Chapter 1: Executive Summary

Figure 1.1: IDÉUM: a workspace for building brighter ideas and better brainstorming behavior

Kungshall was built over three hundred years ago in the coastal town of Karlskrona, Sweden. In that time it has served as a fortress for the Swedish Navy, as a slaughterhouse for a growing Baroque city, and as a warehouse for the regional history museum. Nine months ago, Volvo Construction Equipment, together with Mikael Blomqvist, asked us to help them transform this storied building into an innovation center. Volvo, the very definition of a large, traditional, slow-moving company, wants to address the needs of corporate teams tasked with projects that demand rapid and radical design thinking. Mikael Blomqvist, a serial entrepreneur, is concerned with encouraging meaningful innovation and business development in his home region.

Drawing from both these inspirations, we envision a creative ecosystem that breaks through mental barriers to being innovative. During our trip to Sweden in March 2013, we had the opportunity to facilitate workshops with our target users, corporate teams that would be coming to Kungshall for a project-focused retreat. The most consistent, and surprising, takeaway from our work with them was their insistence that they were not innovative people. Needfinding and empathy came easily to them, but the real roadblock in their design process was brainstorming. Users struggled to contribute new ideas in a fast-paced, energetic way, and had trouble running with and building upon the ideas that had been suggested. While they appreciated our early prototypes that tried to streamline documentation, we discovered that a much bigger need was help with actually creating ideas worth documenting.

This led us on a major pivot - we started Spring quarter with the following goal:

How might we build confidence and make a user feel like an innovative genius, with
a tool that actually helps develop creative skills?

In the eyes of our users, creativity is a cryptic, mysterious process, one which requires a magical X-factor that they simply lack. In reality, learning to be creative just takes hard work and diligence. Researchers who study the greatest creative minds can point to a well-defined set of behaviors that allow them to make new connections and see design challenges in a new light. The d.School has concrete rules of brainstorming that have been shown to create better and more rapid output. It is easy enough to tell teams these rules, but it takes time and practice for this behavior to become internalized. What if, instead of telling them these rules, we showed them? What if the form of your brainstorming tool made these behaviors intuitive, a natural consequence of use?

The result of following this line of thinking, arrived at through extensive prototyping and user testing, is IDÉUM: a workspace for building brighter ideas and better brainstorming behavior.

Instead of on Post-It notes, ideas are written down on hexagonal shaped tiles with embedded magnets. The tiles snap together with a gratifying click, inviting users to build on others ideas, one of the main Rules of Brainstorming. Another rule, that every idea is special and deserves to be paid attention to, is manifest when the tile is placed on the IDÉUM work surface: the idea is illuminated by a spotlight. The spotlight chases after ideas as they are slid around and reorganized, injecting kinetic energy into the discussion. When ideas are snapped together, the lights grow brighter and bigger, once again positively reinforcing idea building. The horizontal work surface encourages equal participation, while the standing configuration summons physical energy and movement. Special tiles that change the spotlight color can be used to highlight certain ideas, while a small but flexible set of other shapes allow teams to organize ideas according to their own visual vocabulary. Finally, the industrial design nods to the naval traditions of Karlskrona, while having a dynamic, inspiring, and futuristic form.

User feedback from our initial testing has been overwhelmingly positive. The system is intuitive: users instantly understand how to use it and start to build on each others’ ideas. In addition to a clear increase in engagement, testers agree that the experience provides a subtle sense of magic that must be experienced first-hand. One team we tested it with, a group working on a ten-week long project, had been stuck in a brainstorming rut for weeks. After two hours of using our table, they managed to see things in a new light and find new ideas that they could get excited about again. When interviewed, team members said that it didnt feel like the brainstorming sessions they had been doing over and over again – it felt like ‘a fun break... that happened to generate a lot of useful insights. Indeed, central to IDÉUM’s efficacy is its introduction of a sense of play back into brainstorming.

IDÉUM is built to be expandable, and it knows where every idea is and has been during a brainstorming session. During user testing, this untapped potential evoked tremendous excitement about other potential applications – from collecting data for design researchers, to elementary education, and even brainstorming games that leverage idea tracking – that we plan on opening it up as a platform for outside developers. Our sponsor has requested a set of IDÉUMs for Kungshall, and companies such as NASA, Intel, and game developers have expressed interest in using IDÉUM, as well as a number of Stanford and international professors. We are excited to move into the next phase of our project, where we will do minor redesigns in order to manufacture the table at a larger scale by outside partners. We cannot wait to see IDÉUM deployed in Kungshall and other innovation spaces, and watch the way it changes teams’ creative processes.
# Contents

1 Front Matter .......................... 1
   Executive Summary .......................... 1
   Glossary .................................. 9

2 Context ................................. 14
   2.1 Need Statement ........................... 14
      2.1.1 User Group ........................... 14
      2.1.2 Previous identified need: Documentation ........................... 14
      2.1.3 Current defined need: Brainstorming and creative confidence ........... 15
   2.2 Benchmarking: Scoping the existing resources for independent innovators in Sweden ........................... 15
   2.3 Existing resources for innovators within a company like Volvo CE ........................... 16
   2.4 Problem Statement ........................ 16
   2.5 Corporate Partners ........................ 16
      2.5.1 Volvo Construction Equipment ........................ 16
      2.5.2 Michano AB ........................... 16
   2.6 Design Team ............................. 17

3 Design Requirements ................. 23

4 Design Description ...................... 31
   4.1 Motivation: Encouraging behaviors through form ........................... 32
   4.2 How it Works ............................ 33
   4.3 The Table ............................... 34
      4.3.1 Frame .................................. 36
      4.3.2 Camera Module .......................... 39
      4.3.3 Projector .............................. 41
      4.3.4 Computation ............................ 42
      4.3.5 Tabletop ................................ 42
      4.3.6 Enclosure ............................... 44
      4.3.7 Cooling .................................. 47
   4.4 The Hex Tiles ............................ 48
      4.4.1 Magnets .................................. 48
      4.4.2 Writing surface .......................... 49
      4.4.3 Fiducial markers ........................ 49
      4.4.4 Form ...................................... 49
      4.4.5 Supplemental shapes ........................ 49
      4.4.6 Color tiles ............................. 51
      4.4.7 Manufacturing process ........................ 51
      4.4.8 Future manufacturing ........................ 52
   4.5 Bill of Materials ........................ 54
   4.6 Design Description: Opportunities ........................... 55
5 Design Development

5.1 Overview of Fall and Winter Quarters ........................................ 57
  5.1.1 Timeline ............................................................................. 57
  5.1.2 Fall Quarter ....................................................................... 57
  5.1.3 Winter Quarter ................................................................... 58
  5.1.4 The Pivot ........................................................................... 59

5.2 Spring Prototyping ..................................................................... 60
  5.2.1 LightFoam ......................................................................... 61
  5.2.2 ProjTable ........................................................................... 62
  5.2.3 Part X: Hex tiles ................................................................. 63
  5.2.4 Motivation ......................................................................... 63
  5.2.5 Learnings ........................................................................... 63
  5.2.6 Paper Prototyping: Table Size and Shape ......................... 64
  5.2.7 Penultimate Prototype ......................................................... 65

6 Planning ..................................................................................... 75

6.1 Spring Quarter Plan ................................................................. 75
6.2 Distributed Team Management .................................................. 75
6.3 Project Budget .......................................................................... 75
6.4 Next Steps ................................................................................ 77
6.5 Reflections and Goals ............................................................... 77
  6.5.1 Eva Hoffmann ...................................................................... 77
  6.5.2 Aditya Rao ......................................................................... 77
  6.5.3 Jonathan Goh ..................................................................... 78

7 Resources .................................................................................... 79

7.1 Vendors .................................................................................... 79
7.2 Contacts .................................................................................... 79

8 Concept ...................................................................................... 81

8.1 What is Kungshall? ................................................................. 81
  8.1.1 Mission .............................................................................. 81
  8.1.2 Kungshall’s Concept Features .............................................. 81
  8.1.3 Bring the world to Kungshall .............................................. 81
  8.1.4 Developing Innovation Capabilities .................................... 81
  8.1.5 Connecting the dots ............................................................ 81
  8.1.6 The feeling of being in Kungshall ....................................... 82
  8.1.7 The Whats in an overall aspect: ......................................... 82
  8.1.8 The How in an overall aspect: ............................................. 82

