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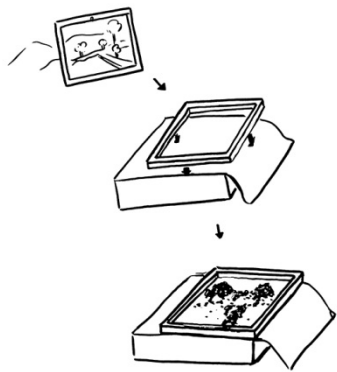
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# Wet Pixels: From Digital to Analogue Originals



**Figure 1:** A concept design scenario of the full Wet Pixels input-output printing sequence. From top: A frame with embedded camera is utilized for image capture by the user; data is then output as a 5 x 5 pixel resolution print of wet paint on Japanese paper. Users engage, in a gallery situation, through tangible interaction with Wet Pixels, which translates digitally-captured pixels into printed "digital originals".

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## Abstract

This paper reports on experience design work currently in progress. "Wet Pixels" is intended to stimulate discussion around the notion of reproducing original digital images in a physical medium. The prototype's design is informed by mechanical reproduction devices (e.g. relief press, large format camera) and retrospective print processes (halftone, dot matrix). The original conceptual design (Figure 1) constitutes a miniature camera encased in a wooden viewing frame that would enable viewers to select and capture photographs. This image could subsequently be printed onto Japanese paper using an Arduino-controlled matrix of stepper motors topped with paint-tipped sponges. When presented in a gallery, Wet Pixels provides users with greater sensory feedback (physical, visual, auditory) than entirely digital processes through tangible creative mark-making on to paper.

## Author Keywords

Digital Arts; HCI; Experience Design; Digital Economy; Printmaking

## ACM Classification Keywords

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



**Figure 2:** The Stamp-it process (a) Copy: Stamp on target image to photo capture. (b) Paste: Stamp on paper to print captured image; a cartridge moves in x-y direction. (c) Release the device after process. (d) User may edit the original image as they wish.

## Introduction: Situating the Work

*Cultural and Disciplinary Convergence: Arts and HCI* Prototypes developed in the science lab and the design workshops are increasingly being presented in galleries and museums [1]. In fact, media arts—a broad range of practices that inherits from a spectrum of expressive art forms and embraces digital technologies—and some practices within HCI are said, by some, to be continually converging [12].

Two projects that are situated at this transdisciplinary conjunction between media arts and HCI, and therefore inform this work, are PixelRoller [14] and Mechanical Mirrors [15]. PixelRoller was produced within the Interaction Design unit at the Royal College of Art in 2005 and exhibited at the Tate Modern gallery. It constituted a "performance tool" that printed any pixilated digital image or text onto a physical surface, such as large rolls of paper. Mechanical Mirrors was an earlier artwork by Daniel Rozin. The interactive "mirrors" reflected back to the viewer a "low resolution" pixilated self-image in real time in a gallery situation. The "mirrors" incorporated a range of traditional materials and processes including wooden squares, rusted metal and woven material.

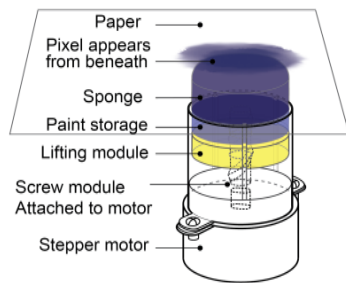
Wet Pixels combines elements of these two works. First, the very low-resolution photo pixilation of Mechanical Mirrors (and similarly incorporating camera input, motors and computer technologies) in a real-time interactive experience. Second, it incorporates the physicality, participation and performativity of PixelRoller. However, Wet Pixels builds upon this by inviting the gallery visitor to experience the work for them self rather than watch its creators demonstrate its use. Similarly, Wet Pixels also produces a digitally-

realized, tangible print output of a highly-pixilated representational image.

