Repurposing Bits and Pieces of the Digital

Vygandas "Vegas" Šimbelis, Pedro Ferreira, Elsa Vaara[1], Jarmo Laaksolahti[1], Kristina Höök

Mobile Life @ Royal Institute of Technology
10044 Stockholm, Sweden
vygandas, pedropaf, khook@kth.se

[1]Mobile Life @ SICS
16429 Kista, Sweden
elsa, jarmo@sics.se

ABSTRACT

Repurposing refers to a broad set of practices, such as recycling or upcycling, all aiming to make better use of or give new life to physical materials and artefacts. While these practices have an obvious interest regarding sustainability issues, they also bring about unique aesthetics and values that may inspire design beyond sustainability concerns. What if we can harness these qualities in digital materials? We introduce Delete by Haiku, an application that transforms old mobile text messages into haiku poems. We elaborate on how the principles of repurposing – working on a low budget, introducing chance and combining the original values with the new ones – can inform interaction design in evoking some of these aesthetic values. This approach changes our views on what constitutes "digital materials" and the opportunities they offer. We also connect recent debates concerning ownership of data with discussions in the arts on the "Death of the Author."

AUTHOR KEYWORDS

Repurposing; Reuse; Recycling; Upcycling Design; Digital Upcycling; Aesthetics of Deletion; Interaction Design; Interactive Art

ACM CLASSIFICATION KEYWORDS

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

GENERAL TERMS

Human Factors; Design

INTRODUCTION

Sustainability has become an increasingly relevant topic of research with concerns regarding overuse of natural resources dominating a large part of the public debate and policy concerns around the world. Reusing our materials is one of the strategies adopted to deal with the mass consumption of goods and elimination of waste. Recycling is one such strategy, but others have emerged in relation to repurposing or upcycling of different artefacts. While these
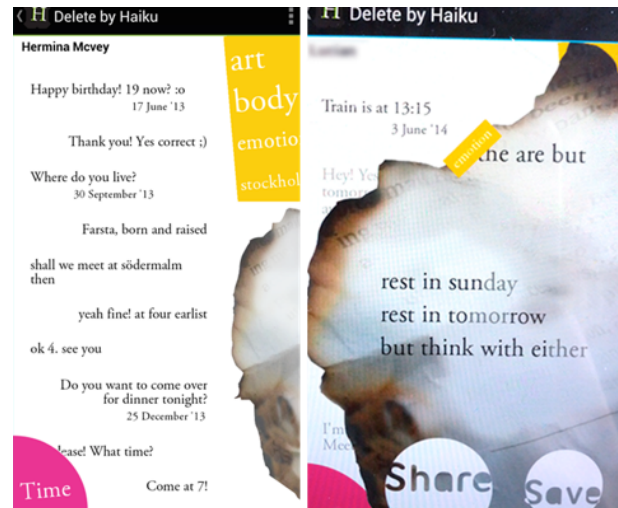
Figure 1. The haiku project: a) SMS thread with themes folder (right). b) The "haiku-bin" with generated haiku.

strategies mainly focus on sustainability research, they have also resulted in particular aesthetic expressions, which have become interesting and appealing in themselves, beyond the demands of a strict sustainability perspective.

With growing digital storage capacity space in the cloud, we are accruing an ever-increasing number of digital "things," often rarely revisited, constituting a form of digital waste. While the cost of maintaining those from a sustainability perspective may not yet be a key concern (even if some argue that the cost of storing all this data is an energy cost in itself), from a human perspective the amount of data is reaching an unmanageable level. To live a rich human life in the digital era means engaging in practices, such as, remembering [42], dealing with life and death [5], creating our identity [24,34], managing our social relations, avoiding becoming overwhelmed by all the data we get from life-logging applications [42] and so on. We asked ourselves whether we could borrow the aesthetics of repurposing practices to find novel ways of dealing with our digital possessions. Through designing and building Delete by Haiku, an application that turns old mobile text messages into poems, we show how we can draw from repurposing practices to inspire design for deletion and handling of digital waste – a way of *letting go* – in graceful and aesthetically appealing ways.

This act in turn raises questions regarding the nature of digital waste: what constitutes meaningful pieces we can

work with to achieve recycling or upcycling aesthetics? Decomposing an old mobile text message into its "bits and pieces" is only meaningful if we stop at the appropriate level – otherwise users will not recognize their old digital waste in the new.

We start by providing a background from the arts on various repurposing practices, such as upcycling, bricolage, sampling and collage. We then move on to show how those artistic practices and design ideals framed our exploration of what can be done with digital waste. Based on our experiences of designing Delete by Haiku, we discuss different tactics for adopting repurposing aesthetics into interaction design, how those may enable us to see novel affordances of our digital materials, and how the ownership of data debate can be cast in a different light by drawing a parallel to the "Death of the Author" – discussion in the arts.

BACKGROUND
In the physical world, recycling is the practice of deconstructing objects into reusable raw materials; as such, recycling practices are slightly beyond the scope of this paper as it is unclear what it would mean to recycle digital materials (as recycling bits does not make sense from a user experience point of view). *Reuse*, on the other hand, is a practice for using the same object several times without emphasizing exactly how. It is an important practice for extending the lifespan of an object. Repurposing practices form a special case of reuse, as they are concerned with adapting the object for use with a different purpose, thereby also changing the use value of the object.

Upcycling, which plays a key role in our work, is the process through which defunct artefacts are repurposed to obtain a renewed (presumably higher) value. The term upcycling was first coined by a German engineer Reiner Pilz in an article from the Salvo journal in 1994 [36]: *"Recycling? I call it downcycling. They smash bricks, they smash everything. What we need is upcycling, where old products are given more value, not less"* [36]. Instead of deconstructing objects into their raw materials, an upcycling process aims to deconstruct and repurpose, but to keep some properties of the old as well.

