusters are coincident with the cliques (highly connected or complete sub-graphs) within the networks. More interestingly, nodes that connect different cliques (nodes with high betweenness centrality) are able to maintain a distinct color preference much longer than other nodes inside the clique. The latter quickly adjust the preference, and are able to maintain a higher level of individuality compared to their neighbors.

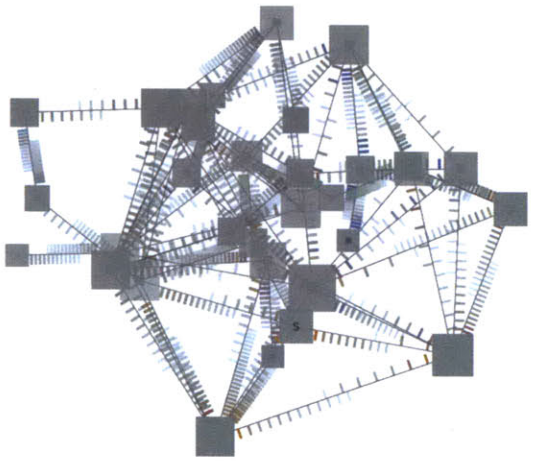


Figure 22 Convergence of color in a generated small world network.

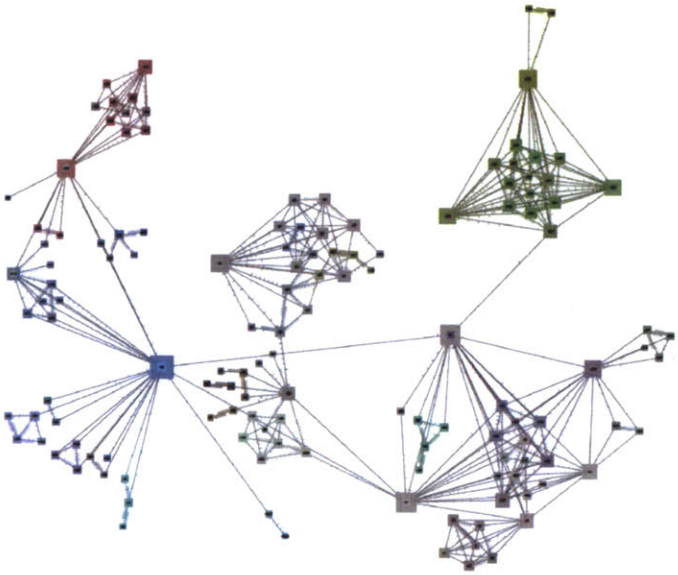


Figure 23 Running the simulation with real social network data from the infoviz 2003 competition dataset. The distinct cliques become apparent.

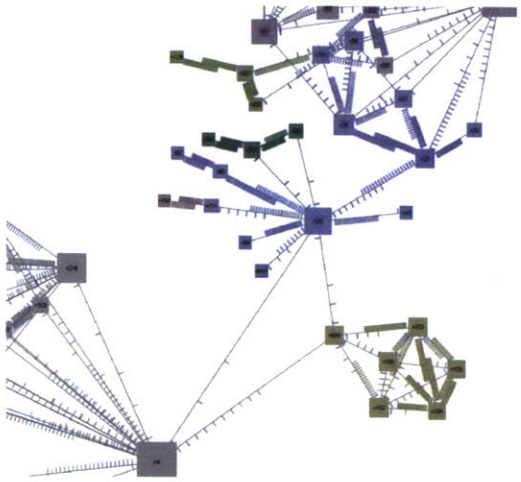


Figure 24 Closeup of the social network's clusters of stable color.

Conclusion

The general observation that can be learned from this model is that the shape of the network is more important than the individual color preference. The structure of the social environment determines the outcome of interaction to a higher degree, than the variety of individual preferences. By deploying very few parameters a big variety of diffusion patterns could be created, the liminal shapes of which have been described above. The results based on the implementation of mutation (conditioned by preference) and a feedback mechanism that modifies the preference (conditioned by the actual transactions) render many features that resemble real-life situations. Just as in the real-world social networks, the nodes of high

betweenness centrality play a special role. They are exposed to the influence of multiple cliques and mediate their communication. Highly connected networks quickly converge to common values and preferences, while the data of the *small world networks* of real social network tends to develop distinct islands of common values. These 'islands' are different from the rest of the network, and they largely coincide with the cliques in the network, as identified, for example, by common cluster algorithms [52].

On an abstract level, the model illustrates a scenario of interest within the scope of this thesis. Starting with a single message, and then gradually changing its content while traveling through a network, we may end up with the whole network sharing the same color, or with a landscape of different colored islands in different parts of the network. The convergence of a color value in a cluster can be seen as an analogue to a message resonating with the preferences of a particular community.

In this model, the structure of the network has the highest influence on the character of the transformation. An individual node's choices and preferences are less important, than the structure of the community it is embedded in.

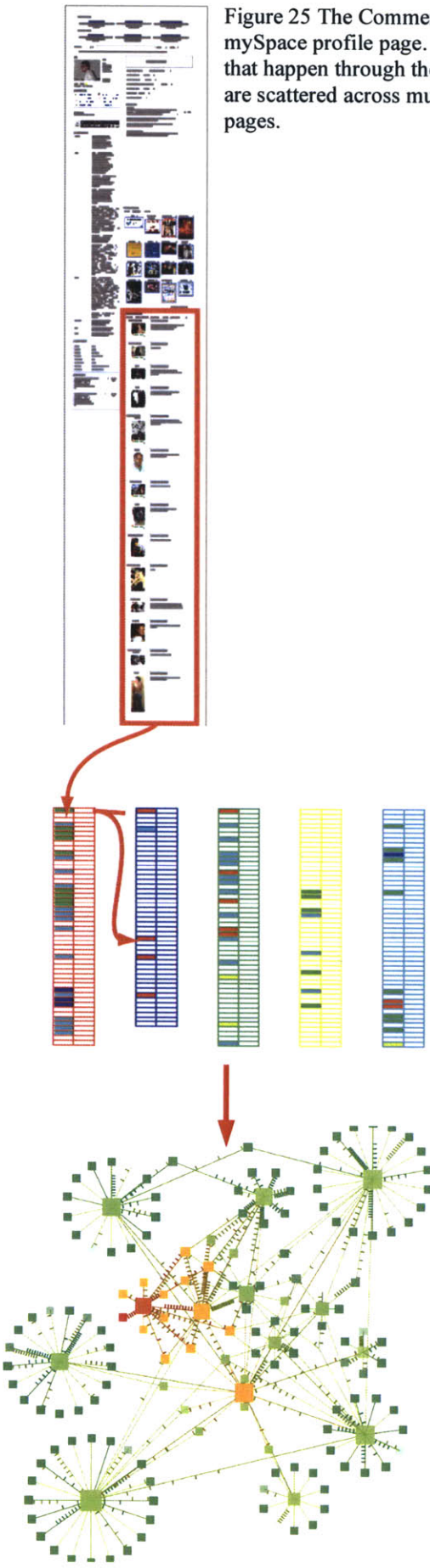


Figure 25 The Comment Space on a mySpace profile page. Conversations that happen through the comment box are scattered across multiple profile pages.

Comment Flow

An interesting aspect of social networking sites is the variety of imaginative ways in which people construct a shared collaborative experience. Exchanging comments on profile pages, as an example, often goes beyond a simple statement of presence and evolves into improvisational and multi-faceted narratives and conversations that involve many participants. The sites were not designed a tools for collaborative improvisation, but still they are used for that purpose in many different ways. Observing the way in which comments are exchanged and information travels through the network tells us more about the social environment than the structure of the network itself.

