vitamin B

a digital reading experience prototype

a project report by
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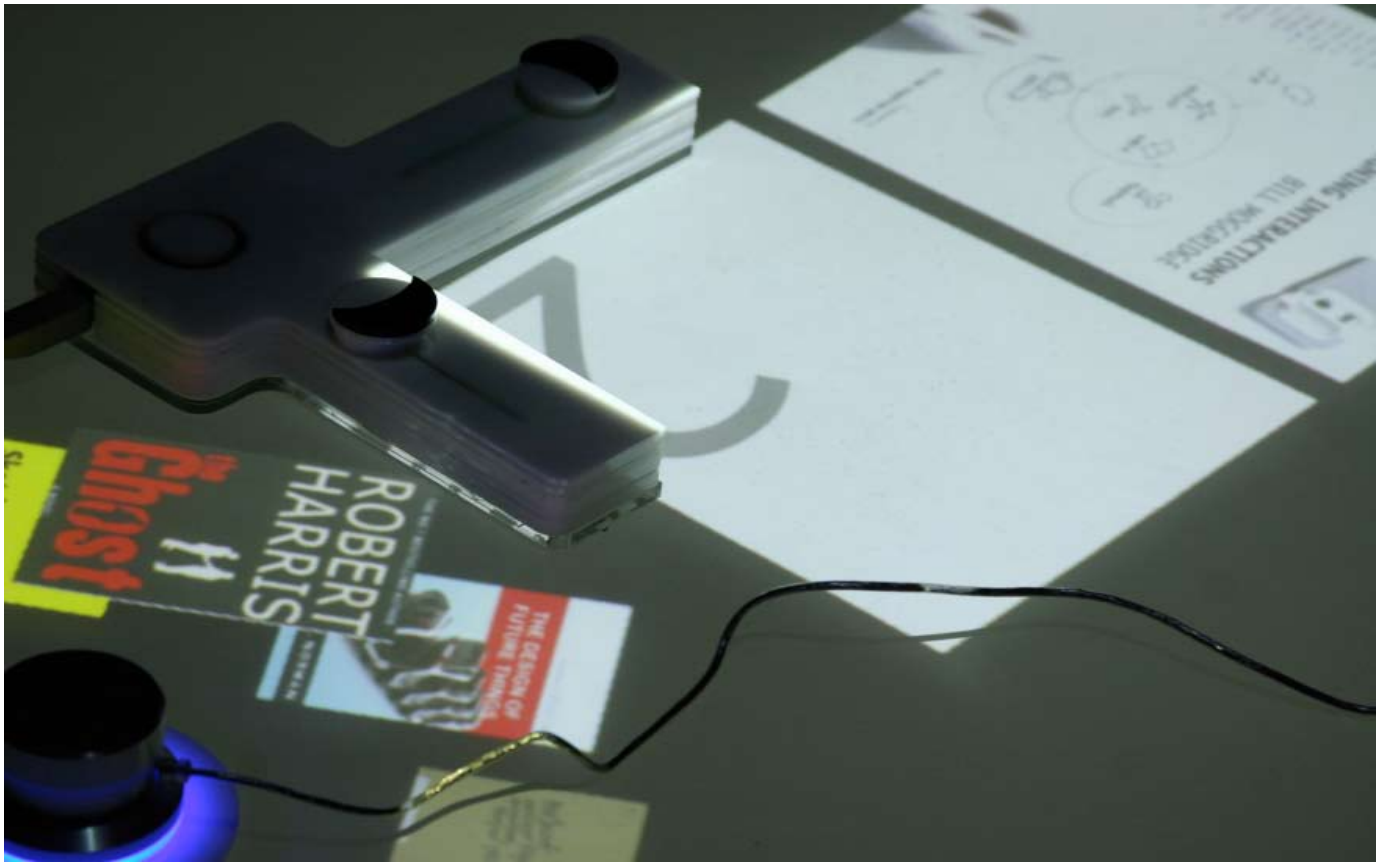
MA Interaction Design

this book is silent and **static**.



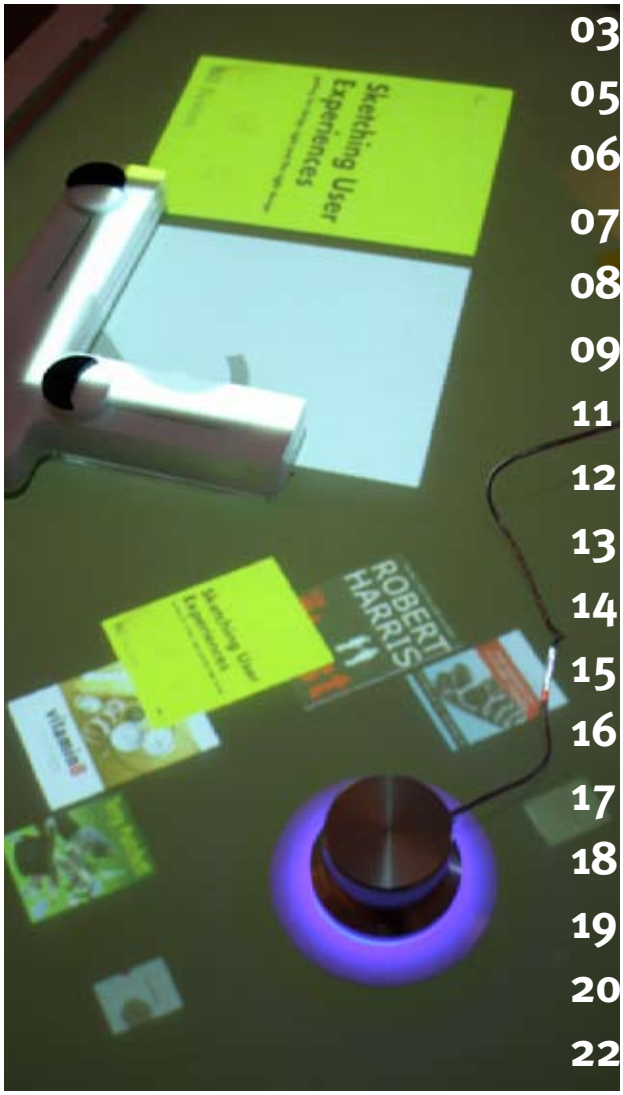
an image from the working prototype of Vitamin B

the stories it wants to tell are NOT.

contents

recipe

Lots of books in digital format.
1 X Griffin Power Mate
2 X Sliding sensors
1 X Pressure sensor
3 X LEDs
Arduino software
3 X Fiducial optical codes
'VVVV' software
Arduino firmata for 'VVVV'
Glass table top
Wooden box casing for table
64 X Infra-red LED's
1 X DV-Camera with phidget wiring
1 X Infra-red filter for the camera.
10 X Working days!



preface

an image from the working prototype of Vitamin B

exploring tangible interactive reading

"Change can be scary. When papyrus replaced clay tablets, and the Gutenberg press calligraphy, did a bit of panic set in? Are we in the midst of a revolution of similar proportion? Very probably."