8.2 What are the needs? ............................................................... 83
  8.2.1 Different levels of isolation: Companies .............................. 83
  8.2.2 SME .................................................................................. 83
  8.2.3 Other challenges for companies ......................................... 84
  8.2.4 Inventors ........................................................................... 84
  8.2.5 Investors ........................................................................... 85

8.3 Benefits for Kungshall Users .................................................... 85
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.3.1</td>
<td>Networking</td>
<td>85</td>
</tr>
<tr>
<td>8.3.2</td>
<td>Prototyping</td>
<td>85</td>
</tr>
<tr>
<td>8.3.3</td>
<td>Specialists</td>
<td>86</td>
</tr>
<tr>
<td>8.3.4</td>
<td>Learning in a Creative Environment</td>
<td>86</td>
</tr>
<tr>
<td>8.3.5</td>
<td>Inspiration</td>
<td>86</td>
</tr>
<tr>
<td>8.3.6</td>
<td>What do we do?</td>
<td>86</td>
</tr>
<tr>
<td>8.4.1</td>
<td>Streams</td>
<td>86</td>
</tr>
<tr>
<td>8.4.2</td>
<td>Offering Packages</td>
<td>87</td>
</tr>
<tr>
<td>8.4.3</td>
<td>I3 D2- Inspiration, ideation implementation - I3 D2</td>
<td>88</td>
</tr>
<tr>
<td>8.4.4</td>
<td>DECISION gates</td>
<td>88</td>
</tr>
<tr>
<td>8.4.5</td>
<td>Inspiration</td>
<td>89</td>
</tr>
<tr>
<td>8.4.6</td>
<td>Ideation (some examples)</td>
<td>89</td>
</tr>
<tr>
<td>8.4.7</td>
<td>Implementation (some examples)</td>
<td>90</td>
</tr>
<tr>
<td>8.4.8</td>
<td>Key design features of Kungshall- what makes the place unique</td>
<td>90</td>
</tr>
<tr>
<td>8.4.9</td>
<td>Connecting the Dots</td>
<td>90</td>
</tr>
<tr>
<td>8.4.10</td>
<td>Bring the World to Kungshall!</td>
<td>93</td>
</tr>
<tr>
<td>8.4.11</td>
<td>Developing Innovation Capabilities</td>
<td>95</td>
</tr>
<tr>
<td>8.4.12</td>
<td>IDÉUM- Stimulating innovation and creativity</td>
<td>96</td>
</tr>
<tr>
<td>8.5</td>
<td>Partners</td>
<td>99</td>
</tr>
<tr>
<td>8.6</td>
<td>Next Steps</td>
<td>102</td>
</tr>
<tr>
<td>8.6.1</td>
<td>How does Kungshall makes its money?</td>
<td>102</td>
</tr>
<tr>
<td>8.6.2</td>
<td>Brief Consideration about rooms design - function vs. flexibility</td>
<td>103</td>
</tr>
<tr>
<td>8.6.3</td>
<td>Testing</td>
<td>104</td>
</tr>
<tr>
<td>8.7</td>
<td>Process for concept development</td>
<td>104</td>
</tr>
<tr>
<td>8.7.1</td>
<td>BTH Concept development process</td>
<td>104</td>
</tr>
<tr>
<td>8.7.2</td>
<td>The Challenge, early design criteria and constraints</td>
<td>104</td>
</tr>
<tr>
<td>8.7.3</td>
<td>Need Finding: hear, observe, listen.</td>
<td>105</td>
</tr>
<tr>
<td>8.7.4</td>
<td>Parenthesis - The meetings within our process</td>
<td>105</td>
</tr>
<tr>
<td>8.7.5</td>
<td>A Vision, a Process for Kungshall and testing</td>
<td>106</td>
</tr>
</tbody>
</table>

A Definition of needs for Corporate splinter teams and their management 113

B Notes from December 2012 Sweden trip 115

C Fall Quarter - Space Benchmarking Visit Notes 118

D Brochures from Spring SGM Presentations 123
   D.1 EXPE Presentation 123
   D.2 EXPE Handout 124
   D.3 Penultimate handout 126
   D.4 X is done handout 133

E Brochures from Winter SGM Presentations 136

F Extra Materials from Trains Prototype 146
G Fall Quarter Prototyping: Experience and Functional Prototypes

G.1 Critical Function and Critical Experience Prototypes (CFP/CEP) .......... 149
  G.1.1 Scrolling Whiteboard CFP Development ............................ 149
  G.1.2 Lessons Learned .................................................. 152
  G.1.3 Key Insights ....................................................... 152

G.2 Annotated Timeline Mini-CEP ........................................ 152
  G.2.1 Annotated Timeline Mini-CEP Development ...................... 152
  G.2.2 Lessons Learned .................................................. 153

G.3 Ambient Stimulus CEP .................................................. 153
  G.3.1 Lessons Learned .................................................. 154

*
List of Figures

1.1 **IDÉUM**: a workspace for building brighter ideas and better brainstorming behavior

2.1 Resources available to small ventures in Malmö

2.2 A photo of the team and sponsors, taken on the day of EXPE. From left to right: Tobias Larsson, Jonathan Goh, Andre Benaim, Mikael Blomqvist, Aditya Rao, Eva Hoffmann, Mikael Johnsson, Massimo Panarotto

4.1 IDÉUM being used for brainstorming

4.2 System Diagram

4.3 Design of the table resonates with the naval history of Karlskrona

4.4 Exploded view of table showing the different modules that comprise it

4.5 CAD of custom designed frame made from 80/20 aluminum

4.6 Custom brackets being cut from 1/4” Aluminum Sheet Stock

4.7 Manufacturing of custom brackets

4.8 Screenshot of video stream being captured by the camera

4.9 Modified Microsoft LifeCam HD for use only in the Infrared spectrum of light

4.10 NEC U300x - Ultra Short throw projector

4.11 Schematic of hexagonal table that is cut from 1/2” cast acrylic

4.12 Schematic of one of the side panels that is cut from a sheet of 26 gauge stainless steel

4.13 Trimming off part of steel panel using a dremel tool

4.14 Rolling the top edge of the steel panel using a mallet

4.15 Grate pattern cut into the steel panels for ventilation. Cooling PC fans on the inside help in increasing effectiveness of cooling

4.16 The final form of our hex tile, with key features highlighted: the scalloped edges for easy grip; the embedded neodymium magnets; and the fiducial marker on the bottom used by the Reactivision software

4.17 We added the above new shapes - chevrons and triangles - to allow new configurations that help users better organize their work

4.18 We added special tiles which are not meant to be written on but can be used to change the color of the spotlights on any other tile by tapping with the colored edge

4.19 A summary of the cuts made when producing the hex tiles

4.20 Images from our hex manufacturing process: laminating the layers together with acrylic cement and heavy weights, and cutting the holes for embedded magnets and scalloping on the laser cutter

4.21 BOM for IDÉUM

4.22 Among the potential other applications of our table that we’ve identified is the opportunity to use it in elementary education. Children find it delightful

5.1 Some tested Tile shapes. Clockwise from bottom left: White acrylic, 4in; Foamcore, 5in; White acrylic puzzle piece, 6in; White acrylic puzzle piece, 5in

5.2 ReedSurface

5.3 Users testing out the ProjTable prototype
5.4 Left: Intermediate Part X. Many small round divots edge scalloping, 7508 opaque white acrylic. Right: Final Part X. One small round divot, 2447 sign white.

5.5 Photographs of Part X prototypes. Clockwise from left: Foamcore + printed paper fiduciary; White acrylic with magnets for ReedSurface; Clear bottom layer + white top layer + circular click magnets + paper fiduciary; Clear bottom layer with black acrylic inlay; Etched fiduciary layer outline with vinyl fiduciary sticker; Foamcore; Circular click magnets; Acrylic inner hexagon with 3d printed outer retaining ring; Top view of etched inlay; Fully 3d printed.