The rich aesthetic and conceptual potentials of repurposing have been explored in the arts, and below we review several examples from the arts as a way of explaining what repurposing is and where it comes from. As we are particularly concerned with examining how repurposing can be used to good effect in design using digital materials, we will focus on how creative repurposing practices can be applied to interaction design. We outline and describe a number of generative, creative tactics and values in repurposing practices. Our aim is to introduce repurposing as a sensitizing design practice with potential for opening up new design spaces (rather than attempting to clearly define exactly what repurposing is or is not).

In design and arts, recycling and upcycling have become well-established practices. They are used to cover everything from utilitarian, conceptual concerns to aesthetic ones. For example, McDonough and Braungart use it for utilitarian purposes, focusing on designing for upcycling from the start by, for example, proposing computers built to be disassembled [29]. However, in interaction-design research, the concept has not been explored that widely (with a few notable exceptions [6, 31, 33]). Most reuse and upcycling processes are, therefore, based on materials in which their physical manifestation is central, although examples of reusing digital materials also exist. Prayer Companion [16] is an example of textual upcycling in which sentences from a wide range of global news sites and websites where people write about their experiences and emotions are repurposed to help a group of nuns keep their prayers pertinent.

In the arts, on the other hand, we also see examples of reuse and upcycling more in the form of conceptual practices, without necessarily having a strong connection to actual physical artefacts. From another perspective, we have to mention that our aim in this paper is not to discuss art theory and artistic implications comprehensively, but to find ways for art to be a contributor to interaction design and HCI, and our scope here is from material culture and various practice-driven activities. We even set aside the question of how purpose in itself is related to art, artistic practice and design.

Repurposing Practices in the Arts
The advent of industrialism explains some of the developments of movements such as Modernism as well as establishes practices around the avant-garde [6]. The political values expressed in the avant-garde made a strong impact not only on the art world, but also on broader societal concerns with everyday life in an industrialized era. Conceptualism, introduced by Marcel Duchamp (1887-1968), for example, was a critical inquiry into the status of art at the time. He questioned the institutionalization and audience expectations regarding art. In his endeavour, he drew a strong connection and critique of the notion of the *readymade*. Readymade objects taken from other contexts were brought into the art space, thereby changing their status, value and meaning. An ordinary manufactured artefact could become an artwork, as, for example, when he submitted a urinal to an exhibition – *Fountain* (1917) (see Figure 2) [6]. Through this act, Duchamp showed that the institutional status is inseparable from the values of the artwork. Duchamp's *Fountain* is an example that also clearly shows some of the characteristics of a materialistic repurposing: a flip, rotation, simple change of an existing artefact suddenly turns it into something entirely different. It becomes part of an upcycling process: a commodity turned into an artwork, with a new and higher value.

In the following Modernist tradition in the mid-20th century, artists started to incorporate randomness, chance, indeterminacy [43], ephemerality and destruction in their works.

Figure 2. Right: M. Duchamp (1887-1968): Fountain, 1917 [62], left: P. Picasso (1881-1973): tete de taureau, 1942 [63].

In Postmodernism, the concepts such as originality, appropriation and authorship (that is, who the art can be attributed to) [20,46] originated and took novel paths to criticizing the established rules and the society at large.

Readymades went further with the use of various objects in neo-avant-garde, Dada and Fluxus, which incorporated those strategies into their art practices. Intentionally humorous situations played a significant part in the works of Fluxus artists, in which George Maciunas (1931-1978) took the lead: "…Dada, an art movement that was often conceptual in nature, as well as subversively humorous" [44]. Jay Belloli discusses the artist Sol Lewitt's (1928-2007) conceptual directions: "…the artist was not there while the piece was being made. Three years later, at the Kunsthalle in Bern, the Silvermans came across a LeWitt exhibition of large wall drawings and other works. It became clear once again that the artist was producing his art by developing directions on how it should be fabricated and leaving its actual construction to others" [44].

The reuse of old artworks by copying or collaging became a permissible practice. Repurposing shares family resemblances with several different concepts and expressions in the arts: *repurposing* of artworks, *compositing*, *cut-and-paste* as artistic techniques, *sampling* in music, *collage*, *reuse* of buildings in architecture, and *cut-up* in literature [20]. Let us explain some of these in more detail.

Repurposing in Remix Culture
Walter Benjamin's work on mechanical reproduction in 1936 [4] discusses the need for a new form of art in the age of mass reproduction – a political way to question the role of originality in an era of mass production. With the possibility of printing and mass reproducing, came replication and possibilities of creating new art through compositions of old (or copied) pieces. An example is the *collage* – an artistic compositing technique that works by putting together various graphic elements (all or parts of existing images) – that arose during the rise of Modernism. Various forms of collage were used in art from manifestations in Cubism, Futurism, and Dadaism [55].

The *assemblage* technique is similar to collage, but it refers to a composition of found objects rather than graphics, in most cases three-dimensional objects protruding from the substrate [55]. Bricolage is a similar technique, using found objects and could take any shape in space. An example of the combination of the bricolage technique, repurposing and upcycling is the insertion of a bicycle seat and handlebar in *Bull's Head* (1942) by Pablo Picasso (see Figure 2). Bricolage is also introduced in interaction design [52] to denote its connection to tinkering and maker culture.