Susan McLester
Editor-in-Chief
Technology and Learning Magazine

preface (2)

The stone tablet and papyrus scrolls were immediate precedents to the printed books we use so inseparably in our lives.

Could we attempt to prototype the new digital avatar of these so that people could experience them?

Could these interactions inspire us in any way?

An ancient stone tablet engraving
http://homepage.mac.com/rmansfield/thislamp/files/pageo_blog_entry37_2.jpg

An Egyptian papyrus scroll.
http://homepage.mac.com/rmansfield/thislamp/files/pageo_blog_entry37_1.jpg

introduction

photo courtesy of: http://www.flickr.com/photos/4737carlin/1643990968/

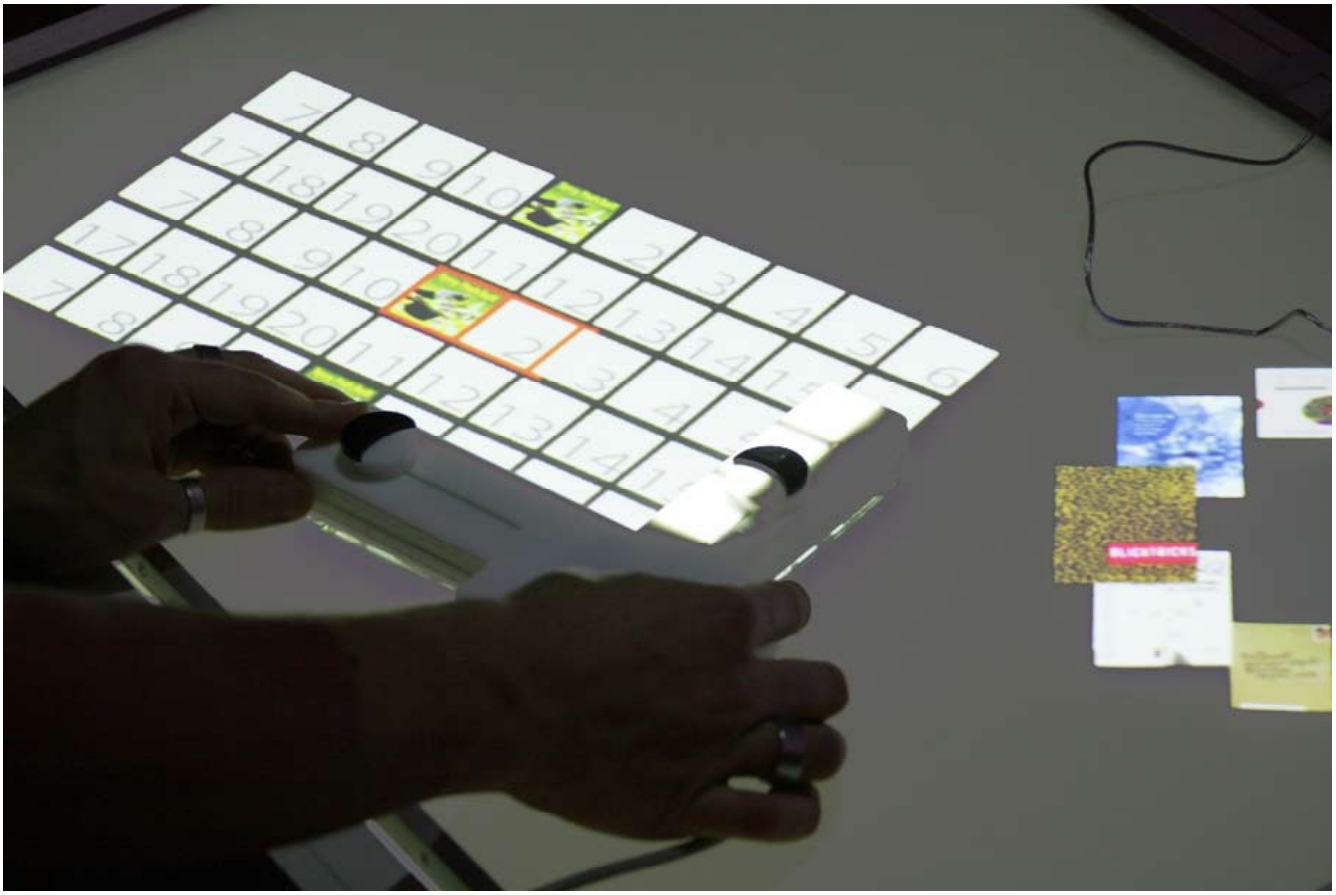
Papyrus scrolls, tablets carved out of stone, printed words on paper. How can we visualize 'books' for a digital tomorrow?

For traditional book-enthusiasts, the mere idea of challenging the 'form of a book' is something that would have been inconceivable until a few years ago. Even now, the takers for 'digitization' of books are far too few, with good reason.

E-paper, electronic ink, E-books and digital libraries are yet to become everyday commercial realities. With sustainable design becoming a key issue in the world today, printed paper - or libraries filled with them, can be seen as a waste of natural resources. Besides, the traditional format of reading books, whilst having their obvious advantages, is also beset with numerous limitations.