Comment Flow is a network browser that investigates how social networking sites are used as environments for collaborative creation. Contemporary Social Networking platforms offer a number of ways for their users to interact with each other. The services usually allow the exchange of private messages, but most of the interaction takes place in the public: sharing media, poking, exchange of small gifts or public messages on each other's profiles. However, the most popular way to communicate with a friend is to post a comment on the friends profile page, where it can be read by all friends or everyone in the network [53].

People use these comments to create faceted narratives that involve multiple participants. The story is not obvious since it is spread out across different profile pages. It is an asynchronous process and the temporal sequence is not always easy to figure out. Because of the nature of a guest book, the roles of the sender and receiver seem to be swapped: every comment appears on the recipients profile page, it is much closer to the recipient than the sender. All these peculiarities that prevent a linear reading of the thread are not a disadvantage – instead they are used in a playful way on the edge between public and private communication. In general, users know that their comments are visible to the public, but when embedded into the profile page within a mass of other comments, the conversations are obfuscated. It is like having a conversation in a crowded restaurant, surrounded by chatter.

An additional element in this play is the ambiguity of the role and identity of profile owners. A profile may represent an individual person, but not necessarily. Fake profiles of celebrities and historical personalities are common; a friend connection to a fake profile is a

way to specify personal tastes and preferences in an implicit way and as such meaningful information.

The comment flow application is a result of this curiosity, and an attempt to map the communication space of these narratives. As raw material, data from public profiles on the mySpace network has been used. Starting from one profile page, the application iteratively crawls the pages that posted comments on the initial page. Repeating this process three times results in a collection of typically over 1000 nodes, enough for covering a comment network of a community of friends.

Looking at the comment sections, three parameters seem especially meaningful:

- The temporality of the network - the age of the messages, the frequency of communication. Is a profile constantly updated?
- One vs. two-way communication - is it a conversation or is it one way broadcasting? Could this provide clues whether people really know each other?
- Quantity of information - is it a one time greeting of a newly added friend or actually a conversation?

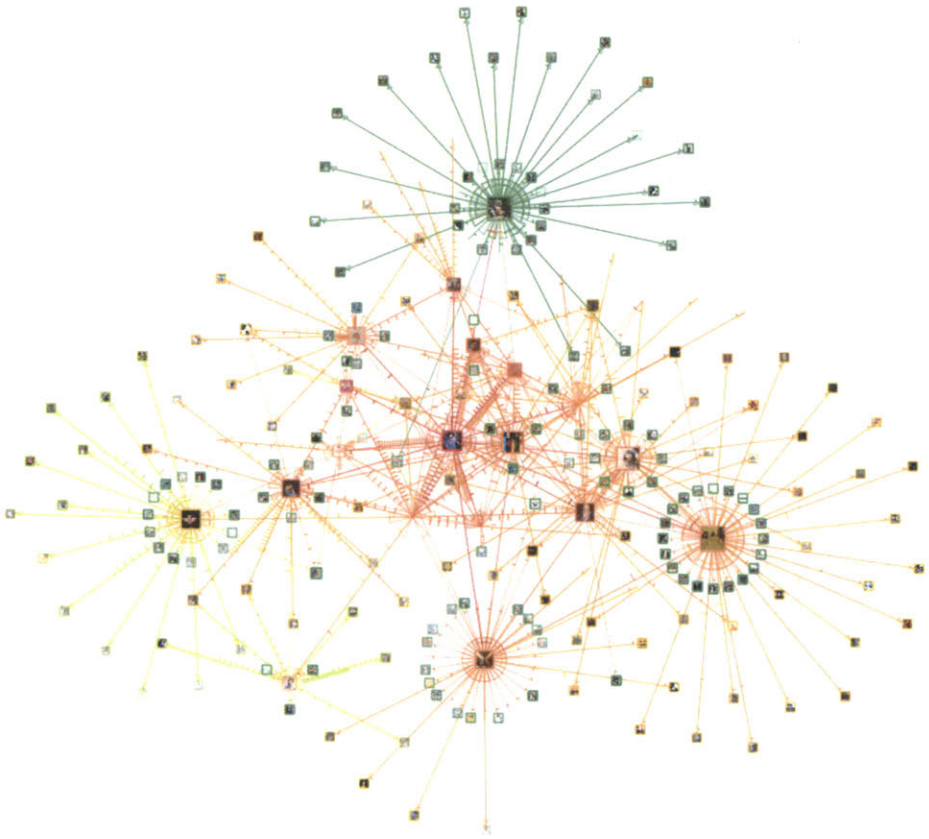


Figure 26 A typical 3-hop comment network extracted from mySpace by the Comment Flow application.

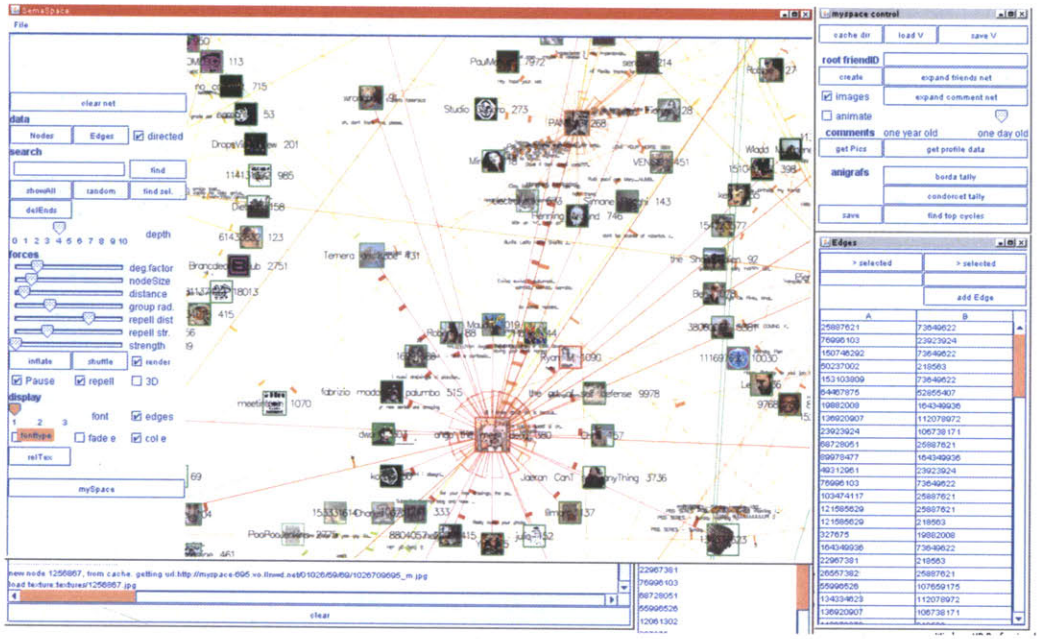


Figure 27 The Comment Flow Software environment

Technical Specifications

The Comment Flow software was specially designed for the interactive manipulation of very large networks. The software was written in java, utilizing the JOGL library for OpenGL accelerated graphics. It uses a force directed layout algorithm, a simplified and computationally less expensive version of the Fruchterman / Rheingold spring-embedder [54]. It uses a clustering approach that discriminates directed and undirected edges, in our case corresponding to the directionality of exchange.

Figure 28 each mark along the edge shows a comment exchange, the transparency of a node corresponds to the age of the last message exchanged.

The network can be explored both in 2d and 3d space. Zoom, pan and orbit (in 3d) are the main methods of navigation; the view can be automatically centered on a node selected from a list or from the visible area. Large network structures can be partially rebuilt. To support visual identification of profiles, the profile pictures are extracted and displayed on the node. Comments are displayed as visual elements with text labels and distributed along the connecting edge. To suggest the direction of the exchanged, they are placed on the same side of edge as the asymmetrical arrowhead. In order to resolve any confusion about the flow direction, the comments can be animated along the edge. The neighborhood of the selected node is highlighted through a color gradient based on the topological distance, facilitating the visual identification of personal networks. The transparency of a node indicates the age of the last activity, helping to identify the most active parts of the network.