Later, in interactive artworks, collage techniques building on pieces of trash were used, for example, by the artist Danny Rozin in *Trash Mirror* (2001) [38]. Mechanical mirrors, made of various physical trash materials, change and move based on input from video cameras and computers, creating complex mirrors of the viewers standing in front of the art piece. In CollageMachine by Andruid Kerne [25], digital collages are composed by browsing web pages. The machine uses randomness and users' choices when deciding which web links to follow.

Reusing and repurposing are common practices in architecture: for example, a hotel designed in an old ship-to-shore crane (Crane Hotel in Harlingen, Holland) or through turning a shipping container into a home. It is an adaptive approach for creating new functions from already existing forms, functions and purposes. By applying its *adaptation principles*, such notions of reuse in architecture and in other disciplines could be opposed to one of the most important creative ideals in modern architecture and design – "form follows function" [19]. Instead of making the form follow the function, they make the function adapt to the already existing form – the core feature of repurposing.

Repurposing and Upcycling in DIY
Repurposing and upcycling has a strong role in do-it-yourself (DIY) practices [54] creating something new, with a novel value, from our everyday 'garbage' [7]. We can wear bags designed from used truck tarpaulins [56] or give away souvenirs made from used basket balls [57]. The whole open-source and maker-culture oftentimes centers on reuse, repurposing and upcycling, for example, media art practices as circuit and code bending, and on more visual aspects – pixel and data bending. Another method is repurposing code as a technique used in the software industry [41].

As we can see in these examples, there is a focus on low-budget processes and making use of artefacts readily available to us – even garbage. Many of these practices rely on an element of chance in the design process. By placing objects next to one another, turning them, reconfiguring them, ideas arise in and through seeing old objects in a new light. These tactics became of use to us in our design process.

THE CASE OF REPURPOSING
To further explore and open the design space where digital data is seen in the light of being a reusable, upcyclable or

Figure 3. a) Time filter (pink), themes (yellow), and haiku-bin (grey). b) Choosing a theme (right).

repurposable material, we conducted a workshop and subsequently designed an app we named Delete by Haiku.

To drive the design process forward, we set some rules for ourselves. The first premise was that we would engage with the large amounts of personal data stored in our mobile phones. Text messages in particular become stored in our phones' digital memories, with little to no revisiting (with sometimes dramatic consequences when they are [13]). These messages constitute, in that sense, a form of waste, despite potentially large amounts of effort and emotional value invested at the time of their production. Second, to follow the ideals of repurposing, our aim was to bring new life and a new value to these texts, while at the same time, disposing of them. Third, we wanted to make use of the low-budget, chance-driven, practices.

We will now discuss the Delete by Haiku application and its design process by starting with the idea behind haiku poetry and our motivation to build on this form.

Haiku Poetry
Haiku is a traditional form of Japanese poetry featuring a simple constructive form with a limited number of syllables. In general, haiku poets use a syllabic structure of 5-7-5 for its three verses, resulting in a single strophe. In some cases, this strophe should contain a seasonal indication and also a shift between two parts that creates a feeling of surprise [58]. Contemporary creators of haiku do not always follow the traditional structure strictly and sometimes write without counting syllables or the number of verses. Haiku poetry offers an expressive, very strict and compact form of poetry, building on an artistic tradition and handicraft process that we could pursue [10]. The constrained format of haiku poetry enforces interesting limitations [35], which can also help framing and enhance a playful [9,39,40] and humorous potential [33].

There have been a number of attempts to automate the process of creating haiku poems, for example [59]. Tosa and colleagues [50] discuss the first non-interactive haiku generator Theo from 1959, and in Netzer et al. [32] linguistic passages of building such generators are explained. One contemporary example of a haiku generator is The New York Times Haiku project [60], which simply copies sentences from different articles and creates a haiku through spreading them out on three lines. By building on these research projects and experiments, we want to extend the user experience, control and interaction over the generative process [22,50].

Delete by Haiku
In the Delete by Haiku application, users interactively repurpose selected old text messages on their mobile phone into a haiku poem aided by a haiku-generating algorithm.

The interface consists of four main elements: the user's list of contacts, the haiku-bin, the time and the theme filters. (see Figure 3a).

Users select messages they want to delete by date and time, by conversation, individually, or any combination of these, and drag them to the haiku-bin. By repeatedly "pinching"[1] the messages in the bin (see Figure 4), the deletion and generation process is moved forward. The generation process is strongly aleatoric, that is, randomness plays an important role. Hence, it is possible to delete identical messages but end up with different poems. However, during the process the syllable structure of haiku poetry influences which words to keep and which to delete in order to create correct haikus. This refers to the repurposing notion of the function being adapted to the already existing form (explained above in the art background), in which the formal count of syllables creates a particular text function, in this case poetry, so the meaning finds its way through the syllable structure. In the process, words that are going to be deleted are greyed-out and eventually fade away. The remaining words in the
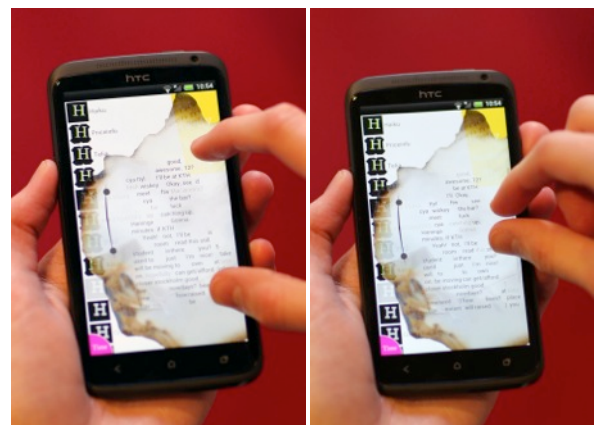

Figure 4. Haiku application, pinching gesture.