This experiment aims to develop a tool to demonstrate such a possible scenario for tomorrow's readers.

aim of the prototype



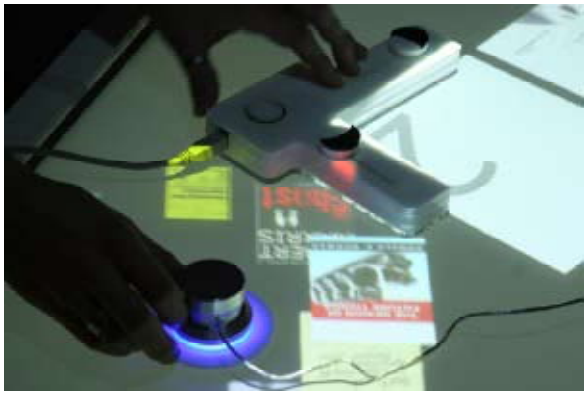
an image from the working prototype of Vitamin B

Objective: To develop a *tangible* platform or a tool to test a scenario for an interactive digital 'book-reading' experience.

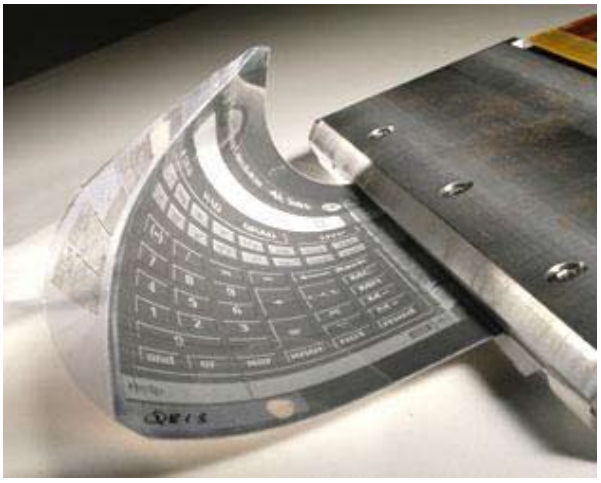
Vitamin B was an experiment.
It aimed to create a suitably thought-provoking 'experience prototype' to demonstrate scenarios for book-reading in a digital environment.

Vitamin B aimed to transform the notion of 'form' and 'interaction' in a book and in a library by bringing the experience to the table instead of an old 'dusty' building. It aimed to combine the dynamism and flexibility of a digital document (a flash file, a pdf file or quick-time movies) with the joy of reading a real book. It aimed to demonstrate the experience of reading a book in which pictures can actually come alive, stories can be read, listened to, copied, pasted etc.

Vitamin B was by no means an ideal solution.
The aim was to provide a tangible tool to visualize scenarios which would broaden definitions of stories, books, libraries and reading in our lives.



limitations and scope



To dream of a future with tools available today.

As interaction designers, it is our role to be able 'render' dreams to those who cannot .

During the process of designing and implementing the Vitamin B prototype, we were confronted by several technical limitations that naturally streamlined the scope of the project in the end.

Technology: Most of the experiences we have rendered could be achieved in many different ways using technology such as electronic paper, e-ink or other products that are currently under development by various agencies.

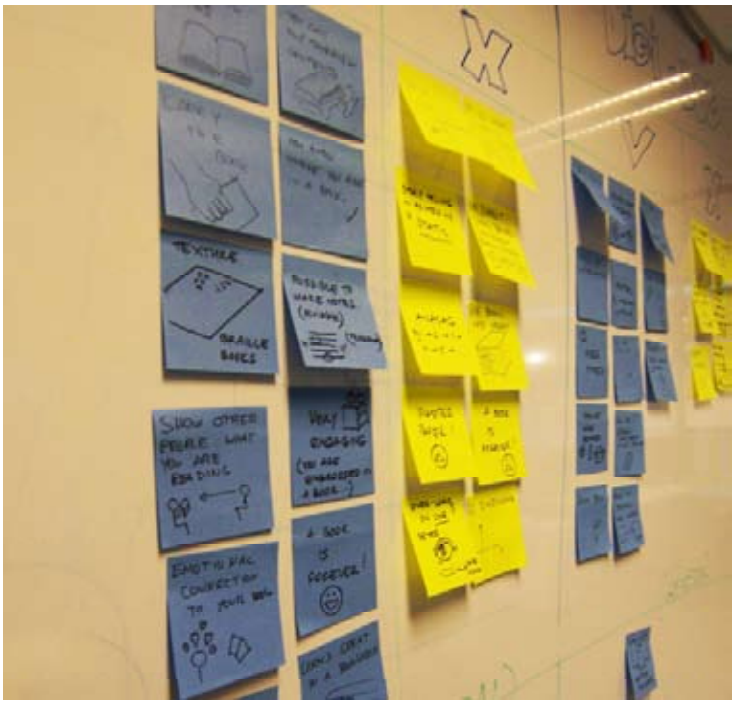
Time: This project was completed in 10 working days. Given a broader time perspective, we could have achieved a lot more depth in our decisions.

Image links:

1) http://images.vietnamnet.vn/dataimages/200707/original/images1371192_epaper.jpg

2) http://www.tamark.ca/students/wp-images/epaper.jpg

in the beginning



We began our project by comparing the attributes of reading a real book against those of reading a digital document.

The experiment started with a brainstorm about the various aspects of reading a book versus a digital document leading to comparisons and debates about the possibilities. The highlights of this brainstorm are listed below.

A Real Book	A Digital Document
1) Books can be touched, felt and carried around constantly. They are warm.	1) Digital documents are flexible in content, scale and size. They can be linked to movies, flsh documents and vastly empowered by the devicd they are housed in.
2) Books have a smell that is difficult to replicate.	2) A digital document can be linear or radially dynamic in its storytelling. The difference can be compared by a VHS cassette with a DVD.
3) Books can grow old with time.	3) A digital document is not damaged if notes are attached to it. They can be erased without trace.
4) Books become companions for their readers, who can flip through its contents in a park, in a bathtub or in a library.	4) A digital document (currently) does not drain natural reserves of wood.
5) The stories in books are static in content, scale and size. The pictures and text are exactly what they are - readers have to fill in the blanks using their imagination.	5) Digital documents can be multiplied and its data can be used with relative ease.
6) Most books are linear in their storytelling method.	6) A digital document is dimensionless, and hence lacks any memorable interaction compared to a book.
7) Books use paper which is a rapidly depleting natural resource.	7) Digital documents are cold and lack in character.
8) Once scribbled on, a book is considered 'damaged' or personalized irreversibly.	

paper prototyping

Images from the paper prototyping stage, using old magazines, post-its and scissors.