5.6 Two of the jigs we experimented with for aligning magnets as we embedded them in the hexes; neither was efficient enough to be used in final manufacturing, and further development of these designs will be needed when we scale up our manufacturing process.

5.7 A selection of cardboard tabletop cutouts exploring the table form.

5.8 Final cardboard form prototype.

5.9 A selection of CAD renderings exploring the table form.

5.10 Annotated photograph of the penultimate prototype.

6.1 Team Expenses for the Year.

8.1 A summary of the Kungshall concept.

8.2 A summary of Kungshall’s offerings, and the streams of users that will come into the space.

8.3 A sample calendar of a years worth of events at Kungshall.

8.4 Sample posters for innovation conferences that might be hosted at Kungshall.
Glossary

10HM (Ten hour meeting) The identified opportunity to find a way for 10 one-hour meetings, scattered over the course of a year, to achieve the efficiency of one 10-hour meeting. This is a real issue among innovation teams and other small 'task force' teams that only meet occasionally throughout the year to check in regarding low-priority projects. Talks with Volvo employees have revealed that any way of eliminating the meeting initialization time would have immediate recognized value. See Meeting initialization time.

80/20 Modular extruded aluminum industrial erector set. Comes with custom accessories that makes building frames easy.

ALMI Government-sponsored venture capital funding for small business in Sweden. Providing both advice and financial support for start-ups, its stated mission is to provide a 'level playing field' for Swedish businesses. At the same time, it is understood that the loans are high-risk and have high interest rates; this encourages honesty because if an idea is bad and a startup is likely to fail, it is in the team’s best interest to kill it.

Ambient stimuli Abstract cues (including light, sound, movement) provided by a space that encourage users in a brainstorm room or other creative space designed to energize and inspire teams. See Prototyping: experience prototyping: ambient cues.

Brainstorming Rules A set of rules developed by Stanford’s d.School for productive team brainstorms. Our design decisions were informed by these: our focus was how to use the physical form of our system to make people automatically follow these behaviors. For more information, see Design Development: Rules of Brainstorming

Blocking behavior Identified in Neeraj Sonalkar’s work as an action by a designer that inhibits a team’s creative flow by shutting down a teammate’s idea. See Appendix: Fall Interviews: Neeraj Sonalkar.

Creative sanctuary Our vision for what Kungshall would be for all user groups. See Introduction: Vision.

D.box A potential product we’re considering offering teams before they come to the space - a ‘starter kit’ to introduce them to design thinking before they arrive as Kungshall.

Design sensei Highly experienced design thinking academics or professionals who come to Kungshall for a number of months to act as mentors or to use the space as a design observatory. These are the Marks and Larrys of our space.

Design sherpa A facilitator in the Kungshall space, this person is a ‘design thinking evangelist’ who is enthusiastic about teaching design thinking to newcomers and, while they may not be an accomplished academic in the way that a design sensei is, has a broad range of experience guiding teams through the design process. Over the course of this quarter, we have come to realize that the Verkholmen table could take on much of this role, so we are reconsidering what our staffing recommendations for the space will be.
**Feature creep** Common term in software design referring to the constant addition of new features to a product, due to the fact that users will always want software to do more. This challenge became extremely relevant during our user testing of the Verhkolmen table: extra features that go beyond the basic function of a product can lead it to be excessively complicated, and with a small design team such as ours, trying to satisfy demands for too many features can spread resources too thin and lead to mediocre quality of all features rather than mastery of a few.

**Hand-holding** The amount of design thinking guidance and feedback that a user of Kungshall should get, based on his experience level, in order to achieve a happy medium between getting the support he needs and receiving advice that feels so simple/obvious that it is boring, inane, or insulting. We are functioning under the general assumption that new would-be entrepreneurs will need far more hand-holding than other users. See also: **Modular design thinking framework**.

**Hex tile** Part of the final IDÉUM system, these small tiles of erasable writing surface are meant to replace post-its during a brainstorm and simulate the feeling of a whiteboard.

**Hutch** The storage spaces at the end of IDÉUM where the hex tiles, writing utensils, and erasers are stored.

**IDÉUM** Our final prototype: a workspace for building creative ideas and better brainstorming behavior. Etymology: Swedish, idé (idea). A stadium or environment for building ideas.

**iGroup or Corporate splinter team or Satellite team** Identified as our main user, this is a small group from a large company that has been tasked with delivering innovation around a specific prompt or challenge on a short timescale.

**Information health flower** A visual display which, as part of the venturoom prototype from Winter Quarter, indicated how well-tagged the team’s documentation was. The idea here was to encourage teams to organize their documentation by making the connection between lack of tagging and lack of quick access to the information - it withers and dies over time as it loses connectivity with the current project path. See **Funk-tional system prototype**, **Team process map**.

**Innovation task** It is assumed that each team coming into Kungshall has been sent with a specific purpose, either self-defined (in the case of small start-ups and individual entrepreneurs) or handed down from higher management (in the case of corporate splinter teams).

**Knowledge broker** The role of connecting a team with information about related or analogous projects, experiences, or work. This may be a person, a forum, or some element of the space itself. Based on the idea that some of the best innovation comes from recombination or repurposing old ideas. The main idea here is to inspire, avoid ‘reinventing the wheel,’ and save time/energy by creating connections between teams and sources of knowledge about a given problem space.

**Kungshall canals** An initial idea for our Trains prototype, where a conveyor system (possibly small ‘sushi boats’ on canals, a conveyor belt, or gondola system) would circulate prototyping
materials and semi-finished prototypes throughout the Kungshall space. The physical movement of materials and prototypes was meant to provide a constant source of inspiration and novelty, and connect teams using the space to each other and to visitors in Kungshall’s Cafe.

**Lagom** Traditional Swedish ethic of social equality and taking only as much for oneself as needed; this pervades all aspects of Swedish culture, including the entrepreneurship scene. While this makes for a very honest culture, it can also mean that startup teams’ aspirations are limited, as they try to avoid being greedy.

**Legacy** The way that the space communicates previous successes to inspire the current users of Kungshall. Inspired by the wealth of old prototypes and posters in the ME310 Loft.

**Lost at sea** The fate of most ideas that an innovation team comes up with and chooses not to pursue for a variety of reasons - personal preferences, inappropriateness for the project, lack of knowledge or resources in that specific area - but would be great candidates for being carried forward by other teams or at a later time. Because the team focuses on another idea, these ideas risk being lost in a sea of discarded ideas forever. Our goal is to rescue these via our documentation system by making them more accessible and making it more convenient and common for higher management to review the masses of ideas that were not pursued in the development of a project.

**Meaningful idea** Where to begin? In Kungshall's quest to encourage creativity, it is essential not only to encourage a greater number of ideas, but to guarantee the quality of those ideas - i.e., not just generating nonsense ideas to meet numbers (although this approach does also increase the chance of getting a few more ideas out of the noise). Our current way to quantify ‘meaningfulness’ is by the number of other ideas a given idea leads/links to; this is because a ‘good’ idea should inspire other ideas, while a ‘dud’ idea should be a dead end.

**Meeting initialization time** The time that a team takes to set up their meeting space and return to the state in which they had left their previous meeting - this includes finding all necessary materials, recalling what they had been working on last, and regaining their work 'stride'. See also 10HM.

**Microclimate** A personalized environment that a team is able to set up for themselves, based on their desired working conditions. Our prototyping throughout winter quarter focused on different methods of shaping a team’s microclimate and what effects these might have.

**Momentum Problem** The challenge of trying to keep up the energy, enthusiasm, and pace of work in a team after leaving a space like Kungshall. Transitioning back to a team’s ‘normal’ workspace is challenging, and especially if there is not a clearly defined path forward for the team, many projects tend to die from lack of momentum when the team is no longer co-located and dedicating large amounts of time to the challenge.

**Modular design thinking framework** One of the main offerings of the Kungshall space, this contains the set of design thinking tools, techniques, and advice similar to what that students in ME310 receive, except that the offerings would be catered to the user’s needs to achieve the appropriate amount of hand-holding.
Persistent cloudspace The space set up for a team to store the information they generate from their Verkholmen (and from any other places they wish to store information). This space persists after the team has left Kungshall, providing a permanent record which can be quickly referenced as well as presented off of. All information in the cloudspace is tagged and structured as a reorganizable Team process map.