[1] By pinching we refer to the multi-touch gesture *pinch to zoom* that most modern mobiles and tablets have [14].
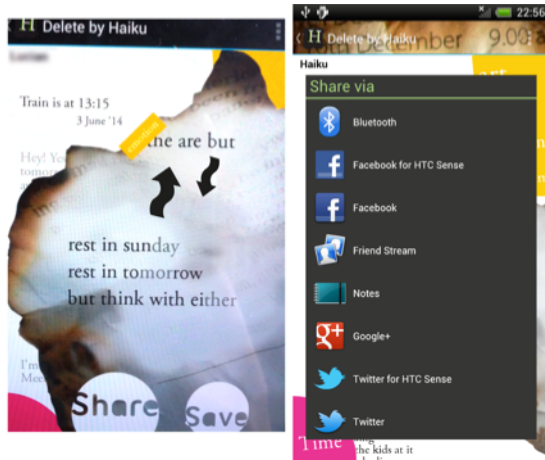
Figure 5. a) Last interaction for a final adjustment by manually moving words (left). b) Sharing window.

haiku-bin are animated when "pinched," falling down in a Tetris-like manner and eventually finding their position in the resulting haiku (see in Figure 4). This important step is animated to slowly expose the work of the algorithm emphasizing the mix of words. Depending on the quantity of text messages that has been selected, users have to repeat the pinching gesture multiple times until nothing but the haiku remains. Since the final poem is dependent on the characteristics of selected messages (expressions, wording, signs, etc.) the initial selection process is fundamental.

A typical haiku poem in the Japanese tradition will refer to nature and convey a certain ambience. While in traditional haiku nature is a standing theme, in our project we wanted to provide users with a broader range of themes to choose from (seen in Figure 3b). Each of the themes directly refers to a library of interrelated words, connected to the haiku-generating algorithm. In the version described here, users could choose to filter the selected messages through one or several of the themes: body, emotion, city and time. Using a theme causes the haiku generation algorithm to favor words from the theme in the generation process. That is, when selecting which words to keep and which ones to delete in the generation process, selecting a theme biases the algorithm to keep words, or synonyms to those, in the resulting haiku. Hence, choosing the emotion theme makes it more

likely that the resulting haiku concerns emotions. This feature lets users direct the algorithm towards a certain flavor of haiku by selecting different themes.

Once the haiku is generated, users can choose to keep the poem as it is or interactively change it (see Figure 5a) by rearranging and removing words of the resulting haiku. Through these last rearranging touches by the user, the poem becomes finalized. All text messages used to construct it are thereby transformed into one single haiku. As a final step, users can then share the poem with friends by sending it as a text message or uploading it to social media (such as Facebook) through the app's built-in functions (see Figure 5b). The users can also send the resulting haiku back to the person whose text messages were deleted in the process, and this could be turned into a "poetry"-based communication as both parties start using the app.

Design Process: Repurposing as a Lens for Design

To convey some of the underlying values and directions for upcycling, we will now show how we used repurposing as a generative lens in our design process.

Interviews

As a first investigative step, we joined the Stockholm haiku society and their weekly haiku workshop. During these meetings, we discussed premier haiku rules and alterations; however, we tried to find particularities of those specific meetings of the Stockholm haiku society and focus on what could significantly influence our design process and the project. The iteration process was one of those specific elements we brought into our design process. In these sessions, members anonymously send their haiku poems in advance and get productive discussions and live feedback from other members in the meeting. In those meetings haikus are collectively discussed in detail and eventually get changed in the reflexive process.

Text Repurposing Workshop

To help our understanding of haiku meet repurposing values and practices, we invited eight colleagues to a workshop in which we engaged in a series of playful exercises associated with the creation process of haiku poetry. The participants (see Figure 6b) were all researchers with different backgrounds (arts, design, anthropology, psychology, sociology and computer science). They were all more or
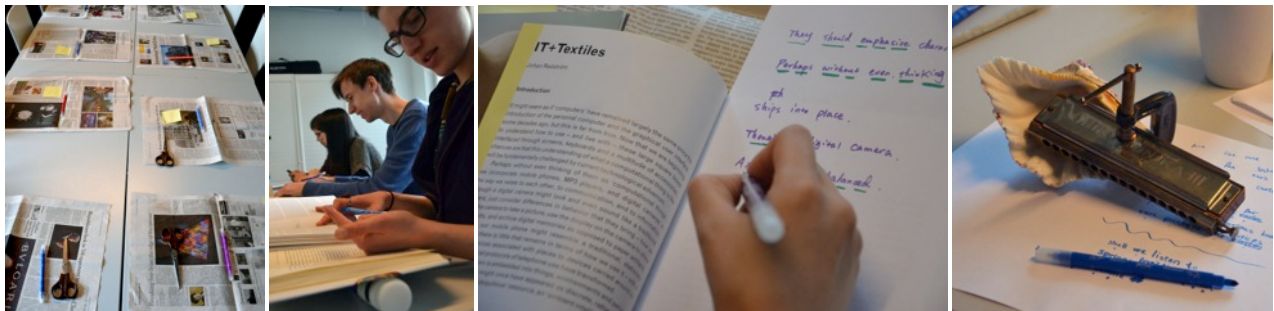

Figure 6. The haiku workshop: a) Settings of the workshop (left). b) Participants creating haikus (middle left). c) Haiku Book Hack exercise (middle right). d) Haiku from objects and sounds, an associative haiku approach (right).

less familiar with haiku poetry. The workshop exercises ranged from more generative to associative approaches. A generative approach (see Figure 6c, 7 and 8) involved recycling of already printed texts in various ways, for example, old artefacts were repurposed through using a cut-up technique, by cutting and rearranging headlines, burning away parts of a newspaper and producing haikus from what was left. Restrictions can be engaging [35], and here the restrictive form of the haiku became like solving a puzzle while sticking to a rather restrictive set of rules, and part of the engagement grew out of efforts to outsmart the rule set to create something expressive in spite of it. Later, in the workshop, we applied an associative approach (Figure 6d) in which haikus were created in more interpretative and intuitive ways, through associations to artefacts and without providing the participants with any printed words.