Observations

The resulting map shows remarkable differences in the communicative behavior of individual profile pages. Some profiles constantly post comments on other profiles, while others receive a huge number of comments but tend to not reply to a single one. Still other profiles are in-between: they actively exchange information

with some profiles, while not interacting with others who post comments on their profile page.

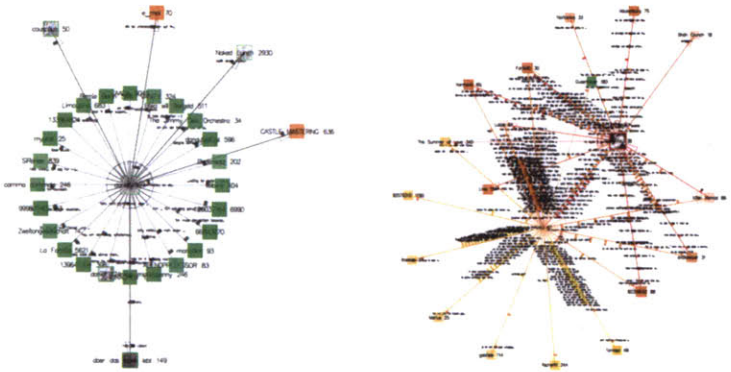


Figure 29 Profiles with one-way communication are arranged in a circle around the receiving node, those with bidirectional exchange remain unconstrained.

The way in which these profile pages communicate is often related to their type. Profiles that are obviously disguised commercials send out a large number of comments on a regular basis without getting replies. Famous artists on the other hand usually tend to aggregate a lot of incoming comments from their fans but often don't have the time to respond to each of them. By looking at the patterns generated by the examples, it is often possible to guess the role of individual profiles.

Social networking platforms are generally seen as "people aggregators" - tools for self-representation including one's social connections [55], but rarely as environments for collective creativity. Comment flow uses the exchange of comments on these sites as an example. It connects the scattered pieces of information and combines them into a meaningful map. In many ways, this map contains more information about a person's social environment compared to the structure one's friend network. It turns out that the directionality of messages is very important for the understanding of the social landscape. Comment Flow shows characteristic patterns that can give hints about the nature of the profile that would not be visible otherwise.

Comparing Comment Flow and the Diffusion Model

The model described in the previous section does not capture a characteristic property, the ratio of incoming vs. outgoing communication. Its propagation is based on a generic probability value - differences in directionality are influenced only by the structure of the network.

In the observed real-world network of mySpace comments, some nodes attract attention, while others primarily broadcast out. The example of mySpace comment network illustrates that this is obviously a property of nodes, and not of the network.

It is interesting to speculate what the analogy in a collaborative network of authors would be – it is easy to imagine that there are participants considered authorities that have more incoming requests than actual contributions.

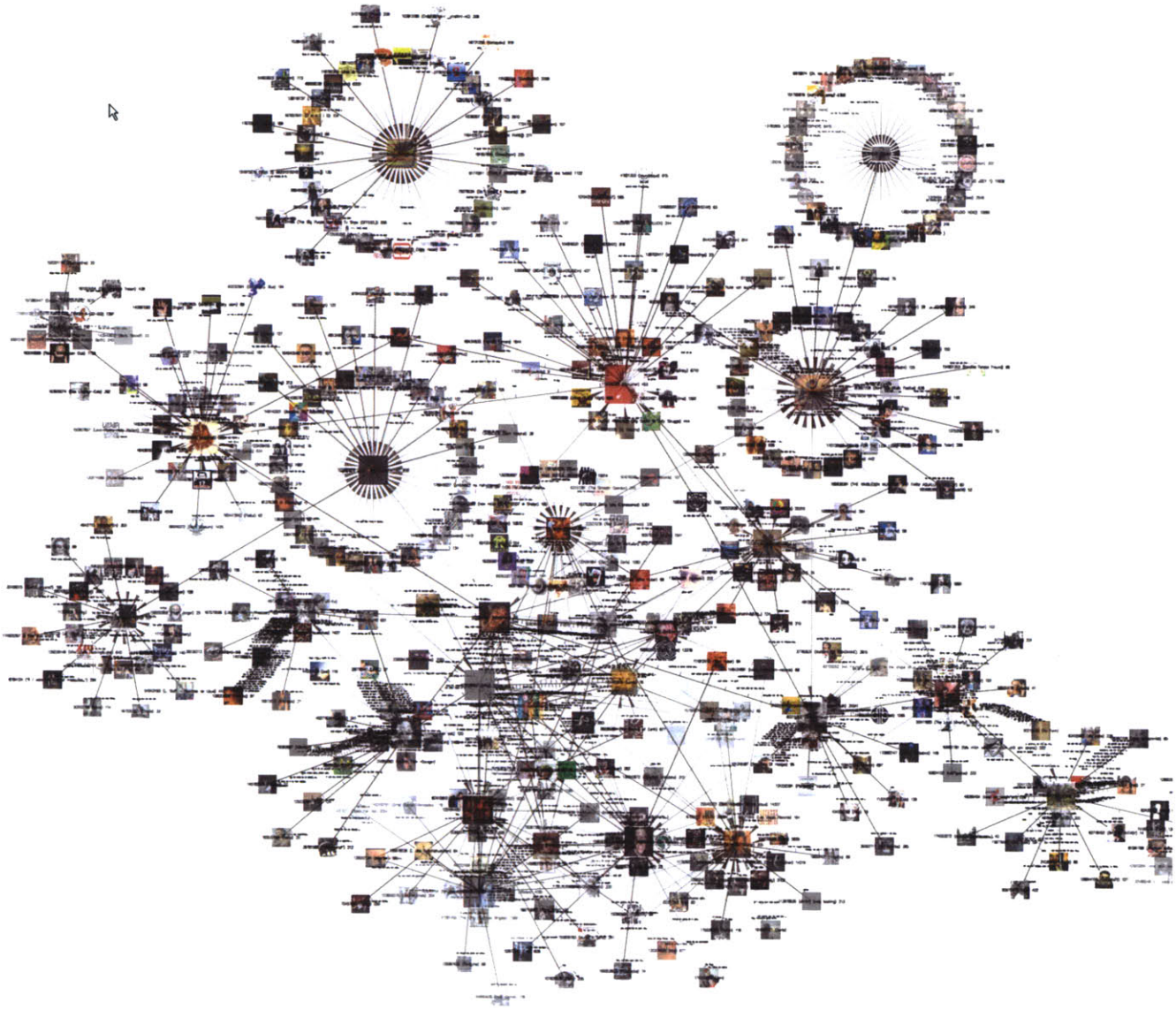


Figure 30 A three-hop network of interconnected comments on mySpace profile pages