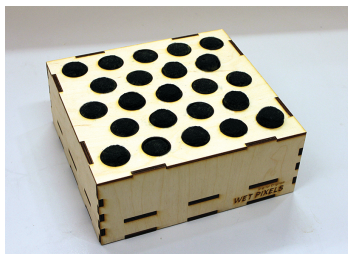


**Figure 3:** Concept model of Stamp-it.

In addition, Wet Pixels builds upon a preliminary concept design project developed in 2009 by the first author (Figure 2 and 3, and see [11]). Stamp-it proposed a "copy-and-print" all-in-one device for playful creative tangible interaction. The hand sized device was intended to enable the user to select and digitally "copy" a drawn, printed or written representation by pressing the device down onto it (Figure 2 (a)). The image beneath the device is then photographed. As the device is pressed again (b) the photographed image is converted into a printout (c). The concept design was intended to enable the user to then physically engage with their reproduced image by annotating with crayons, pens, paint etc. (d). The physical and technical constraints of working with print technologies led to the exploration and production of Wet Pixels. Wet Pixels allows for the physical delivery of digital pixels in real time, in the same vein as the concept design of Stamp-it, but is no longer a hand held device.



**Figure 4:** Schematic of an individual Wet Pixel mounted all together on a 28BYJ-48 – 5V stepper motor.



**Figure 5:** Exterior cover of the Wet Pixels prototype displaying honeycomb grid format with paint-tipped pixels.

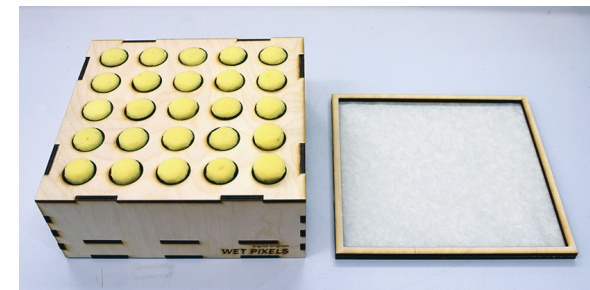
### Wet Pixels: Art and Experience Design

Wet Pixels is being developed as part of a series of prototypes that explore reproduction as a space for design [7][8][9]. Digital technology is currently transforming the ways in which creative output is produced and disseminated. However, it is not easy to limit the dissemination of a digital file, as anyone involved in the music industry would attest. Digital reproduction produces perfect copies for minimal cost. The notion of a limited edition print in fine art was developed to convey value on a reproduction through scarcity [3]. Earlier forms of printmaking, though more time consuming and expensive, produced reproductions which were slightly different to one another, for example prints resulting from a wood block coated in ink. Wet Pixels explores the notion of incorporating the imprecision of analogue printmaking techniques in a digital context.

Wet Pixels is not intended as a defined solution to the problems described above but as part of an explorative creative process in which interaction and experience design might connect in different ways to questions of reproduction in the digital age. The aim here then, is to frame the user's experiences of a work of art in such a way that a particular print, and the digital file from which it was produced, might be valued in relation to one another. By taking an experience design approach [17] the intention is to arouse participants' interest and engagement in digital-analogue reproduction processes, and in more sensual forms of image creation than facilitated by current ink jet or laser processes. By physically realizing digitally encoded images, this first iteration of the prototype design exemplifies some of the complexities concerning paradoxical notions of a "digital original".

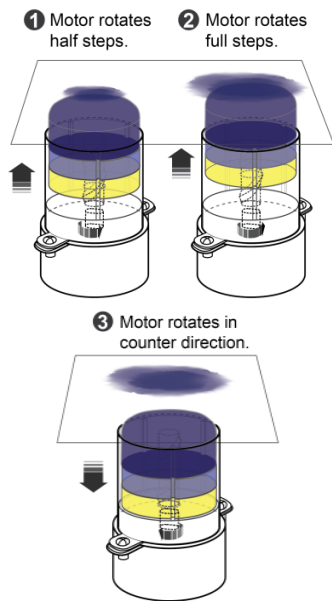
### Wet Pixels: Physical and Technical Design

We have developed a 25 pixels matrix version of Wet Pixels as a proof of concept (Figures 5 and 6). The prototype is operated by serial communication using Arduino open-source electronic prototyping platform and Processing programming language.