Protoprototype, protoprotoprototype, etc. the prototype of a prototype, the prototype of a prototype of a prototype.

Safe cave feeling The experience of being in a small, enclosed brainstorming space that offers privacy and an escape from the outside world. We were shocked by how positively teams responded to having a space like this. See Appendix: Fall quarter experience prototyping.

Scrolling whiteboard A product we invented where a scroll of whiteboard material creates a writing surface that is continuously replenishable (as well as rewindable) with an automatically-triggered documentation device to capture material on it. See prototyping: physical prototyping: conclusions.

Smartboard trap The problem which products like the SmartBoard face: the technology generates initial excitement, and is incredibly successful in theory, but ends up falling into disuse because over time, the minor annoyance of using the technology exceeds the perceived benefit.

(Space) customization or tinkering Adjustments made to the physical environment of Kungshall by the people using it: the success of the community feeling in the space depends on individuals taking ownership of the space.

Space plus General term developed during fall quarter for what the Kungshall space can offer beyond the physical environment; something about the space that makes teams act differently than they would in any other setting and creates a truly unique innovation environment.

Special forces team This refers to the feeling we want to create for teams within our space. The theory is that a team who feels they are on a special forces task will behave like a special forces team - ie, perform better. See Appendix: Fall interviews: Philipp Skogstad.

Team process map A customized map, organizing the development process that a team went through on a specific innovation task. All information in the personalized cloudspace is stored here, and tags on the information make it searchable and reorganizable.

Trains Generic term for our Winter Quarter prototype investigating the effect of movement in a workspace on team dynamics. Some users responded very positively to the stimulus of having moving toy trains in their space, while some found them massively frustrating. See Dark Horse prototype.

Unplanned interactions Unexpected interactions between different users of a space who would not normally collaborate, potentially leading to radical innovation. Might be created or supported by the Kungshall space design. See Appendix: Fall Interviews: Andy Switky. Or go see the Pixar Headquarters, which are famous for doing this.
**Venture branding** Teams entering Kungshall will be guided through this bonding activity where they define as a team what their goals are for the project they’re working on. From this, a venture identity will be formed. There are a few goals of this activity: to help them get to know eachother better; to start a discussion about their motivations so that the team better understands eachother and is aligned around a common goal; to give them the feeling and agility associated with being a start-up venture; and to give them a feeling of autonomy, that they (rather than their parent corporation) have control over their goals and direction.

**Venturoom** Generic term for the system prototype in which we built a customizable smart workspace for teams that had gone through a venture branding activity. The Venturoom prototype consisted of an RFID scanner at the door to identify which team was tagging in, lights which would turn on to the team’s preferred color and tempo settings, a projection space which displayed a ‘control panel’ with the team’s most recent work, and a whiteboard with a ’smart’ eraser that controlled a camera to document all written work before it was erased. See Funk-tional system prototype.

**Verkholmen** (*pl. Verkholmen*) Our previous proposed solution from Winter quarter, an enhanced whiteboard that combines a traditional whiteboard writing surface with a customizable, interactive backdrop screen and a camera system to document work done on the board. The board can function as a standalone workspace or be used in conjunction with other boards to shape a space and make a customized 'room’ for a team to work in; in addition, each individual board can be rotated between horizontal (table) and vertical (wall) configurations. Etymology: *Swedish*, verk (work) + holmen (island): *this name originated from the idea that we could combine all of the elements in the Venturoom to become one small work island. Each smart whiteboard could function as a standalone workspace or as part of a larger 'archipelago’.*

**Work-to-Cloud** The assumption that all work done on Verkholmen is automatically documented in the team’s Persistent cloudspace.
Chapter 2: Context

2.1 Need Statement

2.1.1 User Group

The formation of radical innovation teams within large established corporations, though much desired, is an uphill battle: the team has to swim against the surging currents of large inertia and burdensome burocratic overhead. Team members are often assembled from different departments and sometimes even different countries, and have to work around the intersection of many schedules and timezones. Often, although experienced in their fields, these teams are new to design thinking.

Some teams have been successful in solving these problems by going off on their own and establishing a separate office. But the barrier to entry, both in terms of time and capital investment, is large, and the risk high. What if they could simply rent a space to call their own, far away from meddling micromanagement? A space that is built to encourage innovation, where they can get design thinking help tailored to fit their goals. And it isn’t just corporate splinter teams that need a space like this – start-ups and solo entrepreneurs would find a home there too.

The Kungshall Innovation Center will be used by a variety of teams from different backgrounds (see earlier fall quarter brainstorming regarding this in Appendix: User Chart), and a crucial feature of our system is that it is flexible enough to provide appropriate support to these various experience levels. To give our team focus, during the fall and winter quarters we focused specifically on the needs of the users that we felt would make up the largest part of our demographic, and which we understood most thoroughly: ‘Splinter teams’ coming from a large company such as Volvo.

2.1.2 Previous identified need: Documentation

Traveling to Sweden in December and speaking with representatives from Volvo helped us define our user and the needs that we are addressing (See Appendix - Interview with Peter Wallin). Volvo CEs Technology Working Groups are often formed by plucking people from various departments that have never worked on this problem or with each other before. They are asked to rapidly and radically innovate, but still have to keep up with their usual daily responsibilities. We came to realize that there are actually two sets of needs we need to consider - the needs from the perspective of the team members and from the perspective of their parent company.

Throughout winter quarter, we focused on documenting a design teams process, because we saw this as a gaping hole in every creative team we talked with - from students to IDEOs top designers. We wanted to help teams communicate the value of the circuitous process they had gone through, to justify the time and energy spent in following the design process. We developed an interactive work surface that would help them document, digest, and present it in a streamlined manner. Incorporating other features of space design we had discovered, our design allowed teams to reconfigure the work surface as either a table or a vertical whiteboard for a more dynamic experience. Our winter vision video gives a concise explanation of how we saw our user at the end of Winter quarter, and our plan for how to address these needs.
2.1.3 Current defined need: Brainstorming and creative confidence

When we returned to Sweden in March 2013, we had the opportunity to facilitate workshops with our target users, testing out some of our concepts. The most consistent, and surprising, takeaway from our work with them was their insistence that they were not innovative people. Needfinding and empathy came easily to them - a people who are very sensitive socially - but the real roadblock in their design process was brainstorming. Users really struggled to contribute ideas in a fast-paced, energetic environment, and had trouble 'going crazy' in a constructive way. While they appreciated our efforts to streamline documentation, a much bigger need was help with actually creating ideas worth documenting. This led us on a major pivot - we started Spring quarter with the following prompt:

How might we build confidence to make a user feel like an creative genius, and then support that feeling with tools that actually gave them the skills to perform better?

2.2 Benchmarking: Scoping the existing resources for independent innovators in Sweden

The Swedish entrepreneurial environment is unique in that it fosters a more forgiving, accepting environment than that of Silicon Valley - but at the same time, small companies do not grow as fast because it is generally not as well-connected, and there are not as many opportunities. The Swedish startup environment tends to be more considered: people work slowly, take more time to listen and consider proposals, and therefore tend to be less aggressive in their approach to new businesses. Throughout the startup environment, the concept of lagom pervades.

On a tour of Malmo, one of the main centers for entrepreneurs in Sweden, an advisor at an incubator described the trajectory of startups as a linear progression through the following set of resources:

![Figure 2.1: Resources available to small ventures in Malmo](Image)

Stpln (Stappelbaden) is a general open space for people that do not have offices: it has some workspaces with couches and desks; some tools for basic prototyping, and some meeting rooms. All work is self-structured and there is no coaching or oversight. Once teams have organized their idea and are ready to pitch it, they would move on to a place like MINC, a typical startup incubator as we know them in Silicon Valley; once teams have progressed through this and no longer need serious coaching, they move on to a space like MEC, which is essentially just office space for small business with a good 'vibe' and that attracts a crowd of people interested in innovation and small enterprises.