The conception of the Vitamin B prototype began with simple paper simulations of the interaction we were aspiring to create.

Owing to the rather short time-frame for this project (2 working weeks), we sought to make rapid paper prototypes of the interaction that we were aspiring to achieve through this experience.

We ripped apart abandoned magazines and used scissors, glue and clips to discuss various modes of content navigation such as flipping, scrolling, re-sizing content, copying etc. Some ideas which found greater merit was the idea of navigation using tangible objects rather than touch screens. In a world headed toward multi-touch screens, we decided to focus on touching, holding and moving real objects that would contain the book.

Left: Testing methods of scrolling and testing its limitations.

paper prototyping (2)

Using a vitamin capsule holder as container for the scroll books, we took apart an old measuring tape to mimic the spring-shut mechansm inside it.

The name Vitamin B came from the capsule for vitamins which we used as part of the paper prototypes. During this phase, we even dismantled a measuring tape inorder to mimic the spring mechanism in our scroll reader.

Left: Using simple low-fi paper prototypes to discuss modes of page flipping and the 'form' of such a device. The origins of the L-shaped device are shown here on the nearest sheet of paper.

fiducials and 'vvvv'

Image links:
http://www.infovis.net/imagenes/T1_N189_A1206_Reactable2.gif

We agreed that using fiducial codes and a software patch called 'vvvv' (free for non-commercial distribution) would be the most efficient way to prototype this experience.

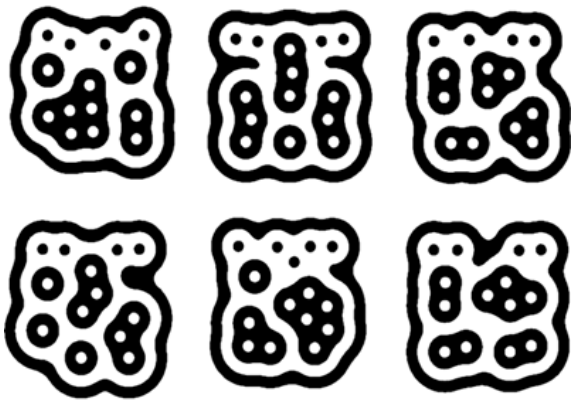


Image links:
http://www.atrapado.net/atrapado2/wp-content/uploads/2007/02/reactable2.png

Fiducials (left): These are amoebic bar-codes that can be tracked using various open source software platforms that are available online. These codes were first used for the project called the "Reactable" (http://mtg.upf.edu/reactable/).

The Reactable project was a big influence on the way we prototyped our experience.

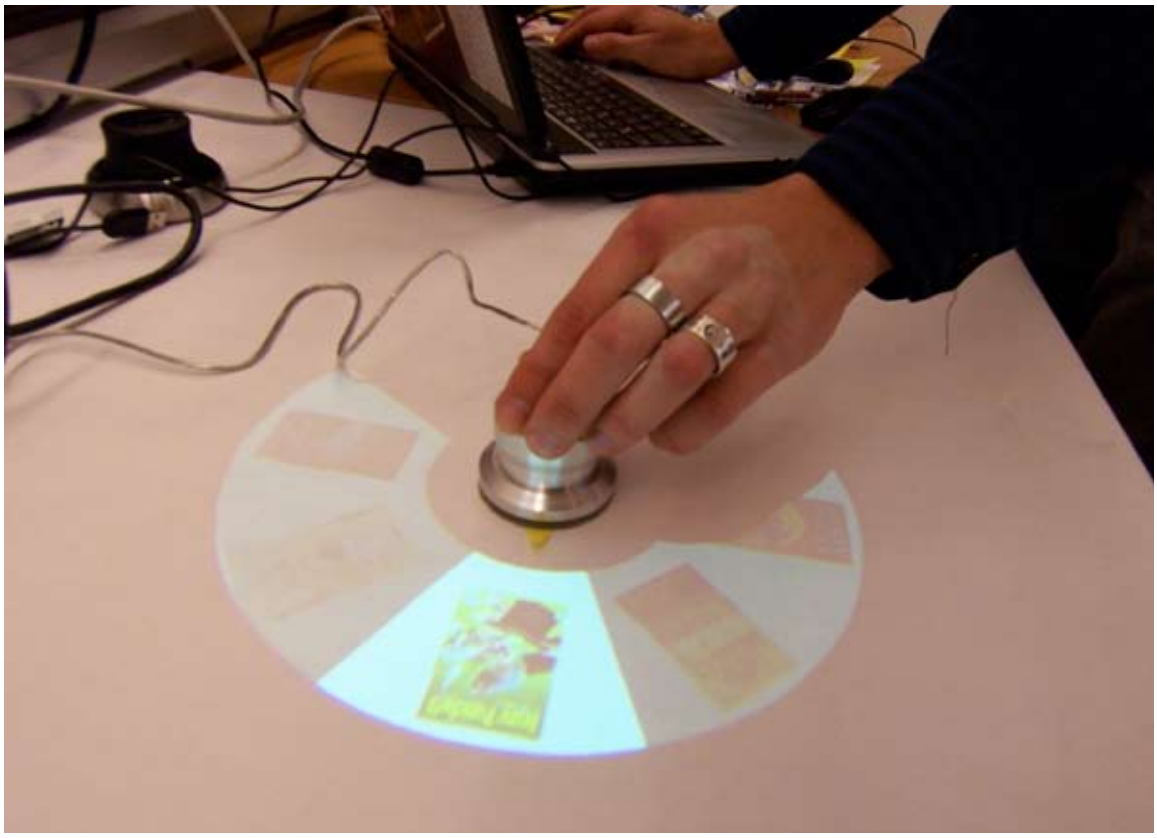
'VVVV' (http://www.vvvv.org/tiki-index.php): Jannes Peters had used this software during his days as a student at the Design School at Kiel, Germany. He decided to teach Rahul Sen the software during the course of this project and work together on developing the experience using 'vvvv'. This software was preferred because it gave instant and visual results.

setting up the scene

Setting up the experience was not going to be an easy task, with the limited time and resources at our disposal. Inorder to be able to view the fiducial codes in 'vvvv', we would need to set up an environment similar to the one in the 'Reactable' project. Our initial tests were conducted using an mini-DV camera and LCD projector, both suspended over a table surface.