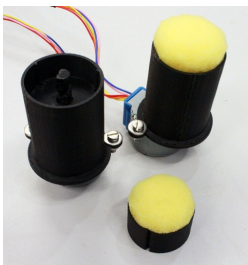


**Figure 6:** 5 by 5 matrix version of the Wet Pixels prototype. The Japanese paper frame is shown on the right.

As illustrated in Figure 4, each pixel is operated by one unipolar stepper motor attached to ULN2003AN chip driver module. The motor was fixed on the bottom of a 3D printed screw module to control each pixel. A screw module affords a simple mechanism that converts the rotation of the motor into a linear movement. A lifting module attached to the screw carries each pixel module upwards and downwards iteratively. The stepper motor was chosen as an actuator for its very deliberate control of these rotation steps. Each pixel will ascend according to the saturation level of the initial pixel recorded in the digital image input via the camera. The higher the pixel rises and longer it remains in that position, the darker and larger the paint stain will appear on the paper (Figure 10).

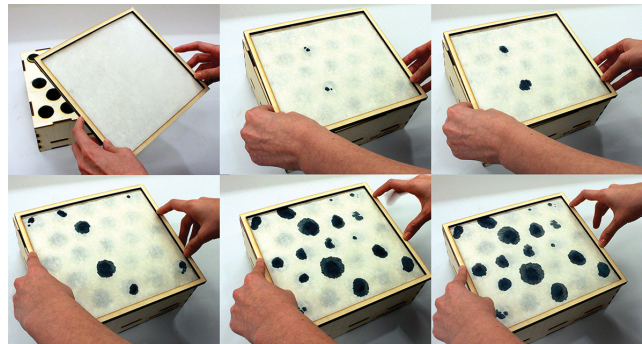


**Figure 7:** The printing process: 1 and 2 illustrate that when the motor rotates the inked pixel ascends beneath the paper. In 3, the motor descends, as it rotates counter-directionally it leaves behind an imprinted image on the paper.



**Figure 8:** Detail view of the pixels.

The name Wet Pixels is indicative of the process whereby watery paint will stain the pixels on to the paper. A thin plain Japanese paper that absorbs the paint drops smoothly was selected. When the pixels arise from beneath the paper, the watery paint soaks into the paper like ink drops (Figure 10: Left). The viewer, or the user in a gallery scenario, would capture an image (i.e. Figure 1) and witness its physical realization on paper (Figure 9, Figure 10: Right); as is similar to an image's appearance on a screen with digital pixels. The attempt is to design a physical equivalent of digital pixels with more sensory, artistic painting effects.



**Figure 9:** Process shows how Wet Pixels prototype works to create a random abstract image.

#### *Scenarios of Use*

It is proposed that Wet Pixels be displayed and experienced in a gallery context. A portraiture painting installation scenario would be appropriate whereby someone standing in close proximity to the prototype uses the camera-viewing device to generate a portrait of other gallery visitors. The experience would engage people with the live performance of portraying themselves and their friends, meanwhile generating

tangible forms of art. Wet Pixels plays with notions beyond the pressing of a device button, or clicking on a screen icon: everyday actions that digitally print a visual representation via the ubiquitous laser or ink jet printer. Rather, The Wet Pixels user may select an "original" image using the camera and witness the full creative production cycle to printed "digital original" output. Wet Pixels constitutes a full input-output digital original printing machine, as in the scenario illustrated in Figure 1.



**Figure 10:** Some pixels ascending to the paper (Left) and visualization of the resulting image (Right).

#### **Discussion**

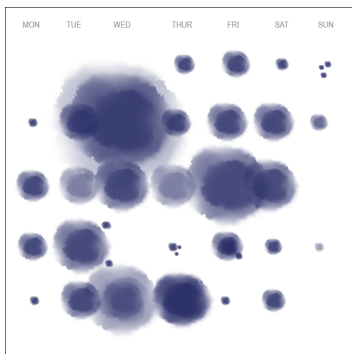
The goal of this design research is twofold; to investigate challenges within arts practice brought about by digitization and to a lesser extent to explore notions around digital aesthetics.