Another unique feature of the Swedish innovation scene is ALMI, an organization associated with the Swedish government that provides funding and coaching to start-ups. Because the amount
of funding available through ALMI is small, it is easy to obtain. Larger amounts of money for promising ventures are available through sources like our corporate partner, Mikael Blomqvist; interestingly, discussions with him indicated that the limiting factor in the Swedish entrepreneurial environment is not the amount of funding available, but the scale at which small ventures dare to dream. This is partially due to the Swedish cultural tradition of lagom.

2.3 Existing resources for innovators within a company like Volvo CE

Large companies like Volvo CE often put very little emphasis on radical innovation and design thinking. The structure at Volvo CE, as explained by Innovation Portfolio Manager Peter Wallin, uses Technology Working Groups, assigned to deliver innovation around a specific topic or area, which meet a few times a year to work on specific projects. This work ends up being a very small fraction of an employee’s time, and groups only meet for a total of a few hours per year. The emphasis is generally on incremental improvement rather than radical innovations in their product line; the groups’ top priority is bringing more value to the customer, but not generally through ground-shaking measures. For full notes from our interview with Peter Wallin, see Appendix - Interview with Peter Wallin.

2.4 Problem Statement

The Kungshall warehouse was built in 1787 on a naval bastion off the city of Karlskrona in south Sweden. Nestled in coastal isolation, it is four hours east of Copenhagen, and 6 hours south of Stockholm, the nearest cities. It has served for hundreds of years as a munitions store – but now Volvo Construction Equipment and Michano AB have asked us to help transform it into a groundbreaking new innovation space.

It is paramount that we take advantage of both this storied past and this uniquely idyllic, if isolated, location. It has to have much more than just beautiful interior design and fancy furniture – what can we offer that would make teams travel this great distance to the middle of nowhere? What can we offer beyond just space – what can we offer that is space+?

2.5 Corporate Partners

2.5.1 Volvo Construction Equipment

Volvo CE is a large and complex international company with a seemingly simple goal: build construction equipment. From diggers to backhoes and front-end loaders, they are world-leaders in several market segments, and are always looking to innovative advances to keep their edge. They want to improve their ability to be innovative, and so are very interested in the results and methods of the Kungshall project.

2.5.2 Michano AB

Mikael Blomqvist, founder of Michano AB, is a highly succesful Swedish serial entrepeneur who founded and then sold two companies: Metget, an RFID technology firm, and Roxtec, a cable
isolation manufacturer. Now, he is a board member at Blekinge Institute of Technology, and chairman of cloud storage company Compuverde. He is interested in understanding and stimulating the design and innovation processes, and is the primary investor in Kungshall.

2.6 Design Team

After a wildly successful Paper Bikes competition, the majority of Stanford’s famous Team 8 Domin8 decided to stick together for the corporate project. The Swedish side of the equation consists of three supremely qualified PhD students with valuable experience in innovation and sustainability research.
Figure 2.2: A photo of the team and sponsors, taken on the day of EXPE. From left to right: Tobias Larsson, Jonathan Goh, Andre Benaim, Mikael Blomqvist, Aditya Rao, Eva Hoffmann, Mikael Johnson, Massimo Panarotto
EVA HOFFMANN
M.E. Graduate Student at Stanford University
ehof@stanford.edu

Originally from New York City, I came to Stanford five years ago to do my undergraduate degree. I started out in Human Biology (studying ecology and environmental change), but I have always loved making things and became more and more involved in Product Design, following along with the undergrad PD program until I was accepted as an ME Coterm MS student. I’m especially interested in affordable design for the developing world, and so it’s been really exciting to see my interests come together; having a background in human health and environment/energy resources has been so helpful for all the projects I’ve worked on. After finishing my undergraduate degree, I took a leave of absence for a year to gain some work experience. During this time, I was briefly on a disease research project in rural Kenya; then working with an interior design firm in Cambodia; and then doing manufacturing work with some 310 alumni at Proximity Designs in Burma. My work in Burma especially cemented my realization of how important it is for me to have experiences like the 310 series - I still have so much more to learn about project management, working with corporate partners, and how to take products from problem statement to concept to implementation.

JONATHAN GOH
M.E. Graduate Student at Stanford University
jgoh@stanford.edu

I am from Vancouver, British Columbia, Canada. I did my undergrad at Princeton, where I majored in Mech E and minored in Visual Arts and some other random stuff like Physics. I love, love, love making things! I also love skiing. I have yet to do both at the same time, but I believe it would be a transcendental experience.

My core skills are graphic/CAD design/3d rendering and manual/CAM manufacturing.
I love machine and wood shop, and am proficient with manual tools and also 3- and 4-axis CNC machines. I also have experience with programming microprocessors, 3d printing, and composites layup. [www.finestruktur.com](http://www.finestruktur.com) is my personal webpage, and has lots of pretty pictures about stuff I have made in the past!

---

**Aditya Rao**  
M.E. Graduate Student at Stanford University  
adirao@stanford.edu

I am originally from Bangalore, India. I came to Stanford straight out of an undergrad in Mechanical Engineering (Design and Manufacturing) that I completed back home. I play a lot of sports, love Scuba Diving and taking apart stuff and putting said stuff back together (or not). I think my inclination for design stems from being a lego-addict as a toddler. I have always loved building and tinkering with things. When it came time to choose an undergrad major, I figured ME would be a great place to start to get into creating and building products and eventually transition into Design. I have had a ton of design experiences during my undergrad including building an autonomous hovercraft that won us 2nd at National Competition. I also worked on building a ”pico wind energy harvester” right from the ideation phase to building a fully working prototype. Some other amazing experiences were during my internship stints at 2 Design Consultancies and the Power Tools Design Dept at Bosch. They gave me an insight into how professional teams go through the design process and the nitty grittys of working with clients.

---

**Mikael Johnsson**  
PhD Student at Malardalen University  
mikael@munktellsciencepark.se
Mikael is currently a PhD student at Malardalen University. He is working at Munktell Science Park at Eskilstuna, where he is conducting research on untapped innovation capacity in employees’ daily work. He has worked extensively as a consultant on innovation projects, has co-founded several innovation-focused companies, and holds several patents.

Massimo Panarotto  
PhD Student at Blekinge Institute 
massimo.panarotto@bth.se

Originally from Italy, Massimo is currently a PhD student at Blekinge Institute, where he is doing research in the Product Development Research Laboratory. He has an MSc in mechanical engineering from the University of Padova, Italy. He worked on his master’s thesis, ‘Creative Methods for Sustainability Driven Innovation’, during an exchange program year at Lulea University, Sweden. Massimo previously played soccer in the 8th division of the National Italian Football association, and now enjoys coaching the sport. He also enjoys fishing, watching movies, and playing the guitar and harmonica.

Andre Benaim  
PhD Student at Blekinge Institute 
andre.benaim@bth.se

Originally from Sao Paolo, Brazil, Andre is currently a PhD student at Blekinge Institute, where he is doing research in the Product Development Research Laboratory. He received his Bachelor of Law from Universidade Presbiteriana Mackenzie in 2006, and a MSc in Strategic Leadership Towards Sustainability in 2008 from BTH. He is interested in human and organizational development towards sustainability, and has

Special thanks to our ME310 coach, Tim Wong and our corporate liaisons, Tobias and Andreas Larsson.
Chapter 3: Design Requirements

Introduction

Going into this project, our prompt, while simple, was not well defined. Hence we did not have any given requirements to start with. However, talking to Mikael Blomqvist (see Appendix: Interview with Mikael Blomqvist) has helped us gain an understanding of the things that are important to him. For example, he wants to foster a ‘maker’ culture in his home region. This was a good stepping stone to defining our design requirements in the fall quarter. Since then, we have gone through many cycles of prototyping, and have gained a deeper understanding of user needs. This helped us formulate our design requirements for our vision of Kungshall. An integral part of the vision we foresee is a tool, for example the IDÉUM, that will be central to aiding users innovate in the space.