Above left: Jannes sets up the DVI camera on the ceiling.
Above: The table surface now became the site for testing and developing the prototype.
Left: The combination of the DVI camera, LDC projector and table surface was the first stage we set up.

‘the wizard of oz’



Above: Testing the Wizard of Oz simulations for scrolling and (below) panning using hand gestures.

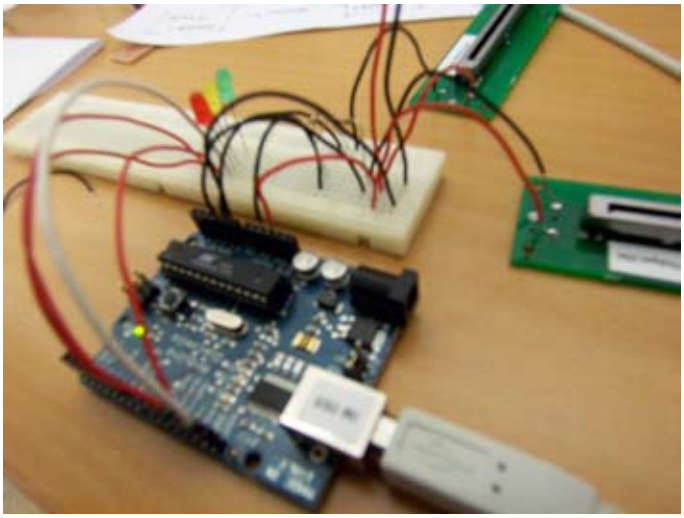
Using a combination of simple Flash simulations and using the mouse and cursor keys to control the navigation, we deviced a low-fi prototype to test scrolling.

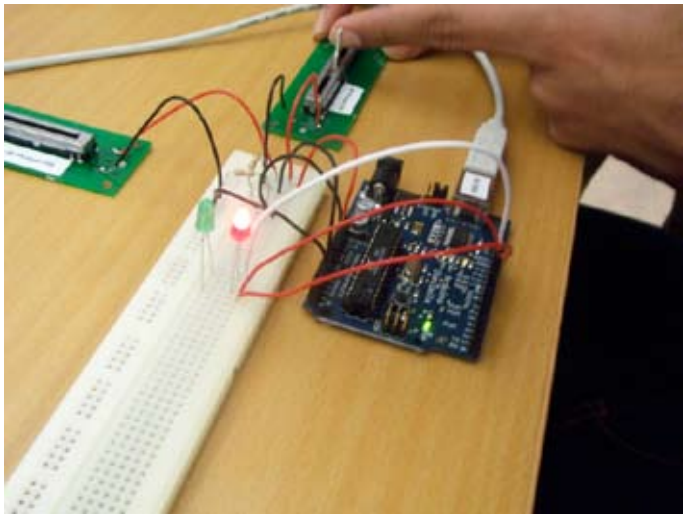
The Wizard of Oz technique, as the name suggests was deviced in the original story by the Wizard who simulated effects by designed illusions to produce that which had not been actually created.

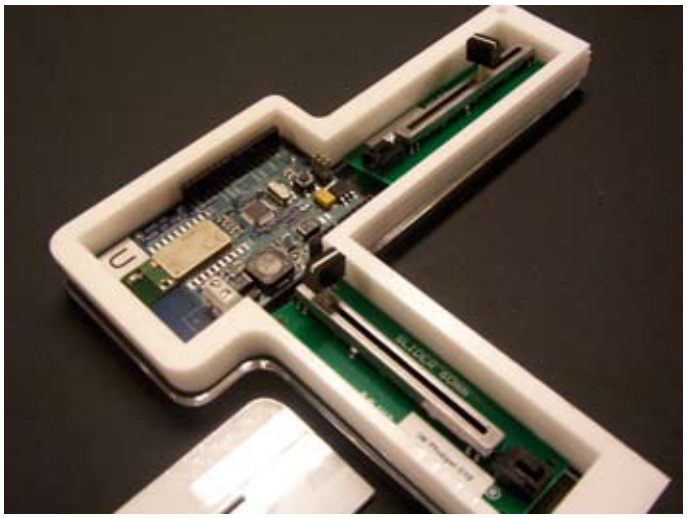
To test the methods of scrolling, panning, page-flipping we were trying to arrive at - we deviced some simple techniques using our projected environment, a few Flash simulations and our test devices like the Griffin power mate or just the hands as input devices.

While we were simultaneously developing the code in ‘vvvv’, and working on paper prototypes - we felt this would be the most appropriate stage to go into user testing to validate our ideas.

building custom hardware







Clockwise from top: The early configuration of the arduino board to LED's and potentiometers; Testing the combination; Encasing the combination inside the acrylic case; The final casing prior to sealing.

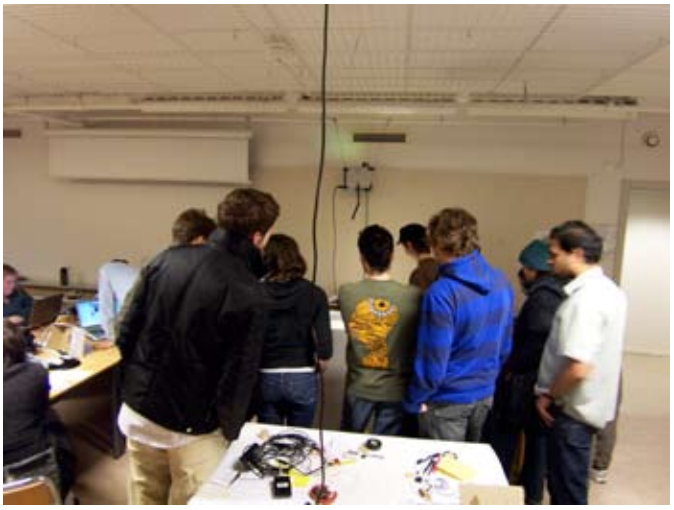
From a multitude of paper prototypes, we had decided to pursue one 'device' that would act as the digital book.

The device was built using 2 potentiometers, connected to an arduino board. The third input device was a pressure sensor. The sliding sensors were to be used for page-flipping and page-scaling. The pressure sensor would generate thumbnails of the entire book, based on how hard it was pressed.