Infinite Animation

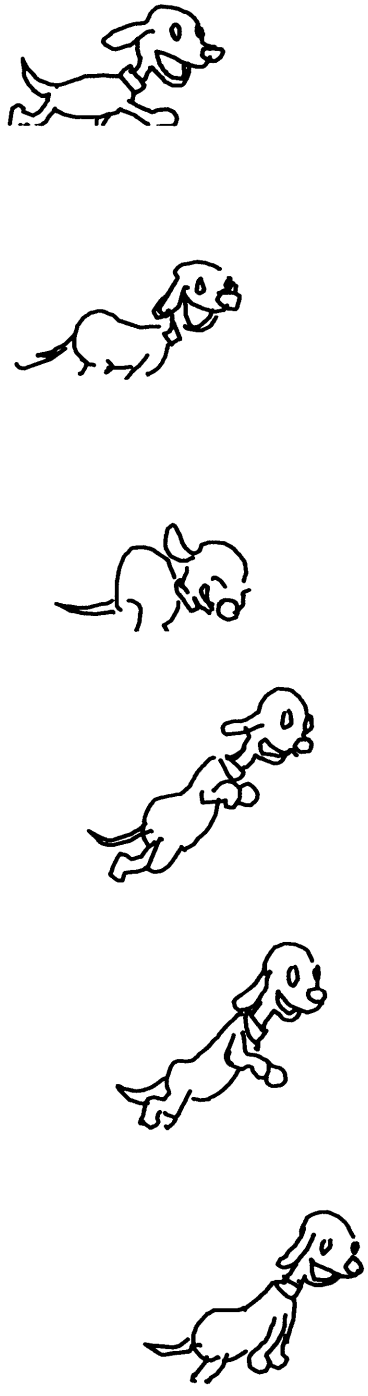


Figure 31 Stills from an *infinite animation* scene by Niall Eccles

After developing a model for a diffusion process involving transformative copying and the observation of improvisational dialog on a social networking platform, the third step is the design of a system that deals with transformative copying of actual media content in a social network.

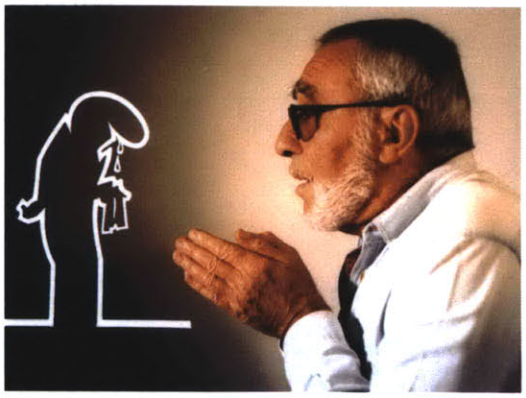
As a medium I have chosen hand-drawn flipbook animation – the resulting application, entitled *Infinite animation*, is a system for creating animations in the shared space of a social networking platform *facebook* [56]. Users who have an account on the platform can install the application and make it accessible through their "profile page", which is a self-descriptive page and the central element of most social networking sites. With the application they can draw animation sequences and pass them to their friends for appending or revision.

Animation was in some ways a problematic choice for this experiment because it is laborious to make and therefore poses a high barrier for participation. On the other hand it is a truly collaborative medium that profoundly benefits from joint effort. Historically, the introduction of new visual languages in animation has always been tightly linked with shifts in the corresponding models of collaboration. Traditional large scale animation production is usually characterized by a strict division of labor, which can be illustrated by the "*pose to pose*" animation principle [57]: senior animators would define *key poses* and specify the timing, followed by assistants who filled in the gaps and create transitions. The transition from traditional animation to software-based production challenged the roles of authorship and the way in which labor was divided among the team [58]. The maturing of social networking platforms as a mass media and the variety of shared activities taking place on these platforms suggested that a similar shift could happen if these networks were more extensively used for collaborative creativity.

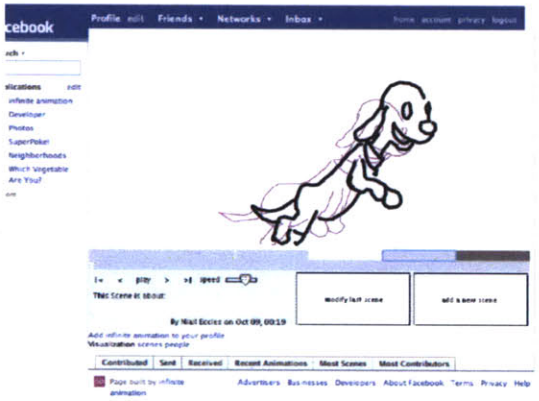
Infinite animation encourages a simple visual style, and its palette of available tools and techniques is limited for the sake of simplicity. Animations are made up from involves strokes of variable size over a solid colored background, similar to the style of Osvaldo Cavandoli (Fig. 21). In addition to animated lines, the tool allows placement of text as well as bitmap images that can be placed in the background.

Process

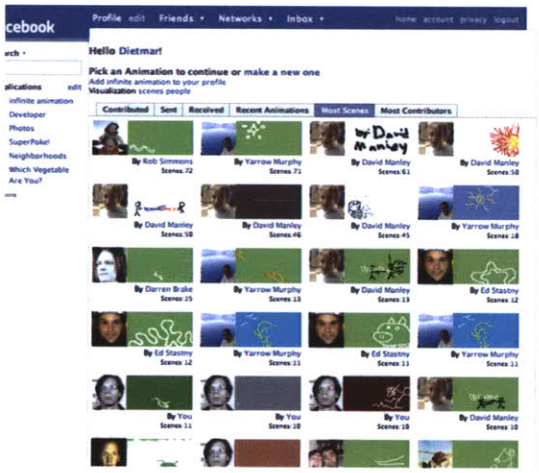
The procedure how participants engage with the system is structured by a simple set of rules, which can be summed up in the following scenario: a facebook user receives an invitation from a friend to contribute to an animation already containing contributions from a number of people. After watching the animation, the user is presented with two choices. The first is to append a new scene at the end of the received animation and continue the story. The other



gure 33 Osvaldo Cavandoli with his single line
ıaracter "*La Linea*"



gure 34 The animation editor / viewer applet



gure 32 The gallery view showing recent
ıntributions

choice is to edit or completely replace the last scene that her friend has previously worked on. It is important to note that only the last scene of an animation can be modified, the earlier segments are fixed. After the user finished her contribution and saved the file, she can send an invitation to continue the animation to any of her friends.

Alternatively to the described model of an animation consisting of different scenes, there is also the model of the loop animation: In this case, no decision has to be made between appending and modifying. Instead, a copy of the last scene is automatically appended and can be changed by the user. The result of this change becomes the basis for the next contribution. The result is a looping sequence that constantly evolves as it is repeated.

Technology

Infinite Animation is a PHP based web application paired with a mySQL database server for storage of session- and user data. The application is embedded into the facebook canvas page, meaning that it is subjected to a number of restrictions enforced by the facebook server for security reasons, such as the blocking of active components such as java scripts.

The system talks with the facebook server via the php bindings of the facebook API, which is necessary for example for retrieving the usernames and profile pictures or the social graph.

The animation editor itself is the core of the application. It is implemented as a java applet running under runtime version 1.5+ and embedded into the facebook canvas page via an HTML iframe. The applet receives its parameters through the PHP script generating the content of this iframe.

Interface

The user interface consists of two main components: the gallery and the editor/playback application.

In the gallery section users can browse animations organized by different criteria, and choose scenes they want to edit. Every animation is represented through a thumbnail of its last frame, basic information such as the creation date, and the profile picture of its last contributor. The gallery also facilitates correspondence among users: it includes sections for incoming and outgoing invitations. Once an invitation is sent via email, optionally with a short personal message attached to it, a link to the corresponding scene is posted on the main page of the friend's profile.

The editor is used for viewing and editing animations. These two functions are not strictly separated, while watching an animation the user may immediately start editing it. Based on the mode the current animation has been created in – loop or scene mode – the user is presented with the options described above. Once this decision is made, the interface elements for editing the animation appear. The user can modify the timeline by inserting, copying or deleting

Figure 35 Screenshots of the topic space and social space visualization modes.