During the workshop, we noticed that the process of creating a haiku was important, perhaps even more interesting than the resulting haiku itself. The tactics we used in the hands-on workshop were purposefully tangible, low-budget and low-fidelity – to make participants focus on the process rather than their poetic abilities. It was low-budget in its choice of materials – newspapers and various old artefacts lying around in our office – and also in its methods – burning, cutting, arranging and rearranging objects and pieces of burnt newspaper. This procedure was in line with original ideas of repurposing in particular from the DIY community.

Implementation of the Workshop Results
The outputs from the workshop provided input to our design: combining mobile phone constraints, the haiku technique, deletion, and repurposing. Some parts of the repurposing methods that we tried with our participants were developed further and implemented in the mobile app. For example, in the Book Hack (see Figure 6c) exercise, participants blended texts from different books, taking random lines from one another and arranging them into a haiku. The Cut and Mix technique (see Figure 7) similarly arranges texts, but instead of books we used headlines and texts from different thematic newspaper pages (sports, culture). The way in which Delete by Haiku works was heavily inspired by these exercises.

The layout and design of the mobile interface was also influenced by the outcomes from the workshop. The interactive haiku-bin, represented by a burnt and crumpled sheet of paper, was inspired by the burnt newspaper, and aimed to
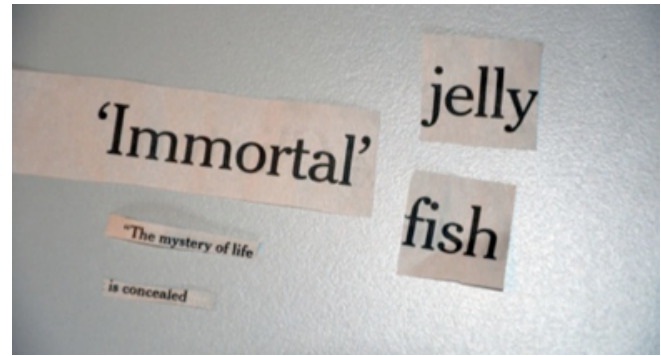

Figure 7. The Cut and Mix example of aleatoric method, generative approach in the workshop.

symbolize how the bin collects forgotten and fragmented messages. The text and buttons in the interface follow a non-symmetrical and non-geometric, natural, colorful and textured, cut-out style expressing aliveness and a messy style that often characterizes the type of defunct and second-hand physical artefacts.

In the development of the haiku generator, we gradually shifted from an initial design, in which we worked with grammar-based rules, to a design combining the theme database with retaining not only the significant words from users' text messages, but whole structures – part of or whole sentences – from the text messages that were being deleted.

User Encounters Shaping the Design
The resulting Delete by Haiku-app was exposed to ten users and haiku-experts through interviews, and was intensively discussed throughout the design process as well as in its final form. There were two focus groups composed of 25 people to discuss the main ideas and so far 64 users have tried it by downloading it. These encounters helped us to iterate on our design and understand some relationships between the concepts we applied and the chosen tactics and directions. These studies, as well as the expert encounters, are not full-fledged studies in themselves but rather orienting and inspirational for the design process.

We learnt from users trying the application that the possibility of tinkering with the haiku material to get a haiku that makes sense and has personal value was crucial (see Figure 9). The feeling of interacting with the poem cannot stop after the pinching gestures, but needs to continue into edit-

Figure 8. The workshop, generative approach: "Newspaper on Fire" aleatoric exercise in progress.

ing the poem until the user feels satisfied with the result. The importance of having some degree of control over the generated result comes not only from the workshop and user encounters, but also from the initial discussion with members of the Stockholm haiku society. Therefore, we added the option for users to rearrange and remove words in the final steps of the haiku creation.

In the example below (see Table 1, left example), a bunch of boring text messages, talking about meeting up for a coffee, are repurposed into an amusing haiku. This haiku captures the main essence of the whole text communication and in the end adds a humorous twist. The final poem became so amusing to this particular user that he decided to post it on his Facebook wall.

coming all order the coffee to departure our mind some coffee	pastry figuring sure but contemporary about midsummer

Table 1. Examples of generated haiku.

In the two examples above (see Table 1) from the end-user perspective, the process can be seen as adding a new, higher value to their mundane everyday messages. They are, using repurposing terminology, *upcycled*.

From one user encounter (Emma), we got feedback about summing up the whole conversation and adding value through creating a haiku, in this case the humorous and playful element works for having a smile:

"Instead of reading the whole conversation I had a day before I could read a small haiku and if that made me smile that would have value for me."

The same user discusses emotional connection to the conversation and also a surprise about a humorous situation:

"I'm an arty emotional person. I think I would like to find the beauty of conversation, that perhaps, it appeals to me that something that very random makes me smile, feel something. I would use it with certain conversations."