The configuration was encased by creating a box out of several acrylic sheets (cut on the laser-printer), which were then subesquently sealed shut.

The combination of sensors was configured on the arduino software to give tangible results on sensor-changes. The outputs used in this case were blinking LED's. Having test these with LED's, the configuration was connected to the 'vvvv' software using a arduino firmata installation.

user testing



On the fifth day of our project (Oct 26th), we conducted a short series of user tests with the prototypes we had built by then. The tests lasted about an hour and proved invaluable.

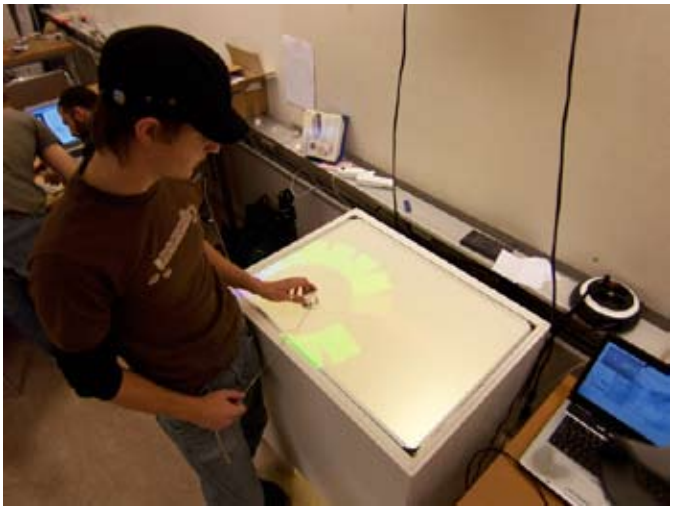
The users comprised students of Interaction Design in the first year, and Product Design students who very kindly agreed to spare us some time to give us feedback on the progress we had made so far.

Prime objectives:

- To test our interface on users who could give us feedback on the quality of the experience and how best we could fine tune it.
- To assess the coherence of the experience as a whole.

Method:

- The group was split in two, with Jannes demonstrating the working prototypes of the library object. This group comprised about 6-7 people.
- A second group comprising 4-5 users, were introduced to the 'book-device' to test the quality of the page flipping mechanisms and the scaling and browsing techniques.



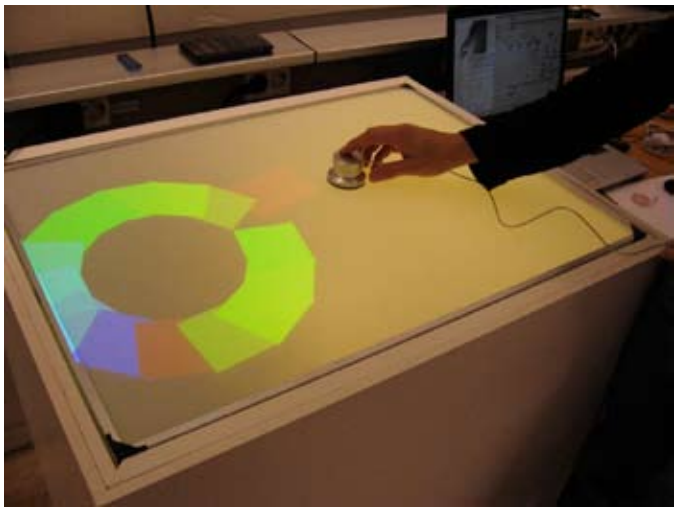
User testing proved to be an invaluable method for gauging the effectiveness of the interaction that was intended with this experience.

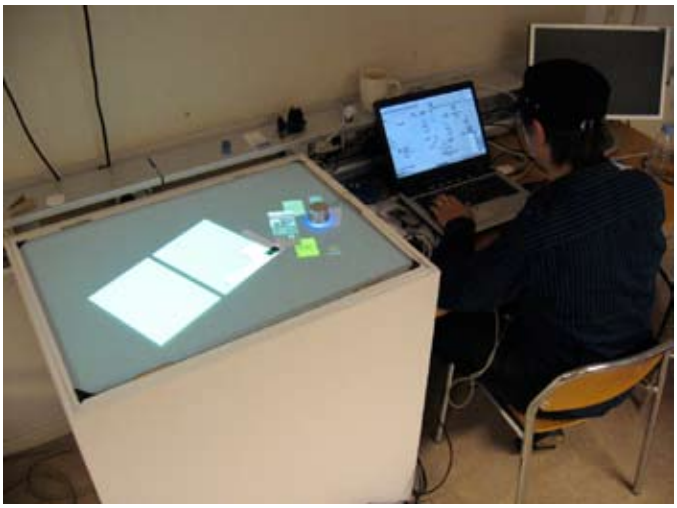
Having the actual physical model of the Vitamin B Experience Prototype working had huges advantages. Even though at the user testing stage, our ideas were in part conveyed by Wizard of Oz methods, partly by simulation and part reality, users were able to give tangible feedback with a tangible experience. In the absence of such an experience prototype, users would have debated and discussed this concept for hours without actually discussing real issues.

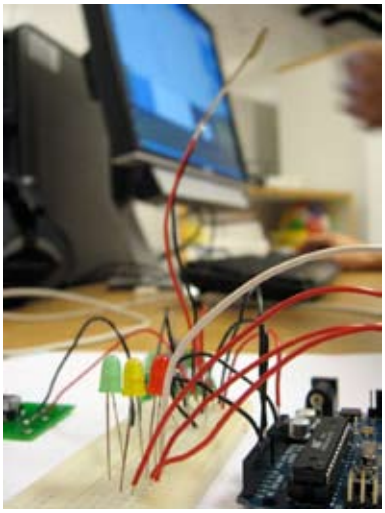
Results:

- The most definitive result of the user test was the fact that we realized how little of this subject area we were going to be able to prototype in the given time-frame. It enabled us to set our boundaries with our ambitions.
- The testing session also gave us helpful feedback about the effects we were trying to attain with page flipping, navigation and scaling.
- It raised issues about other possibilities.

towards the final setup







The next 5 working days were spent finalizing the Vitamin B Experience. We fine tuned the problems we were having with the webcam with a phidget DVI camera, and also worked intensely on developing the code on 'vvvv' and arduino.