Regarding the first, and as briefly outlined, severe challenges are apparent in the creative industries with the advent of digitization due to the ease and speed with which digital files can be copied and shared (see [7]). The music and film industries have been radically transformed by associated technologies and face tremendous difficulties around the control of file sharing and protection of intellectual property.





**Figure 11:** Anticipated printing process with 100 by 100 Wet Pixels.



**Figure 12:** Life logging calendar painted with Wet Pixels. The size and opacity shows the amount of accumulated data.

On the one hand, digital technology is transforming the ways in which art is produced and disseminated. The British artist David Hockney has produced a large body of work on the iPad and iPhone using the Brushes app. When he began emailing these images to friends and colleagues critics began to ask where the original of such work might be [2]. Art dealers have begun to seek new models for generating income in the digital age. The 'S[edition]' website for instance offers users a "digital vault" where users can see the digital "limited edition" images that they buy [15]. Artists such as Damien Hirst are offering digital prints in runs of 10,000.

On the other hand, the art establishment is said to have been "curiously unresponsive" to the disruptions wrought elsewhere by digitization [4]. Academic Claire Bishop concludes that the pervasiveness of more material art forms in the elite art world is primarily due to "commercial viability" (ibid). Another critic notes that successive record-breaking art auction prices are driven by global capitalism [10]. Art has become a reliable investment for the super-rich as turmoil continues to grip the financial markets (ibid). Economic models based on provenance and rarity remains key to art's desirability as a commodity. Complex cultural contradictions are very much evidenced in contemporary art practices.

Regarding digital aesthetics, James Brindle has posted a collection of photographs on Tumblr [6] which aim to exemplify the convergence of virtual and physical visual languages. His work and notions of a resulting "new aesthetic" has generated much discussion amongst media artists, critics and curators [12][16]. Images typically display evidence of their digital means of

generation, e.g. forms of digital or data visualization, digital montage or more literally, digital imagery that draws attention to its digital form through pixelation.

## Iterations and Applications

This work in progress paper concludes with some proposed iterations for Wet Pixels. The prototype would be simultaneously enlarged and further miniaturized if given sufficient resources. A 100 x 100 matrix is desirable, using more miniaturized electronic components. However, these are designed and developed for the electronics industry (e.g. for cameras), not intended to be combined in such large numbers, and therefore prohibitively expensive. However, such a prototype would enable more complex images, as suggested in Figure 11. Furthermore, the pixel surface could be designed into different shapes (triangular or square) depending on the style of the image being created.

A smaller device would additionally untether Wet Pixels from a gallery situation, making it applicable in a variety of novel research contexts. Figure 12, for example, uses Wet Pixels as a visualization output device applied in a pervasive interaction life logging context. Peripherally embedded sensor-captured data pertaining to everyday life could be collected, and then output by a device such as Wet Pixels. Visual feedback of one's daily lived-life patterns might be presented in an alternative, more organic and abstracted aesthetic form, quite unlike schematic graphical formats typical in data visualizations. Another scenario is to foster collaborative art-making, extending the scale of interaction and production to a group. Since the pixels are able to be lifted individually, each pixel can be assigned to one person.

The applications proposed here share a common objective, that is: designing more physical substitutions of digital bits and bytes, thereby preserving aspects of provenance and originality. This paper proposes that Wet Pixels provides one possible perspective to raise discussion around the severe challenges due to the ease and speed with which digital files can be copied and shared. Wet Pixels exploits digital technologies to mediate and transfer human creative expression onto stained marks on physical paper. Additionally, this experiential artifact is intended to provoke discussion and contribute to discourse around "disciplinary anxieties" [5], emerging and converging art genres and practices.

### Acknowledgements

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