Another user (Santiago) emphasizes sentimental and emotional connection to people and conversations, very selec-

tive regarding which SMS messages to repurpose:

"Yeah, but you want to get a nice haiku. I made some nice haikus. It was conversation with my friend, very sentimental, some old stuff, then I created a nice haiku. I don't want to use messages with my girlfriend cause those are very personal. And this other friend it was about her stuff, she is a writer as well, so she writes very well and her messages were very long so it was perfect for the haiku. But I don't think I would use it myself."

User (Jonas) focuses on crafting technique in digitally shaping the poem and of that practice relating to getting rid of junk. In this case, the junk is attributed to memorabilia, a process of sort of letting go of your old personal experiences through deleting the core and by creating something substantially new:

"It's like crafting something. It almost feels like you are creating something out of the junk. Also at the same time it's a performance since I aim to share it. You sort of get into the loop of hunting to get the next good haiku. And that helps to get rid of all the junk. It's a way of processing old memorabilia."

Delete by Haiku sometimes has this effect of creating an added value – text messages of little, or forgotten, value to the user are given new life, providing a delightful, humorous surprise, shedding a new light on old, nearly-forgotten, conversations, playing a new role in our communication with others, in some ways similar to but distinct from recent additions to social media platforms, such as building albums and memories from old user data. The messages are perhaps not upcycled in a literal sense, but from the user experience perspective they are.

DIRECTIONS FOR THE DESIGN PROCESS
The practical directions we chose to work with in our project concur with our artistic intentions and fall under the general header of repurposing of digital waste. However, we want to emphasize that the space we are working in is only the initial mapping of a new domain and to suggest interesting directions in this design space. The introduced directions are not really actionable tactics; they are intentionally left open and underspecified as an invitation for the
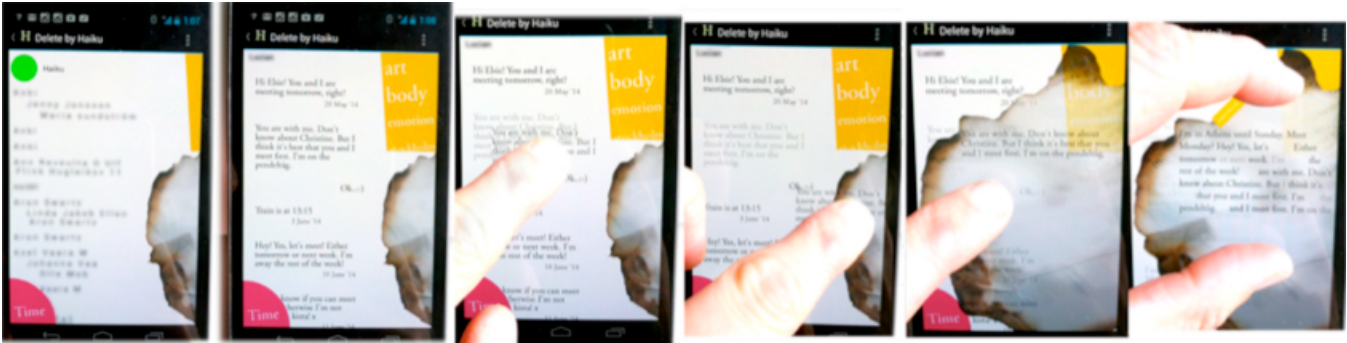

Figure 9. The interaction, from left: the contact list in Delete by Haiku in alphabetic order. A conversation within one contact was chosen. User drags and drops parts of the conversation into the "haiku-bin," which automatically opens up. And finally, user repeatedly pinches the text to compress it into a final haiku poem.

community to join us in engaging with these concepts and populate this novel space within interaction design and HCI.

As suggested above, there are various forms of repurposing processes, transformations, constructions and deconstructions that may help designers to render interesting results in their own design cases. By considering one or several of these directions in an early phase of project development, new design spaces can be opened. Throughout our research and design process, we have distinguished between two different types of repurposing: reuse and upcycling. Some practices that help bring out specific repurposing aesthetics, as described earlier, for example, *compose* and *reshape*. In the workshop exercises in which we were rearranging objects, these concepts were guiding us, closely connecting us to our initial aims: to provide a sense of repurposing of the old. Here we will revisit three of the main principles and what we have learned by incorporating them: working on a low budget, introducing chance to design and combining original values with new ones.

At-hand: Working on a Low Budget
In DIY practices, work is usually done on a low budget, using cheap or easily available materials and quick interpretative ideas. There are established activities, such as *freecycling* with dedicated online communities [27,61] that allow for the exchange of old and defunct artefacts. In our Delete by Haiku design case, we chose to work with mobile text messages, which are easily attainable and, for the mobile phone user, free. Others have attempted to repurpose digital content and user interfaces [26].

As we move into the digital realms, there are other methods that require equally low budgets. One such interesting method is *reverse engineering,* in which knowledge is extracted from the artefact (hardware and software), as design features are deduced through deconstructing it [31]. Such a process has a design potential for repurposing and upcycling. Another possible method is *improvised engineering*, that is, solving engineering problems with whatever materials and tools are at hand.