The various functional and physical requirements for such a tool and the system it is a part of is enumerated in the tables following.
### 3.1 Functional Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction is simple, intuitive, and doesn’t require special training,knowledge, or extensive setup</td>
<td>Any inexperienced person approaching the table can begin using it to brainstorm - even if he feels there are some aspects of the system that he does not understand, this does not inhibit his ability to use it. Teams coming through Kungshall (and other spaces where the system will be used) do not want to invest time to learn new technology that they will only be using for a brief period. Therefore they must be able to instantly begin using the system effectively.</td>
</tr>
</tbody>
</table>
| Encourages movement -fidgeting/micro-movements -macro or reorganizational | **Micro**: Users are more likely to fiddle with hex tiles.  
**Macro**: Users need to stand to use the table.  
**Micro**: Fidgeting during brainstorming sessions has been proven to make designers more generative (Leifer, Personal communication)  
**Macro**: Standing during meetings raises the energy level; being free to move on a macro (body) scale has been proven to make designers think of wilder, paradigm-shifting ideas (Edelman, Personal communication) |
| Increases engagement of participants in the brainstorm                                                                              | Participants face each other and have more intimate and meaningful interactions than they do on normal work surfaces. Focus on each other (as measured by eye contact and responsiveness to each other’s statements) increases by 25%.  
The team’s engagement in the brainstorm is a driving factor for performance. |
| Adding ideas to the brainstorm is gratifying                                                                                 | 100% of users say they feel some positive emotional reaction the first time they add an idea to the brainstorm. This feeling may diminish over time as users get used to the system, but they always feel some sense of reward when they add ideas.\(^\text{24}\)  
This is one of the rules of brainstorming: *defer judgement*. We want each idea to be rewarded, regardless of its individual value. See Design Development: Rules of Brainstorming for further information. |
<table>
<thead>
<tr>
<th>Increases number of ideas generated</th>
<th>The number of ideas generated per half-hour of brainstorm is at least 25% greater with the table than without it.</th>
<th>This is one of the rules of brainstorming: <em>go for volume.</em> See Design Development: Rules of Brainstorming for further information.</th>
</tr>
</thead>
</table>
| Encourages building on ideas by making connections between ideas tangible and physically gratifying | - Users show a preference for connecting their ideas to others over placing their ideas on the table alone  
- The rate of idea ‘branching’ (i.e., how often each idea leads to at least one other idea in the brainstorm) is at least 25% greater with the system than without it.  
- The connections that users build between ideas are expressed in a more physical way than adjacent post-its being put together.  
- 100% of users say that they feel some ‘reward’ for connecting ideas. | This is one of the rules of brainstorming: *build on the ideas of others.* See Design Development: Rules of Brainstorming for further information. |
| Introduces elements of ‘play’ | Users are more willing to consider or build off of each others’ wild ideas than they are on a normal work surface. They smile 25% more. | This is one of the rules of brainstorming: *encourage wild ideas.* See Design Development: Rules of Brainstorming for further information. |
| Allows for reorganization and structuring ideas by tagging, grouping, moving and disconnecting blocks of ideas. | Facilitates voting on ideas by allowing users to change the color or turn illumination off for each tile. Allows users to regroup and move tiles via a system that holds connected ideas together as they are rearranged. | Users should be grouping ideas during the brainstorm; at the end of the brainstorm, reorganizing these groups and voting on ideas is a crucial next step to process and decide on next steps. |
3.1.1 Functional Constraints

1. Users need to feel productive when using the system; it cannot distract them from the brainstorm, and it should help them stay more focused. There are some opportunities for channeling users’ distraction to be more productive; see opportunities below.

3.1.2 Functional Opportunities

1. **Encourage productive fidgeting:** While groups cannot stay perfectly focused at all time, an effective brainstorm requires strong engagement from all teammates. If users are distracted by things that are relevant to the brainstorm (i.e., they are fidgeting with tiles that have brainstorming ideas written on them), this introduces the opportunity for generation of seemingly spontaneous wild ideas that are related to the conversation; it could inspire new connections between seemingly unrelated ideas.

2. **Programming additions:** through our development and testing process, we have identified a number of exciting supplemental uses for a tool such as ours. For more detail, see *Design Description: Opportunities.*
   - **Data mining:** Design researchers could use the software to track teams’ design behaviors.
   - **Programming games:** Adding simple games that are commonly used by facilitators to teach brainstorming could help the table further improve behavior.
   - **Mapping process:** Teams could keep track of when ideas were added and later get a playback of their idea generation process.
   - **Instances of randomness:** introducing random stimuli could help serendipitous idea generation.
### 3.2 Physical Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work surface should be easily accessible by all users</td>
<td>A person of standard height (5’5”) should be able to reach all areas of the work surface from any position around the table.</td>
<td>To create an equitable environment where everyone can participate and no one person dominates, all users must physically have equal access to the workspace.</td>
</tr>
<tr>
<td>Comfortable to use for extended period of time</td>
<td>100% of users between the heights of 5’0” and 6’0” can stand at the table for one hour without saying they are distracted by discomfort.</td>
<td>Brainstorms shouldn’t last longer than 1 hour, but during that time, comfort should not be an issue for users.</td>
</tr>
</tbody>
</table>
| System is (and feels) durable and can stand up to use in a non-regulated environment | - Hex tiles stand up to scratching, dropping, and other incidental conditions of use.  
- Table surface can withstand weight of four users leaning on it incidental impact of users banging their fists on surface.  
- The table structure is strong enough to withstand the weight of two people leaning on each side, and does not distort significantly under these conditions. | Users need to feel comfortable using the table without worrying about breaking it. They need to be able to use it as they would a normal work surface without risk of harm to themselves or to the table. |
| The technology inside the table is protected and the system can be easily moved. | All components of the table are enclosed (in a way that can still be accessed for service/repair), and all parts of the table are mounted to the frame, which can be slid. The table is not so heavy so as to be immobile. | The table must be safely left in public spaces without constant monitoring, so all components must be protected from outside interference. It will need to be moved occasionally without risk of damaging the components. |
| Software runs quickly enough that users feel it is responding to their actions in real time. | Frame rate >30/sec. | When the software is too slow, users get frustrated with the interaction and feel that they system is not processing as quickly as they are. |
| Intuitive and simple booting mechanism | - 100% of users can turn the table on or off within 1 minute without being told how to do so  
- System reboots every time it is turned on or off to minimize complications related to software bugs | Users must easily be able to turn on and off the system on demand. Users need to be able to restart the system in case there are issues with the software. |
| Work in diverse environmental conditions (ambient lighting, temperature, etc) | - The work surface can be used in all indoor environments  
- The work done on the hex tiles can be recorded in all indoor environments with a standard smartphone camera | In order to be commercially viable, the table should not require any special environment to be comfortable and usable. |
| Projected light is not blinding or distracting | Users can stand at all locations around the perimeter of table without the light obscuring their vision or focus. | Earlier testing indicated that the light from the projector was an issue and was distracting users. We want to ensure that nothing about the table makes them uncomfortable or impedes their focus and interaction with each other. |
| Writing surface should be easily erasable but not accidentally erased during the course of normal use. | Writing does not get accidentally erased as hex tiles are passed between users. No chemicals or tools are needed to erase tiles. | Users want to be able to correct/update their work as they would with a whiteboard, but want the permanence of post-its. |
| Access to resources should not hinder flow/pace of brainstorm | The table has a space to store all needed materials (markers, erasers, reference papers) conveniently. | Teams often get sidetracked and derailed when supplies are not readily accessible; members branch off and the team loses focus. Because of this, all necessary supplies should be within reach. |
3.2.1 Physical Constraints

1. Kungshall is laid out like a warehouse with large open spaces and a built up area of about 2500 sqm. There is limited light available on the ground floor (very few windows), and structural modifications are limited by heritage building protection policies.
2. Physical size of tool is limited by typical human height and reach.