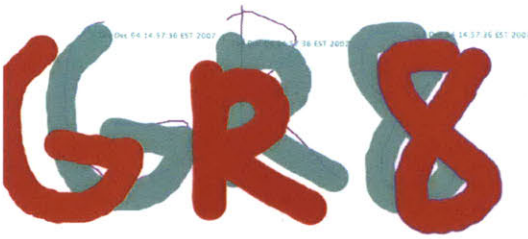


Figure 36 The XRay mode shows the interaction history of a single frame

frames. The drawing palette includes tools for drawing, uploading background images and entering text. A basic set of tools is available for selecting visual elements and modifying their properties such as their positions, widths, sizes and colors. Once an animation is saved, it appears as a new entry in the "created" panel of the gallery page, from which it can be sent to other facebook friends.

The Visualization Module – Topic Space vs. Social Space

A separate applet has been developed for visualizing the contributions and its social metadata. It offers two different modes. The first one shows the topic space: it renders the genealogy of all contributions with the nodes representing individual scenes, the edges their connections. As a visualization method a radial tree layout was chosen – the inner ring contains the start scenes, with the timeline growing outward. Each scene is represented with an icon of its first frame, and the names of the contributors when selected. The second mode shows the social space: here, every node represents a contributing individual; links show that the corresponding exchanged contributions with each other. Like in Comment Flow and the diffusion simulation, individual transactions are represented through a mark along the edge.

Design Principles

During the development of the system, the main principles discussed in the background chapter have been adapted and implemented.

Document History and Social Context

Infinite animation's file format implements the concept of social History. For each element, frame and stroke, metadata such as author id, time of creation, parent strokes and original position is stored.

The application offers an X-ray mode that allows the users to observe which part of a drawing have been modified.

Remembering strokes, and social provenance of editing. In this implementation, social context information such as the list of contributors is stored both in the animation files themselves as well as in the mySQL database.

Figure 37 Using a set of existing visual elements – „*Mr. Picassohead*"

Active and Passive Transformation

The fashion in which participants can evolve the content is determined by the rules described before, which are different for scene and loop mode.

In loop mode, all predecessors of a scene are visible in the same space, making the successive evolution visible, while in scene mode the emphasis is set on the narrative flow. Besides transformation through the revision and decisions by the participating users, the system also implements passive transformation that happens automatically if a file is copied without modification. This transformation affects only parts of the animation that are copied without further modifications by the users.

Evaluation

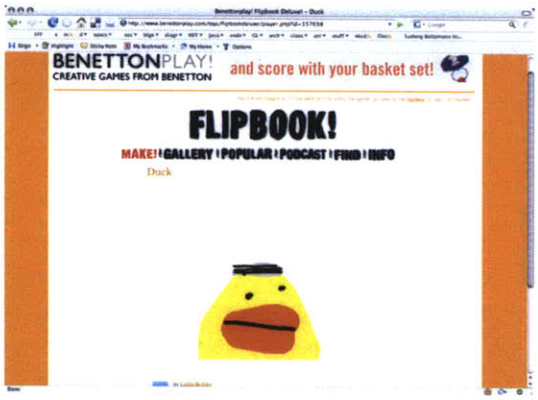


Figure 38 *Flipbook!* by J. Osima

The evaluation involves two parts: the first is the observation of contributions by the general public on facebook; the second is a study among users via a web-based form.

Four weeks after public deployment, *infinite animation* had over 340 users, with an average of three people using it per day. Two weeks after deployment, the application had still only around 100 users. In order to increase the user base, information has been sent out to facebook groups interested in animation.

Most users decided to create animations from scratch rather than continuing someone else's work. A number of users kept adding scenes to their own work instead of passing it over to friends. One animation, a star wars inspired contribution, consists of 61 scenes all drawn by the same person, whereas another one consisting of 71 scenes contains contributions of two different authors.

During these four weeks, 153 animations were created, containing a total of 397 scenes. The median number of scenes per animation is two.

From the survey, we gathered thoughts and responses from 13 users, addressing issues of collaborative work, attitudes towards authorship and attributions, and finally feedback concerning the usability of the interface.

Reviewing Design Considerations - Choice of the Animation Technique

The term „Limited animation" combines techniques that trade animation quality for the sake of faster and simpler production. It

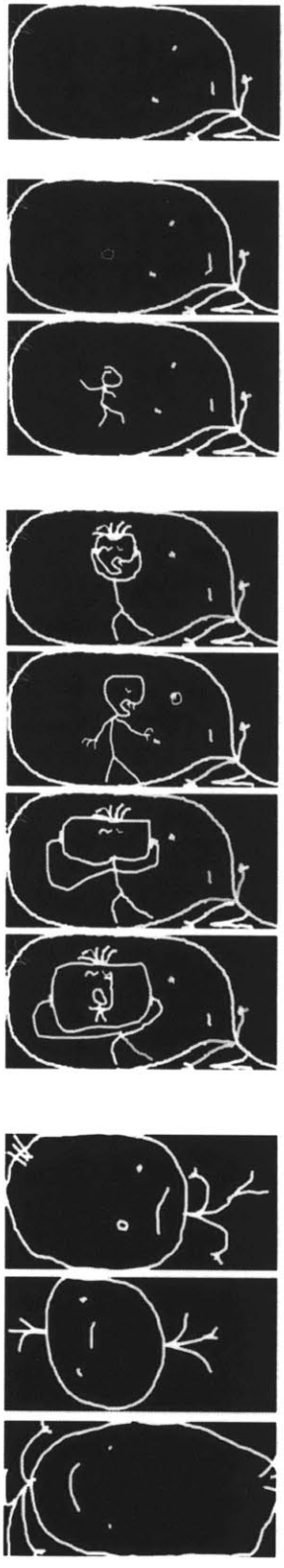


Figure 39 Variations on an initial single frame from four different authors

works with a set of persistent graphic elements, that are repositioned or substituted rather than recreated for each frame. For example, a dialog scene would use a static image of the head with just the mouth and occasionally the eyes being animated.

During the design phase I was considering implementing a limited animation approach by providing a set of visual elements that can be positioned and moved on the canvas. An approach like that would speed up the animation process, but at the same time define the visual style of the animation. The popularity of applications like graffiti that involve line drawing helped me make the decision for the more free form of line drawing with the option to copy elements between frames.

Two users asked for a set of standard shapes, as well as tools, that would facilitate more drawing precision such as a zoom mode, or guides and grids. Drawing precision was never a goal of the application, but these comments points at the difficulties encountered when drawing with the mouse or the track-pad of a laptop.

The Right Animation Editor

This leads us to a major issue. Designing an application for simple flipbook animation sounds like a very straightforward task, as a large number of examples exist.

However, it is more complicated than one might think: authoring a frame-based animation involves many repetitive steps, compared to authoring a single drawing. Existing editors either make it clear that they do not offer anything more than a colored pencil (as for example the „flipbook!" editor [28]) or offer a comprehensive set of animation tools. The first option removes the barrier of learning the tool, while the second option potentially makes the process more efficient but confronts the user with a higher complexity. In the evaluation, many users requested additional features that would simplify the process, such as rotation and scaling manipulation. Some of the features requested have in fact been developed for *infinite animation*, but have not been included into the interface for the sake of simplicity. There is no simple answer about the best compromise, since most users have a different approach to the animation process.

The Concept of Scenes

During conception phase, many thoughts went into the decision what should be the atomic element of an animation. Is it a single frame? Is it a certain number of frames? Following considerations were made:

- A participant's contribution should be recognizable as a single element.
- A participant should be provided with enough space to frame a narrative idea in her contribution.
- A single frame might not be enough for that.

Figure 40 an animated dialog between two contributors

- A fixed number of frames is a strong constraint for a contributor to deal with. It would generate a repetitive rhythm not always desired.