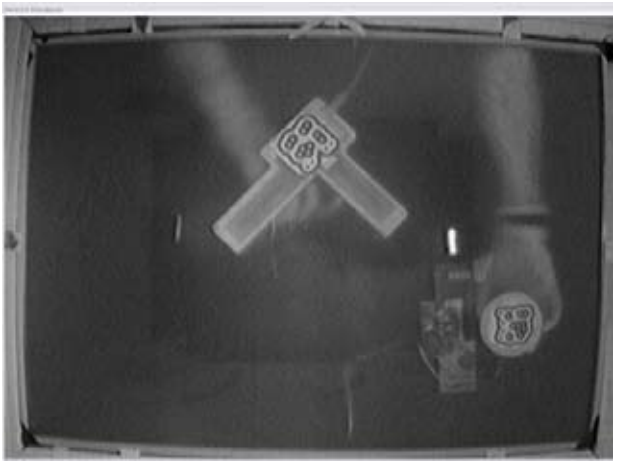
At the user testing stage, most of our mockups were made using coloured rectangles and random images to illustrate the pages, covers and content of books. Now in the final phase, we shifted gears into production mode and focused on achieving the degree of accuracy in the experience that we had aimed at.

The greatest problems we faced at this stage was in dealing with the delay of the projected image's movement with respect to the actual object's movmement. We were unable to identify the cause for a while until we learnt that the Panasonic DV Cam we had been using earlier was always going to give this slight delay due to its image resolution whilst image tracking.

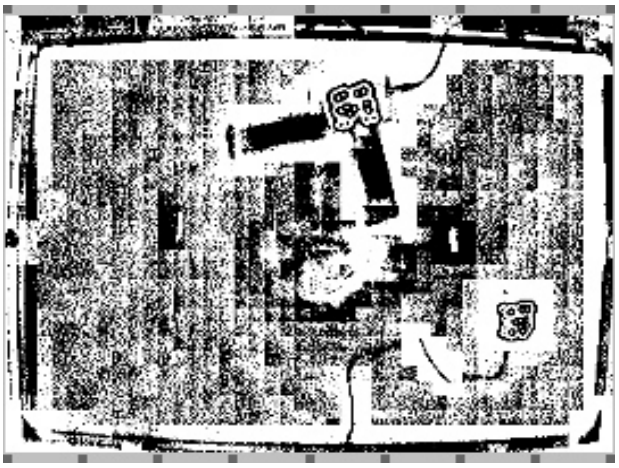
We also experimented with ways in which to multiply the quantum of infrared light within the box (caused by 2 X 32 IR LED's that we had setup inside it. We tried using aluminium foil, sheet and white paper. In the end we found that using simple black pieces of board was sufficient to cause a uniform reflection.

a look inside

vitaminB-table look inside - two ir-led panels and a dv-cam.



video picture seen by the dv-cam



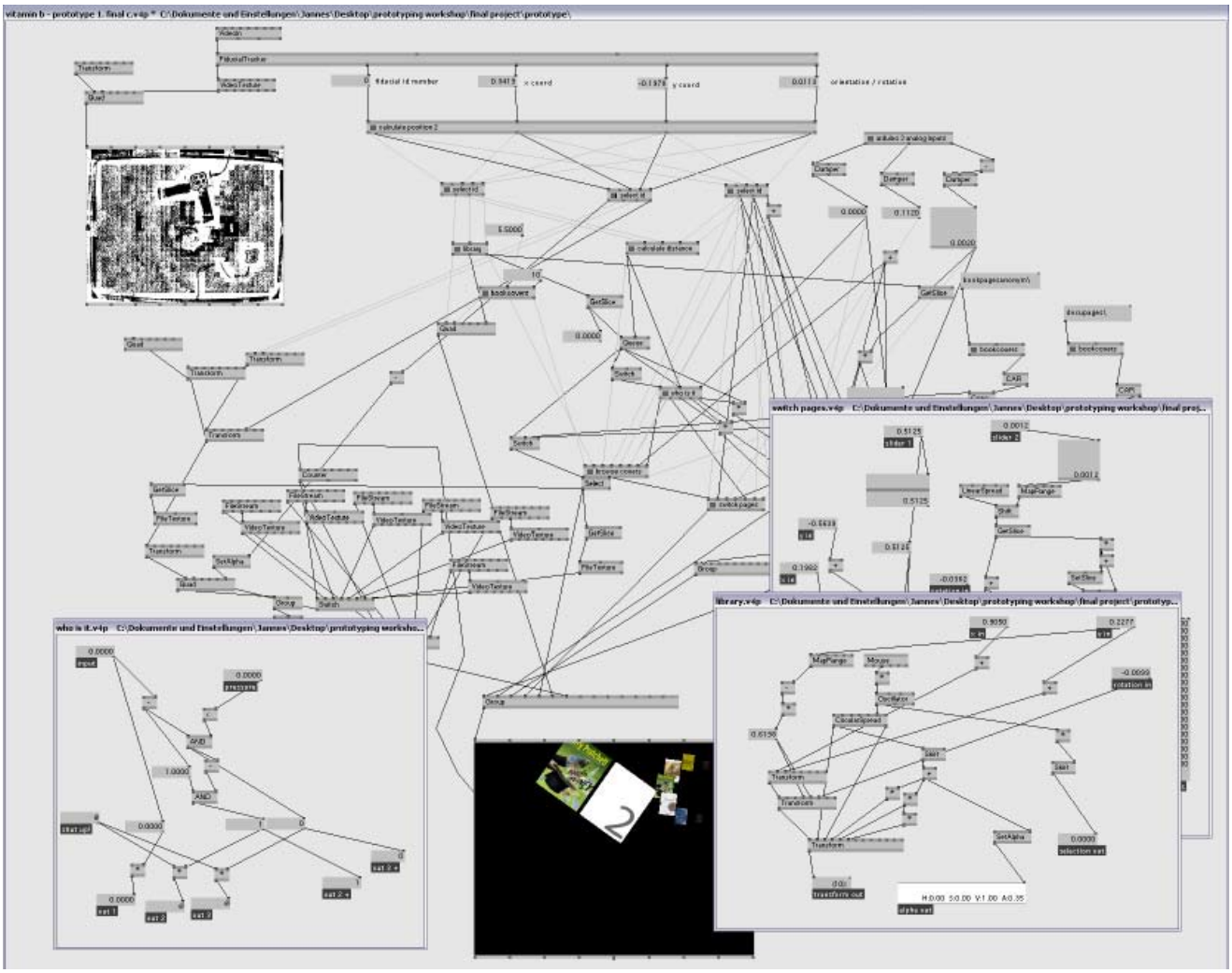
video picture as seen by the fiducial tracking software

To work best the fiducial recognition-software needs a bright video picture with high contrast and very few noise.