3.2.2 Physical Opportunities

1. Tool can be moved around the space as needed, and multiple be used together to sculpt out workspaces for specific uses.
2. Tool can create a sense of ‘magic’ for the users that raises team’s energy level simply through the ambience.
3. Tool can control how users stand around it, so it dictates their position and orientation relatively to each other and has the potential to sculpt their interaction.
3.3 Business Requirements

| Affordable price | FOB cost for producing one table should be less than $10,000. | While we expect to price the table significantly higher as an art installation piece, we want to keep the production costs reasonable to allow us to make a number of further prototypes (over the summer) and to keep the sticker price accessible for creative spaces that offer affordable services to entrepreneurs. |
| Appeals to a range of audiences and does not rely on a facilitator to be used effectively by teams | Tables can be controlled by teams, and the space provides brainstorming benefits that stand alone (are useful without outside facilitation). | While we plan on having facilitators in Kungshall, not all clients interested in this table will have full-time facilitators. In order to appeal to a range of audiences, the table must be able to be used by teams without any formal instruction. |
| Workspace appears sophisticated and serious, users feel productive while using it | When untrained outsiders observe the table in use and ask what is designed for, they describe it with language related to work rather than play. | Businesses need to see a clear value in the work done at Kungshall; regardless of how effectively the table increases productivity, if it does not appear to be so, then it will struggle to attract corporate users. |

3.3.1 Given Business Constraints
1. Enhances the attractiveness of Kungshall by creating a unique experience that users feel that they have to see to experience it. *(This was Mikael Blomqvist’s original design directive for us.)*

3.3.2 Business Opportunities
1. Use of the material aesthetics and history of Kungshall for inspiration: the Kungshall building is already an inspiring space; there is potential to use the industrial design of our table to complement this and make the space even more alluring. Potential use of Karlskrona’s naval traditions to inspire both the form of the table and the design of team interactions that take place at the table.

2. Use in K-12 Education: Adding simple code could allow this table to become a teaching tool for young children. For more detail, see *Design Description: Design Opportunities.*
Chapter 4: Design Description

Figure 4.1: IDÉUM being used for brainstorming

IDÉUM is a workstation for building brighter ideas. The IDÉUM experience is designed to encourage behaviors that result in better idea generation. Inspired by the d.schools Rules of Brainstorming, it incorporates some of these mantras into its physical form. This focus on tangibility - on physical movement and sensory stimulus - creates a sense of play. Evoking memories of toy blocks and imaginary worlds, it encourages users to lose some of the inhibition of the corporate meeting room.

A soft glow highlights ideas as they are added to the surface, reinforcing the value of each contribution. Spotlights follow tiles as they are slid around, injecting kinetic energy into the discussion. They glow brighter and bigger as ideas are gathered together, echoing the mounting excitement. Organize your ideas on hexagonal tiles that magnetically snap together with a satisfying click. Building on others ideas becomes intuitive, gratifying, and fun. Tangible ideas can be easily clustered and reconfigured, inspiring new structures and connections. The dynamic hexagonal shape makes teammates face each other while keeping the work area within arms reach, ensuring equal and active engagement. The horizontal work surface and standing configuration encourages physi-
cal movement and energy.

4.1 Motivation: Encouraging behaviors through form

To give ourselves direction as we began building, we worked from the d.School’s Rules of Brainstorming [?]. As always, rather than telling people what they should be doing, we focused on how to show them and invite the desired behaviors with our physical form.

- **Defer judgement** Don’t block teammates’ ideas; put them up, because they may be useful for building on later.
  IDÉUM literally gives each idea its moment to shine. The illumination behind the tiles seems like a simple feature, but evokes a disproportionately positive reaction. In fact, it was inspired by overwhelmingly positive feedback from an accidental experience in one of our very first prototypes when we accidentally projected fireworks onto groups’ work and they loved it (see Design Development - Fall Quarter - Critical Experience Prototype). In addition to this, the size, shape, and horizontal orientation of the table were all designed so that each team member can reach all parts of the table and engage equally; no one person stands at the front and controls which ideas get recorded.

- **Go for volume** Regardless of what the ‘quality’ initially seems to be, more ideas are always better than fewer. It is often helpful to set a goal for a minimum number of ideas to reach before ending the brainstorm.
  Deciding that 50 ideas was an appropriate number for a productive brainstorm, we produced 60 tiles (to have some spares) and found that users often assumed that they should go through all of them before stopping. By keeping the technology within the tiles minimal, and making them erasable, we try to make them feel as disposable as possible, so that users felt comfortable throwing many ideas out onto the table.

- **One conversation at a time** This helps everyone focus.
  After extensive testing of shapes and sizes, we chose the form of our table to guarantee that users always faced eachother. The size encourages an appropriate size of brainstorming group - three to six users - and keeps the conversation intimate.

- **Be visual** Sketch out ideas as much as possible to communicate them.
  **Headline your idea** Explain it quickly, so that the group can move on to the next one.
  We carefully chose the surface finish, size of tile, and type of marker to get a comfortable writing and sketching experience, and to get users drawing and writing at an appropriate level of resolution. Some testers requested bigger tiles, but we deliberately ignored this because we wanted to limit how much information was put onto each tile.

- **Build on the ideas of others** This is especially useful when the team feels stuck, and helps to leverage the diverse perspectives of multidisciplinary teams.
  We reward building on ideas with a satisfying experience when users click two ideas together and see the lights grow brighter. We encourage reconfiguration and interbreeding of ideas by making it easy to disconnect and reconnect ideas, move chunks around, and pass groups of concepts to other users.
• **Stay on topic** *Don’t get carried away with ideas that are exciting but irrelevant to the prompt.* Users tend to be hesitant to put ideas down if they don’t connect with other chains of ideas; the fact that they need to choose where (/whether) to connect their ideas means that they have to think carefully about how they relate to the topic.

• **Encourage wild ideas** *The crazier the better... and they are often seeds that your teammates can use to build off of.* The form and illumination of the table is designed to evoke an inspiring dreamlike state where anything is possible.

4.2 **How it Works**

The basic working of IDÉUM is explained with the aid of Fig 4.2. The integral components are simple: a camera is looking at the surface and tracks the position of the hex tiles. This information is relayed to a projector via a computer. The projector projects a soft glow that shadows the position of each hex tile. The computer acts as an interface between the camera and the projector, in that it interprets the position of the hex tiles from the camera image and generates an image with white circles mapped to the position of each hex tile. The position data of each hex tile is...
tracked with the help of a fiducial marker that is on the bottom of each of them.

The IDEUM has 2 distinct parts

1. The Table
2. The Hex Tiles

Each of these parts is described in detail below

4.3 The Table

Figure 4.3: Design of the table resonates with the naval history of Karlskrona

The table has been designed taking into consideration several factors. The initial constraints spawned from establishing the use case for the table. It is designed for use during the idea generation phase of the design process by a team of 4-6 people. Firstly the height of the table top surface was set at 38. This was done so as to encourage standing around the table. Standing is widely known to induce energy into a brainstorming session, which is reflected in various interior design decisions made at design spaces, most notably the d.school at Stanford University. The hexagonal shape of the table top was chosen as it proved to encourage a configuration of people around the
table such that participants always faced it each other while having equal access to the center of the table. The shape also mirrors the shape of the hex tiles which makes for consistent design language. The size of the table was set at 50 across so that the center of the table is within the reach of all participants. At either end of the table are storage bins designed for ease of access to the hex tiles and markers. As seen in Fig 4.3, the overall design of the table resonates naval themes inspired by the heritage of Kungshall and Karlskrona. The table base enclosure is made from folded stainless steel sheets. Close attention was paid to the choice of materials used. The combination of stainless steel (2B finish) for the enclosure and dark wood for the hutches gives the table a distinct aesthetic that works well with the existing aesthetic of the Kungshall space.

The different modules that comprise the table can be seen in fig 4.4 and are described in detail below.

Figure 4.4: Exploded view of table showing the different modules that comprise it
4.3.1 Frame

Figure 4.5: CAD of custom designed frame made from 80/20 aluminum

The table is built around an aluminum frame as seen in Fig 4.5 that acts as the supporting structure for various components in the table. The frame was constructed using 1 80/20 extruded aluminum stock. 80/20 aluminum was chosen as it was a perfection combination of structural integrity and easy of assembly. Aluminum stock was cut to the right lengths and attached together using a wide array of fasteners. Some of these were part of the 80/20 system, for eg- live hinges, while others were custom designed and milled from 1/4 aluminum sheet stock as seen in the Figures 4.6 and 4.7 The frame sits on slide pads designed for heavy loading. This is so that the table can be slid around with relative ease.
Figure 4.6: Custom brackets being cut from 1/4" Aluminum Sheet Stock
Figure 4.7: Manufacturing of custom brackets
4.3.2 Camera Module

The camera module is the eye of the table. It frames and captures the bottom surface of the table top and sends a live video stream to the computer as seen in Fig 4.8. The camera works in the infrared spectrum of light so that the projected image is separated from the captured image. The camera used is a Microsoft LifeCam HD that has been modified (Fig 4.9) to meet requirements. To capture infrared spectrum data, the IR filter on the lens of the webcam was carefully removed. Light from the visible light spectrum was then blocked using a filter. A Zeikos 0.45x wide angle lens was added on top of the camera to widen the image and ensure that the entire surface of the table top was captured. The surface being captured needs to be adequately lit so that individual pixels in the image can be distinctly resolved. To do this there are infrared flood lights installed strategically inside the table such that the surface is evenly lit.