The solution was to introduce the concept of a „scene", containing an arbitrary number of frames, as an atomistic element created by one user. A scene has a single solid background color and, optionally, a single background image. These two constraints were chosen in order to support the notion that a scene expresses a kind of narrative unit. The term „scene" was chosen because we assumed that most participants would understand its meaning as a narrative unit better than the previously used "segment".

Most people understood the concept generally well. Most „scenes" have a articulated start and endpoint, designed to fit into a narrative plot. A few participants designed „cliffhangers" that would suggest many alternative contributions to follow up. As mentioned, many contributors used scenes also to structure their own work.

Figure 41 Open end of a scene by Khalid Abushaban

Comparing loop and scene mode

Based on the results of the survey, there is no significant difference concerning accessibility.

Authorship & Ownerships

> *„ i don't think the point is to improve on an animation. this type of process resembles a conversation where people participate to create some sort of aesthetic emotion. i think of it as contributing to a dialogue not really as improving already existing work"*

> *„ i know that in both cases they can be further modified and my contribution is not the most significant part. this type of collaborative process is about sharing authorship not about comparing the various effort levels of the participants"*

Conclusions - What has Been Learned

In some aspects, the choice of animation as a medium turned out to be problematic: authoring an animation requires a lot of effort, resulting in a high barrier for participation. Java, the software platform used for the system turned out to be a second obstacle for participation. The Facebook API requires a java runtime of version 1.5 and above, a system requirement that is not met by the majority of users.

Another disadvantage is that the Facebook environment does not allow active content on profile pages, so the users have to open the

application in order to browse through contributions, lowering their visibility.

> *„it's harder to start with a blank canvas. when adding to an existing animation one already has some subject matter to start with or some action to complete or change"*

Based on the contributions from the participating users, it is worth noting that the majority chose to create a new animation from scratch rather than continuing an existing one. Some of these are quite elaborate and took a long time to make. These users obviously brought interest and skills for animation, but had difficulties finding likewise people to continue their work.

A last problematic aspect of the application is that it enforces a certain workflow. There is a chronological order and a certain way in which things have to be done. This may not be desirable for an open collaborative system.

Despite all the mentioned problems, the experiment showed that social networking platforms could be a successful medium for collaborative creation. Compared to for example a wiki, it offers a richer set of social tools that can be utilized for augmenting the creative process. Social networking sites like facebook have a very low barrier for participation. Since the platforms are not dedicated to a single purpose, there is no pressure or expectation to contribute - contributions can happen on an ad-hoc basis.

Figure 42 Stills from a "*star wars*" themed animation by David Manley

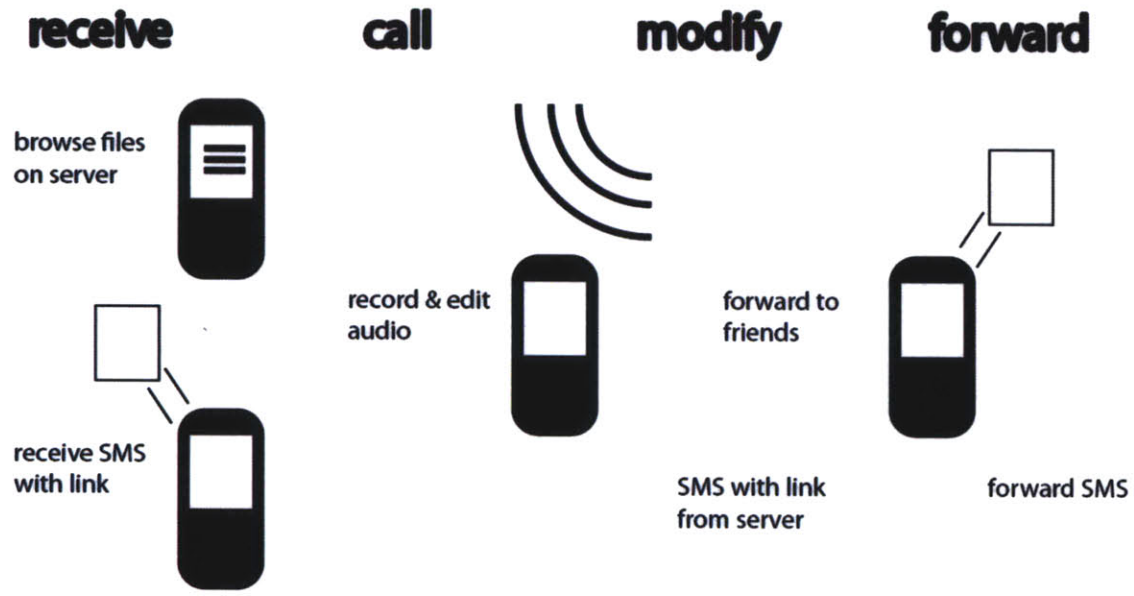


Figure 43 *roaming whistles,* interaction process

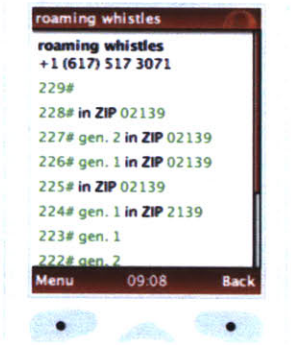


Figure 44 The mobile webinterface for roaming whistles

Roaming Whistles

"Roaming whistles" is a project about gathering and juxtaposing sounds in public space. Similar to infinite animation, the participants generate media files and pass them on to their friends for further modification. By using mobile phones as an interface for recording sound files, the situation for authoring media is quite different. With less attention resources and a limited interface on the one hand, and more engagement with the surrounding space on the other hand, the application requires a different approach.

While *infinite animation* focused on the relationship between social and topical proximity, roaming whistles adds a third dimension of proximity, that of geographical space. To sum things up, we have three different notions of distance:

- **Social proximity** – the social distance (i.e. „degrees of separation") between two individuals
- **Topical proximity** – the relationship or similarity between two contributions or between the preferences of two individuals
- **Geographical proximity** the location in geographic space

Taken together, these three metrics can describe the social architecture of a city. For example, the extent to which social and

geographical proximity overlap tells us a lot about diversity or homogeneity in a neighborhood. The relationship between topical and geographical proximity on the other hand tells us about the existence of local styles. Different neighborhoods often have their characteristic styles of fashion, language or music. The amount of users and data necessary for a detailed picture like that however is beyond the scope of this experiment.

Process

The system combines three basic technologies available on nearly all mobile phones: voice, text messaging and WAP pages. Typically, a participant receives a forwarded text message from a friend. The message briefly explains the project and contains a link to the mobile website and to a specific file recorded by the sender of the text message. By dialing the number and extension specified in the text message, the participant can access the file directly, or by going to the mobile webpage, explore its history and predecessors. The provided links use the tel:// protocol, allowing most modern mobile phones to dial the provided number of the file directly without requiring the user to copy and dial in the number and extension manually.

After dialing the number of the recording passed on between participants, the user is presented with a recording consisting of two audio tracks. She can choose to replace one of them with either a new recording or apply one of nine different manipulations to one of the tracks, accessible via the number pad of the phone. After the modification is completed, the user is asked to type in the zip-code for localization. This is important since the available soundtracks are different for different areas and can be changed through the web interface. After the call, the participant receives an SMS message from the server containing the link to the file she just modified. This message can then be forwarded to friends by traditional means.

On the website, the visitor can explore the evolution of different sound files, download mp3s that can be used as ring tones, and view a visualization of the genealogy. The website looks different depending on whether the webpage is accessed from a mobile phone or from the desktop – its visual information and navigation structure are adapted for the platform.

Scenarios

With the availability of two tracks, a number of different scenarios of usage can be imagined:

- Mixing and recording soundscapes: the users record audio from their environments and combine them. The juxtaposition of two different, maybe conflicting, audio environments often results in surprising and interesting effects.