What is perhaps additionally interesting when repurposing old text messages is the underlying political issue. Big Data is often referred to as the "new oil" (Bryan Trogdon) [1] as large corporations make substantial profits from harvesting personal data. Mobile text messages over time, or any other personal and sentimental data, through their abundance on personal users' devices, could be thought of as *Little Big Data*, large in quantity on an individual level, but not really on a "Big Data" scale. That data is of undetermined quality, untouched and not interpreted yet, till it is stored on users' personal devices, and it is not harvested by third parties nor shared with anyone. Most qualities it has are personal, private and mostly valuable on an emotional level, sometimes sentimental, whose importance is its content and information level instead of as data. Although it is not yet converted into data, it contains qualities of data. Oftentimes,

those Little Big Data streams, our personal data, are worth so much to corporate entities, and yet so little to us as end-users. Upcycling of those text messages into haiku poems draws our attention to the value of the mundane, putting us in contact with the kinds of data that corporations are already tapping into and using for their own projects. The materials may be cheap and readily available, but its potential value has become enormous. By empowering users to engage with this data, we aim at getting users and the HCI community to explore issues around Big Data – ownership, privacy, and so on – from the bottom up, rather than from a large scale perspective such as Google's or Facebook's handling of it.

Introducing Chance to Design
In repurposing practices, randomness and coincidence are crucial. This is why we purposefully introduced chance into our workshop process as well as into the way the Delete by Haiku algorithm works when selecting words and sentences from the text messages. A creative process within the arts determined by and concerned with processes of chance is called *aleatoricism* [21] (seen in Figure 7).

Dadaism and Fluxus promoting chance procedures [6,44] clearly appear in Duchamp's Erratum Musical (1913) and later in John Cage's music compositions. For example, Music of Changes (1951), textual collages of Fluxus by Maciunas [43,44] and *Silence* by Cage [8] are prominent examples of forms of indeterminacy and aleatoricism in the arts. Matthew Herbert's music production exemplifies how chance can be used in contemporary music. He experiments with whatever artefacts are at-hand and plays live performances, for example, with a can or produces music from body and food signals. Improvisation, interpretation and indeterminacy are important features in those settings where live performance is the end result of the repurposing process. Burning newspapers and using the left-over pieces as we did in our workshop is an example of an aleatoric approach (seen in Figure 8) in which chance is introduced through letting the burning complete the process.

Combining Original Values with the New Ones
In a repurposing process, some of the old properties of the artefact become incorporated and adapted to fit with the new design. However, some of them have to be changed into new properties, qualities and functions in order to add the required new value (in upcycling a higher value is required). There have been some attempts in HCI to facilitate repurposing, as in, for example, repurposing of barcode-technology to facilitate indoor navigation [37] or repurposing a laptop to create a novel musical instrument [23]. As mentioned in the background above, design actions that might be applied in order to bring out this potential are, for instance, simple acts such as flipping, rotating or turning around in order to see an object in a new light. For example, a chair can be turned upside down and fixed onto the wall to become a shelf, adding a substantially new value.

The initial and original properties of an artefact constrain and limit the repurposing process but also help the user to grasp the major constructive parameters of the upcycling and repurposing aesthetics. The properties of a previous design (the shape, materials, functions, damaged parts) of the initial object become the materials for repurposing. Overall, at least some properties or elements of the initial artefact have to be kept evident in the final form of any repurposed artefact – in particular if we aim for upcycling. Through this process repurposing becomes a *critical practice*, calling for new perspectives and new ways of seeing what is there, offering an opportunity to deconstruct the newly designed artefact picking up on materials, values and significant factors there as well as reading the embedded cultural connotations within the material artefact, be it digital or physical.

UPCYCLING AND REPURPOSING AESTHETICS

Similar to other design strategies which have been discussed in HCI, such as: ambiguity [17], defamiliarization [3], or machine aesthetics [49], repurposing is not a one-for-all tool whether for design and art practices, or for information technology and computing. Nonetheless, as we have shown in this paper, it can be one tool in our design repertoires to aid designers in creatively generating designs in a structured manner. In this case, it involves thinking about and building on the materials that have been intentionally created and already have complex and somewhat valuable forms to build on and that are already there for free.

The most important way we see repurposing aesthetics in interaction design is as a lens through which designers develop their design cases in regard to repurposing processes. In this case, however, the upcycling aesthetics mostly refers to the end-user experience, which is shaped by inviting users to take an *active and creative stance*. By inviting participants to take part in shaping the artefact through repurposing, we wanted to create ways of experiencing the project through the upcycling and new value additions. An inherent quality in any upcycling process is the subjective value added by this interpretative process in which new meanings and relationships are created by re-evaluating, re-contextualizing or reimagining already existing ones. To the end-user, the creative upcycling process brings forth these aspects in several steps, combining old and new properties of one or several existing pieces of information, contexts, artefacts or users' relationships to them, thereby creating significant and meaningful intersections between the previous and new states. This active, creative process is at the heart of what we mean by upcycling aesthetics.

MATERIALITY OF THE DIGITAL

Research on materiality in HCI is gaining traction and deals with a wide scope of materials, bringing materials into a design process in its early stage [11], working with computational materials for interaction design [53], noticing digital material qualities in design [48], discussing various manifestations of the immaterial through diverse historical and cultural contexts [30], using radio signals as design material and discussing it through an immateriality lens [45], performatively engaging with materials for music production [12], discussing imperfection in relation to interaction design [51], appropriating materiality for meaning and spirituality [16] and lately having a discussion and working with experiential qualities [28] of materials for emphasizing and creating materials experience patterns [18]. Materiality research in interaction design and HCI discusses multiple aspects of materials touching upon physical and digital, meaning and experience and opens relevant design spaces for designers to engage in practical work.

Following on this materiality discussion in interaction design and HCI [15], we see how physical materials are sometimes, but not always, intertwined with the digital materials. We draw our design with both physical and digital, eventually emphasizing the digital aspect and its specificity within recycling-oriented practices, but, in our case, we take account of materiality through a body of text. This specific field of working with text and language, on the one hand, narrows down the complexity of the endeavour, but, on the other hand, makes repurposing even harder as it requires taking semiotics into account.