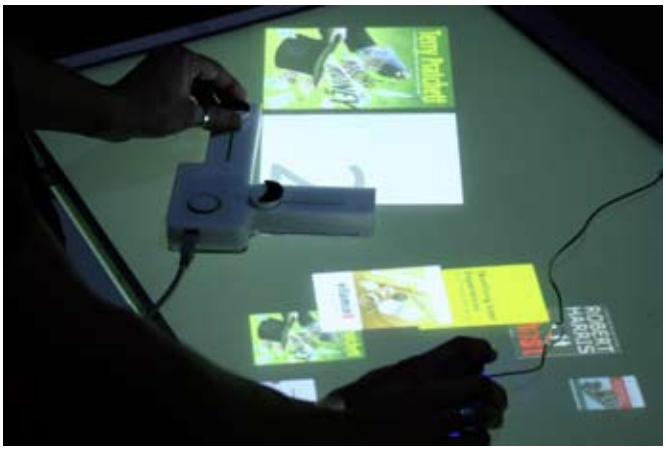
To get a clean picture we had to make sure that the projection does not interfere with the fiducial-tracker recognition. We attached a filter to the camera. It filtert all the visible light including the light of the projection, but not infra-red light.
Infra red is invisible to the human eye. But it can be seen by cameras.
To get a bright video picture we flooded the inside of the table with IR-light. For that we used two led panels with 24 IR-leds each. To prevent a reflection on the inner side of the glas we attached a small piece of black cardboard to each panel. A reflection would disturb the visiblity of the fiducials-markers. Finally we got a good and clean picture. Good enough to be interpreted by the computer.

the code

The final vvvv code existed of a main patch. Its the big window in the background. In the top of that window you can see the fiducialtracker-node. This node puts out values for rotation, position and id-number of each fiducial. We interpreted this data with different nodes and modules (some of these modules are opened in seperated windows in this screenshots). Finally all grafics (and information about postion, transparency, size etc...) are send to the renderer-node. This node can be seen in the bottom of the main window, it shows the picture that is send to the projector.



Problems we encoutered that could not be solved because of lack of time and hardware included the sychronizing of the position of objects on the table and position and size of projected grafics. Due to wide angle camera and not very accurate projection it was very difficult to archieve a good picture. It would need some more thinking and higher math to solve this problem. Another problem was the fast recognition of fiducial markers. We had some problems with deinteralcing and sometime the recognition was very slow, so the grafics “followed” the objects with a delay. Maybe a faster computer and brighter ir-light could solve this problem.



Vitamin B in action

the grand finale(2)

In the end, the Vitamin B experience prototype met with immense success. The work was exhibited along with the rest of the class at a 'vernissage' at which the entire school and distinguished guests were invited to attend.

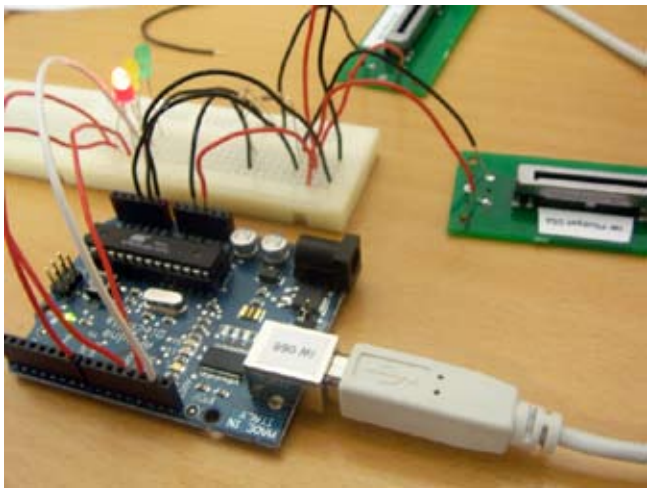
Almost everyone who saw the Vitamin B prototype was amazed by it. At first they were not quite sure what they were seeing, but once they experienced the object-interaction and actually saw and experienced the reading of a book in this manner - their imaginations soared and they were astonished that such a thing could actually work!

Many who experienced Vitamin B were curious to know how it was made and we let them have a sneak peak behind the scenes to reveal the fiducial codes and the sliders.

The most encouraging comments were that in the absence of such a prototype, it would have been impossible to conceive of the details and the concept behind such an intangible idea.

People saw and believed.
We sketched this experienced because we wanted them to see.

conclusion



Le Corbusier in his book - “Towards a new Architecture” (!931) wrote - “I draw because I want to see”.

When translated into the context of Interaction Design, this quote may be translated at I sketch because I want to experience.

During the course of the 10 working days that were invested in the Vitamin B prototype, this was the most valuable lesson we took home with us. A concept as abstract and vague as digital reading could never have been tackled by traditonal sketching methods or verbal descriptions. Experiences are detailed in their richness as reading, can only be tackled by actually replicating the intended interaction as a simulation or a reality.

The result of the project was NOT the creation of a finished product, but a tangible platform or a tool that made it possible for both the designer and the user to sit across the table and assess the quality of a design or an experience inorder to improve upon it.

A sterile, non-interactive sketch could not involve the user in such a high-resolution participation within the design process. It is through the sketching of experiences that we became aware of details. It is through the sketching of experienced details that we were able to raise real issues.

The Vitamin B prototype was not the first of its kind by any means. However, it attempted to add weight to an argument of digital reading, and doing so, we think it succeeded.

references

For VVVV - http://vvvv.org/tiki-index.php

For Arduino - www.arduino.cc

For Reactable - http://mtg.upf.es/reactable/

This project would have been impossible without the help and guidance of :

Professor Camille Moussette
Professor Niklas Andersson

and our class mates Haishu, Youle, Vittorio, Annika, Stina, Fabricio and Mike!

Thank you all sincerely !!