Figure 46 Visualisation of the genealogy of *roaming whistles* contribution space.

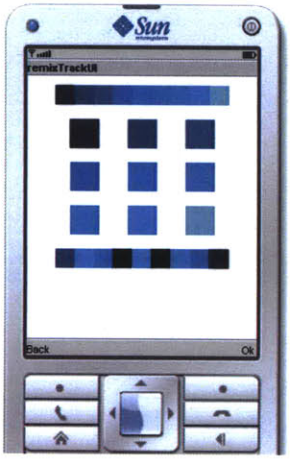


Figure 45 Java Client for remixing soundtracks by Yannick Assogba

- Annotating places
- Conversation game: similar to text based exquisite corpse variants like 'consequences', a dialog between two persons can be staged, the first track contains questions, the second answers. By replacing one of the two tracks, the meaning of the conversation can be reinterpreted by the participants.
- Mobile Karaoke: the first track could be an instrumental music track, the second one the vocal track the user has to record.
- Game of telephone: the first track contains a phrase that the participant has to repeat and record on the second track.

Visualization Module

The visualization shows the evolution of the individual contributions as well as how they changed during that process in an iconic form. A simple tree layout is used for the display; every node is rendered in two colors representing the two tracks. A color change indicates a replacement of a track.

The Track Editor

For more control over existing tracks, my colleague Yannick Assogba developed a mobile application based on J2ME that can be installed on most mobiles. The application allows the users edit and temporally rearrange short samples of the recorded sound file. The application splits the original sound into 9 pieces of equal length, each of them assigned a key on the keypad. Within the limits of this process, the user can pick out interesting pieces from the original recording and generate rhythmic patterns with it.

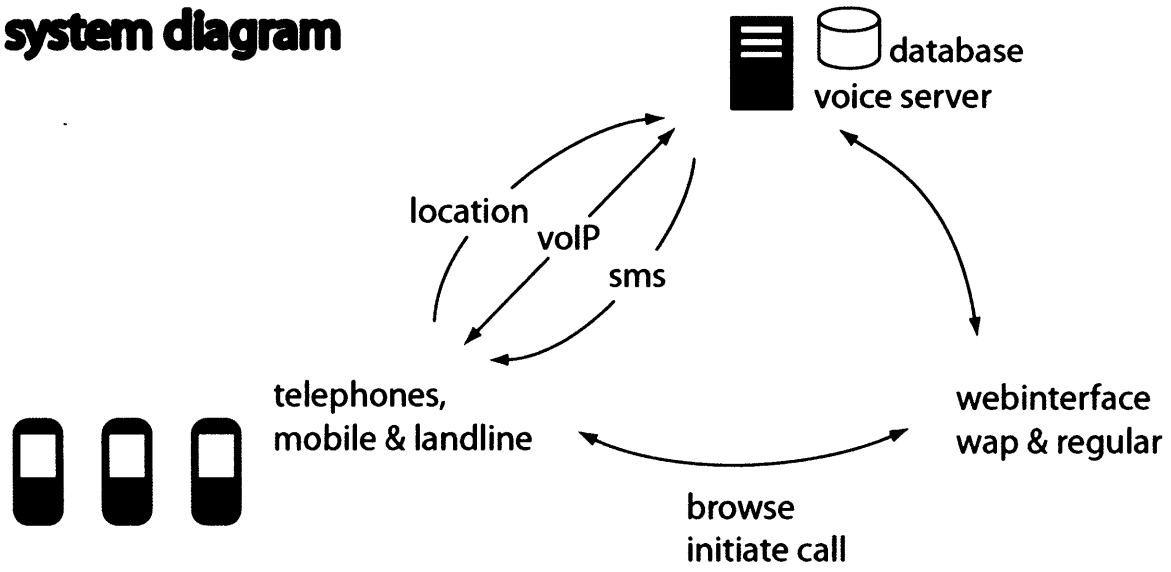


Figure 47 *roaming whistles* system diagram

Technical Specifications

The main design principle for the development of the application was to provide a maximum of accessibility and compatibility across all of available types of mobile phones. No client software should be installed. This required most interactions to be handled via voice and keypad.

For this purpose, we implemented a voice-server using the python based voIP toolkit *shtoom*, which my colleague Aaron Zinman extended with a custom iLBC codec for audio compression. The voice-server waits for incoming calls from an outside VOIP carrier, provides the voice menu necessary for the interaction and records audio files at a sampling-rate of 8 kHz at 16bit resolution. The voice-server application also stores all required information in a mySQL database. The website is based on PHP, with the visualization module running a java applet using JOGL interface for hardware accelerated rendering.

Evaluation

Interaction with the system takes quite an amount of steps, and some users had problems navigating the menu structure of the voice server. Not expecting the preliminary step necessary for accessing a received file, they were not sure at which point they could actually record something.

> *„It was not that easy. It was difficult to remember pressing the # key at the end. It was also a little vague when to start recording and how to stop it. I had to do it a couple of times to figure out*

how the system works. A preview option would be handy before submitting it as a file. "

The biggest limitation of the system was the audio quality of the result. The quality was determined by the characteristics of the phone's mic and speaker, as well as the low sampling rate of the audio stream. As one user noted,

„I had a hard time figuring out what kinds of audio my cell phone would capture well. At first I wanted to juxtapose different music from my laptop, but after trying that I quickly discovered that cell phones seem to throw out non-human-voice frequencies and it makes music sound pretty terrible."

and another one said:

"One problem is the quality of the audio recording. I think the mobile phone chipset is optimized for voice so it sounds like it is cutting certain frequencies. This imposes its own aesthetic one needs to deal with..."

Transformational Aspects

At an early stage of the project, I experimented with various ways how the representation of revision history could be applied to the audio domain. One approach involved the notion of imperfect deletion - replacing a track with a new recording would not wipe out the original track entirely; it would remain audible as a faint echo on top of the new track. Accordingly, late generations of a file would carry a subtle ambience of past versions with them. Since individual elements of this ambience are indiscernible, the representation is "translucent" rather than "transparent".

I experimented also with techniques of automatic transformation: With each person listening to a file, it would slightly change its characteristic, for example acquire some reverberation.

However, in the final version both approaches have been dropped for a variety of reasons. One reason were the limitations of audio quality that come with the usage of phones. The audio rendering of the soundscape representing the files history was an interesting and intriguing effect using a set of high quality speakers, but almost inaudible over a phone's speaker.

But even with the best hardware, there are also limitations to the human perception of soundscapes [59]. For the listener, subtle and gradual changes are hard to identify, and it is impossible to discriminate, which part of the audio is based on transformation as a result of the file's history and what is the actual recording.

Yet, the biggest problem with automatic transformation is that the meaning of the effect is generally not understandable, if the effect is noticed at all. Unlike the physical world, where aging and traces of usage are understandable as an analogy to a documents history, there is nothing similar for acoustic experience. There are many ways how

history of a sound file may be expressed, but eventually they are all based on arbitrary rules.

Issues of the Interface

Cellular phones pose a challenge for editing and manipulating sounds. There is a tradeoff between ease of usage/ complexity of the application and the range of manipulative possibilities it offers. The dynamics of the involved sound files are sometimes hard to tune:

> *„If one of the audio channels is too dominant (too intense), it is really hard to deal with it. Sometimes, I guess, the only improvement can be to delete that channel and dominate the file with your own."*

The Participant's attention is a limited resource especially on mobiles – while the user of a desktop computer may have the time and attention resources to learn how to author a complex animation, the mobile user in the urban environment has to share her attention with the spaces and events around. The number of options is already limited through the keypad, but also the number of steps involved in the course of the interaction has to be minimized.