While the digital world should not be seen as separate from the physical world, the digital materials (or digital waste as in this case) as a basis for our creative efforts are quite different from creativity arising from engaging with physical materials. Some acts are much easier to perform in a digital world, such as moving words, deleting them or treating whole text masses algorithmically. The final sharing process, spreading the resulting poem, can also be accomplished in many ways, reaching many easily in the digital realms, quite different from a physical setting.

We must draw on materiality as a way to understand the components of the digital as well as to contribute to an understanding of digital materiality in itself and bring that to our end-users. It allows users to perceive the power behind what was largely left behind as "waste," how it can be repurposed and given a new life, something which is already happening under the term "Big Data" and which the HCI community as well as users struggle to grasp: "one man's waste, another man's gold".

In the interaction with Delete by Haiku, the end-user is encouraged to engage with the text through a collage technique, selectively moving words in the digital format, setting aside traditional physical writing or digital typing. The algorithm plays a critical role in this process, facilitating and enhancing the making of the poem; the user is, nonetheless, actively involved in the interaction.

The aesthetics and evocative nature of Delete by Haiku relies on a particular stance to what properties we choose to extract from the digital material/waste, that is, from the mobile text messages. We can, of course, choose to regard

them as ASCII signs or a bag of letters, but that would not have preserved and then repurposed their value in the eyes of the users. It would have become meaningless. Words, parts of sentences and the structures of the text messages are more relevant to a repurposing process. Using letters would have been a form of recycling – and as such meaningless as any digital process can ultimately be reduced all the way to currents flowing through a circuit, a level at which the recycling metaphor breaks down. What we find especially intriguing here is how the end-users can be empowered through the process of interaction sort of the "upcycling of interactions" view, in which the creation of new values appears. The digital, interactive material affords participants the opportunity to actively engage in the upcycling process – they, in a sense, become authors of the upcycled end-product, The authorship responsibility becomes shared between artist (or designer), system and the user. In that role, upcycling can become a powerful tool in critically and playfully examining the proliferating abundance of digital artefacts, data and applications we all live with, thus creating new relationships and meanings.

THE DEATH OF THE AUTHOR IN THE DIGITAL AGE

The generative and interactive aspects of Delete by Haiku, connects us to Roland Barthes' "The Death of the Author" [2] manifestation and his undermining of traditional literary criticism and the notion of the author's intentions and biographical context in an interpretation of a piece of art. It is a discussion regarding not assigning a single interpretation to the work of art (in this case – a text) as we cannot know the original and precise intentions of the artist. Barthes claims: "The unity of a text is not in its origin, it is in its destination."

This perspective shifts the focus onto the reader instead of the writer. Furthermore, he claims: "The birth of the reader must be ransomed by the death of the Author."

Tying Barthes' theories back to our Delete by Haiku project, paradoxically, we see how the user becomes an author in the production of the generated poem, but also the reader, the receiver of the poem, gets the same credit just by reading it. The mixing and spreading of the authorship to several parties is thus much easier in the digital realm. This fact in turn makes us ask questions about rights and how they can be shared – even for a small and humorous application such as Delete by Haiku: who is the poet behind the resulting poem? Everyone can suddenly be turned into an author, as everyone can change the artwork and in turn share it. Through a limited interaction, a limited creative act, they become authors.

We may also ask ourselves what the role of the haiku-generating algorithm is? What happens when the haiku-generator becomes an active agent, an intelligent supporter, not only a simple matcher of random words or, for example, as in The New York Times Haiku project, in which whole sentences are simply layered down into the three verses? Further, is the algorithm and interface merely a transparent

support, so we as users are still in charge of the processes and are able to make decisions on how to use our own data, without any hidden processes underneath?

Another important question is how do we deal with the mechanisms of sharing everything, and who in the end owns digital possessions. Is it the one who collects them and eventually shares an "object" online that has more rights and privileges, or are we all on the same level, all jointly owning it, authoring it? Also on a more political scale – if we see this through the upcycling lens, which values are currently attributed to our Little Big Data (do we want to attribute corporate values to our sentimental data?) and what do we get back from sharing our intimate communications and sentimental data?

CONCLUSIONS

In this paper we started with presenting our main concept in relation to practices in design and the arts. In our discussion of artistic as well as design or DIY practices, we have identified important aesthetic principles that have arisen within traditional repurposing practices: reuse and upcycling. We use our design case, Delete by Haiku, to show how we explored this space, in the digital domain, through repurposing directions dealing with digital waste, and implications for thinking about personal data. Namely, we have suggested that working on a low budget, introducing aleatorism and combining the original values with the new ones are important resources to think about when building these aesthetic expressions within a material digital framework and contributing to the material turn in HCI [15]. While expanding our design space by showing how these aesthetic forms and values can enrich how we think of digital interaction-design was our central focus in this work, it led us to reflect on a wider range of topics: the value, materiality and ownership of our personal data in particular, something which is very timely, thereby tying it to a larger societal debate on what Big Data and Little Big Data really mean.

To live a rich human life means engaging in practices, such as, remembering [42], dealing with life and death [5], creating our identity [24,34], managing our social relations, avoiding becoming overwhelmed by all the data we get from life-logging applications [42] and so on. In many of these settings, design through the lens of repurposing aesthetics and user experience through upcycling aesthetics may open up design spaces previously untapped, helping us to create practices that are manageable on a human scale. Directions for the upcycling and repurposing design processes can provide a means to cope with the masses of information that we generate without losing its sentimental value – a form of *qualified-self* instead of the more famous quantified-self movement.

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