> *„The two track system is pretty good. It's simple, but you can do some cool stuff with it. I got a little frustrated with differing recording lengths, though. I ended up with some foot stomping track (not totally sure how...) that just seemed to last FOREVER and had big gaps in it."*

Fitness

A last point concerns the judgment of the participants. How big is the range of perceived quality? Did people have the impression they could improve the result? Most users liked the informality and possibilities of the acoustic medium:

> *„Audio sources can be very diverse, so I feel much more free (compared to a visual editing interface). It allows much more of a collage feel."*

Roaming Whistles - Multitrack

+1 (617) 517 3071

Filename: Browse... track 1 Submit

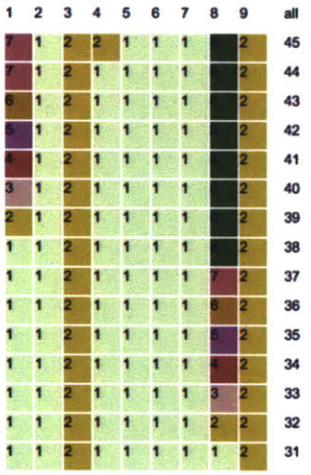


Figure 48 The web interface of the multitrack version of roaming whistles

Based on the evaluation of *roaming whistles*, I implemented an alternative version of the project.

The feedback from the *roaming whistles* surveys exposed a disadvantage of the application – a certain number of steps are necessary in order to interact with the system, and the selection and storage of files requires more input than the actual modification of the file. As one user suggested, *„why limit to 2 tracks? 9+3 keys!"*

For the next iteration, the interaction process therefore has been radically simplified: instead of many different contributions the participants have to choose from, there is only one central audio file. Compared to *roaming whistles*, this audio file is more complex – it is composed of nine simultaneous tracks.

As a result, all steps necessary for the interaction process are dedicated to the manipulation of the file. By pressing individual number keys the user can listen to each track separately in order to decide which of the tracks to change. When the caller makes a choice, pressing the star key after listening to the selected track allows her to re-record this one track.

Compared to the previous version, Multitrack is more oriented towards performance than on asynchronous exchange. While a recipient of a *roaming whistles* invitation will find the file as the sender has created it, in the *multitrack* version other users might have already changed it in the meantime.

Another difference from the previous version is the possibility to upload sound files in a variety of formats via the web-interface. This works in the same way as the recording process – in order to upload a new sound, an existing track has to be replaced. The system therefore allows a performance between mobile users and web users, with the means of recordings and existing sound files.

The visual interface is very simple – every row represents a complete composition, with all tracks individually accessible in its columns. The vertical axis shows the history of recent activities, each modification of a track indicated by a color change in the corresponding column.

6 Future Work and Conclusion

An Outline for a Sociable File Format

The guiding vision for this thesis is a framework for thinking about transformational copying how this concept could be realized in a sociable file format for documents.

A selection of important properties of this framework have been implemented in our different experiments, based on their findings it is now possible to articulate the general architecture of such a format.

Social History

The first principle is the encapsulation of social history: the format should record and store both active and passive interaction history. Active interaction history would include information about recent revisions, while the passive interaction history information about previous consummation and approval of the content.

Privacy

Recording of interaction history raises questions about privacy. Nobody would expect that the way in which a document is read being recorded into that very document. How to communicate the fact that reading a document influences it and at the same time protect the privacy of its users?

In order to answer this question, we come back to the principles of *translucency*, *awareness* and *accountability* as discussed in in Hill et al's paper [22]. The notion of translucency as opposed to transparency means in this case that not the actions of an individual user are of interest for the system, but the behaiour of the totality of users. Social information should be stored in a de-individualized form, so that it is not possible to identify previous authors, but still possible to determine a common history of two different documents can be determined.

Awareness is an important factor – visual feedback should make it clear when interaction history is being recorded, the stored history should be visible and easily accessible.

Application Scenario - Peer to Peer Social Networking

A scenario where the recording and encapsulation of revision interaction history would make sense would be a decentralized social networking application. In this scenario of peer-to-peer social

networking based on the social context of the shared files, the social graph is not stored on a central server, but distributed in a loose collection of documents.

For this purpose it might make sense to include personal data, for example by offering individuals the possibility to sign the document and add contact information. This would be useful for example to control the permissions to access, change or append to a document based on the social context.

Since it focuses on the activity and the interaction among individuals, peer-to-peer social networking could be an interesting alternative to current platforms. Instead of constructing a social graph by inviting other people or accepting their requests, in this case the social network could be implicitly determined by the amount of interactions between two individuals, as it is stored in the social history of the file. With a small collection of files sharing a common history, social network information could be extracted. This social network information is ephemeral, decentralized and within the control of the individual user. If two members of a group have a different set of files, they would see different parts of the social network.

Transformation

Mutability would be the second central aspect of the file format. Depending on the type of document, different modules could be employed to handle automatic transformation.

The transformation could serve a couple of useful purposes. It could act as a fitness function that has an influence on the appearance of the document: the character of the automatic transformation could be specified through personal preference settings of the original author. These settings could specify how the document ages, which aspects of the content are more stable than others. For example, if the goal were the maximum variety of results, the initiators would specify the media as very unstable so that a high degree of mutation might occur. On the other hand, if the original author would like to direct the aesthetics of the file into a specific direction, such as a specific color palette, contrast settings, or shapes of strokes they could specify that in the original preferences, so that every copy that is not further edited brings the document a step closer into that direction. For example, a photo could have the preferences so that it degrades by increasing the contrast each time it is being copied, resulting in a photocopy-like appearance.

Technical considerations

It might be necessary to include executable code with the file, for handling things like detecting whether a file has been copied, recording social history, applying transformation, or simply displaying the file. The other option, having these things handled through the editor or viewer would work equally well, but would limit the mobility of the document by constraining it to specific

client software. A compromise could be to provide a file in two versions, a light version including only content and metadata and an extended one with executable code.

Metadata and revision history could be handled in a way similar to a decentralized version control system like DARCS [60], that stores history as a series of interdependent patches both locally and remote.

A second possibility would involve storing interaction history at the level of the file system. File systems like reiserFS4 [61] are based on plug-ins that would allow to handle interaction history and transformation for different documents accordingly.

Conclusion

Today, copying is mainly discussed in the legistic domain concerning issues of intellectual property and the economy of informational goods.

In this thesis I argued that beyond these questions, there is a large cultural dimension to the concept of the copy, rich in connotations and meaning. Through history, copying has been a way to preserve knowledge, to evolve ideas and to distribute information.

This thesis investigates the concept of the transformative copy in the digital domain as a vehicle and device for collaborative authorship.

The concept of the copy is inherently transformative, even if just as the transformation from *"the One into the Many"* [62]. However, until the recent transition from analog to digital media, the perfectly identical copy was not possible, every reproduction went along with some form of transformation. While this transformation usually is associated with loss of information, it also creates new information, for example in the form of traces and wear that testify of an objects history. As a result of the ability to create of unlimited numbers of perfectly identical copies from digital files, this dimension of context information is lost - digital files do not have a history.

This thesis examined the implications of a scenario where each copy of a digital file would go along with a transformation of content, based on its history. By creating a framework for transformation and the accumulation of context information, some of the described analog qualities are migrated into an appropriate digital form.

The application space is vast and ranges from methods for automatic mutation of content to a new paradigm for peer-to-peer social networking.

The contribution of this thesis remains in many points speculative - it identified and framed a way of thinking about cultural dimension of the copy, and to utilize it as a creative device rich social tool by adding transformative qualities that reflect its social context. The implemented projects should be seen as steppingstones in the vast application space, unable to cover it entirely. Each project could be a starting point for future research ...

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