Figure 4.8: Screenshot of video stream being captured by the camera
Figure 4.9: Modified Microsoft LifeCam HD for use only in the Infrared spectrum of light
4.3.3 Projector

The soft glow that shadows each tile is achieved with a projector. The projector used is an NEC U300x (Fig 4.10), an ultra-short throw projector, with a 0.377:1 throw ratio. This is so that the projected image can cover the entire width (50) of the tabletop from a short throw distance. The projected image as seen in the fig(abstract) is an image of soft glowing circles on a black background with positions mapped to the position of the respective hex tile.

Figure 4.10: NEC U300x - Ultra Short throw projector
4.3.4 Computation

A basic PC (Core 2 Duo 3.0 GHz processor, 4GB DDR2 RAM), running Windows 7, handles all
the processing of IDÉUM. The computer takes in the video stream from the camera, runs software
that deciphers the position of the hex tiles and then generates an image of soft glowing circles
mapped to the position of the hex tiles that is then sent to the projector.

The software consists of two distinct parts: The open-source Reactivision runtime application
that calculates the positions and orientations of the hex tiles, and a Processing script that creates
the visualization output.

Reactivision

Reactivision is an open-source API for tangible object tracking. It recognizes fiduciary markers
through a webcam, and outputs the position, rotation, and ID number for each fiduciary it sees.
It delivers this information to the Processing script through TUIO (Tangible User Input/Output)
protocol. There are 400 different fiduciary markers available. Reactivision provides this output at
10FPS running with the Microsoft LifeCam at 1280x720. Running at lower resolution provides up
to 30FPS, but with worse object recognition.

Processing Script

The Processing script interprets the TUIO output from Reactivision.

When a tile is placed on the surface, it creates a spotlight in that location, mapped by a
manually calibrated linear mapping function. It moves the spotlight to track the hex tile location
provided by the TUIO output. The velocity at which the hex tiles is set in software so that it trails
moving hex tiles, creating a chasing effect for added kinetic energy. As well, this smooths out jitter
from Reactivision, since Processing will run at 30FPS while Reactivision only outputs at 10FPS.
Additionally, Reactivision has trouble tracking fast moving fiduciaries, so this helps to account for
the loss of signal as tiles are thrown across.

The code also keeps track of collisions and the angle of each hex tile. Hex tiles that are close to
each other have larger and brighter spotlights, up to a maximum size and brightness when there
are 3 hex tiles together.

This combination of basic information tracking allows the software to add functions when special
tiles are used in certain ways. The Colorizer tile is a grey hexagon without magnets. On one face
is an orange triangle. When the face is collided with another tile, it transforms that tile’s spotlight
orange. When the diametrically opposite face of the Colorizer is collided, the color is restored to
default.

4.3.5 Tabletop

Apart from functioning as the horizontal working surface, the tabletop also acts as the projection
surface and the surface through which the hex tiles are captured and tracked. The tabletop is made
of 1/2 cast acrylic that was waterjet cut to the required hexagonal shape as shown in Fig 4.11.
The top of the acrylic surface is sanded with 220 grit paper to give it a translucent finish. This
achieves two things a surface that is adequate to be projected on, while retaining the ability for
the camera to clearly see the bottom of the hex tile so as to be able to track them. The sanded
finish of the tabletop also makes it a gratifying tactile surface. The acrylic is mounted onto the aluminum frame and locked in place within L-channels along the perimeter of the hexagon.

Figure 4.11: Schematic of hexagonal table that is cut from 1/2” cast acrylic
4.3.6 Enclosure

The enclosure of the table primarily houses and protects the components that power IDÉUM. The shape also gives the table its design aesthetic. The enclosure has a boat like form that was inspired by the naval history of Karslkrona. The enclosure material was carefully chosen to be 26 gauge 304 Stainless steel sheet stock in a 2B finish. Stainless steel was chosen in 26 gauge as it is easily re-workable. The 304 alloy was chosen as it is a non-magnetic and widely available alloy of stainless steel. The desired shape was achieved by folding the sheet metal much like origami. The sheet was first waterjet cut into the different required shapes. One panel is shown in Fig 4.12 The steel sheet was then backed with 1/8 plywood to give it rigidity and make it easier to bend. The sheets were then bent at the crease lines to the required angles using a length of 2x4 wood as a brake. To mount the steel sheets onto the aluminum frame, the top edge of the sheet was rolled over such that the edge fits onto the L-channel. The steel sheet was additionally held in place by tying different points on the sheet to the aluminum frame. The rolled edge on the top edge of the steel also gives participants a comfortable rounded edge to rest their hands on. Figures 4.13 and 4.14 show some of the processes used in forming the steel.

Figure 4.12: Schematic of one of the side panels that is cut from a sheet of 26 gauge stainless steel
Figure 4.13: Trimming off part of steel panel using a dremel tool
Figure 4.14: Rolling the top edge of the steel panel using a mallet
4.3.7 Cooling

The various electronic components housed in the table, especially the projector, generate significant amounts of heat. To adequately cool these components a grate pattern was cut into either side of the steel enclosure as shown in Fig 4.15 to provide ventilation. To aid in effectively cooling the air inside the enclosure, 6 PC cooling fans were placed at different locations inside (2 at each vent, and 2 near the projector exhaust).

Figure 4.15: Grate pattern cut into the steel panels for ventilation. Cooling PC fans on the inside help in increasing effectiveness of cooling
4.4 The Hex Tiles

The hex tiles used in our system were designed to combine the best aspects of Post-its and whiteboards with some additional features that make them better teaching tools for brainstormers. Like Post-its, the hex tiles limit the amount of information that can be placed on them, making users headline their ideas (one of the Rules of Brainstorming). We chose to keep the utility of small modular pieces, but enhance this by making it easier to link and group them (thus the tesselating shape) and keep those groupings together. Like a whiteboard, the hex tiles have a surface that is comfortable to write on and easy to erase.

![image.jpg](image.jpg)

Figure 4.16: The final form of our hex tile, with key features highlighted: the scalloped edges for easy grip; the embedded neodymium magnets; and the fiducial marker on the bottom used by the Reactivision software.

4.4.1 Magnets

We carefully selected a magnet strength that would allow groups of ideas to be kept together and passed around the table to reorganize and share ideas, yet still were easy to detach from each other. After testing a number of different strengths and spacings, we chose 1/2" x 1/8" x
1/16” Neodymium magnets from KJ Magnetics, and inset them 1/16” from the edges of the hex tiles.

4.4.2 Writing surface

The writing surface of the tiles was designed to preserve the feeling of a whiteboard without getting accidentally erased during handling. We chose Expe Wet-Erase Overhead Projector Markers because they are not as easily erased as dry-erase markers (which had become a problem in earlier prototypes when tiles were getting touched frequently) but can be erased with a damp cloth and do not require any special chemicals (unlike Sharpie permanent markers, which we had also experimented with). Because we wanted the illumination to show through the tiles, we chose a semi-translucent cast acrylic (2447 White from ePlastics.com). We chose acrylic as an ideal material because it was easy to work with, made a smooth dry erase writing surface, and was relatively scratch-resistant. We were initially concerned that brittleness would be an issue if tiles were dropped, but soon discovered that this was not a problem at all (filleting all the corners on our design completely reduced cracking).

4.4.3 Fiducial markers

In order for the hex tiles to be read by the Reactivision system, we needed to place a unique fiducial marker on the back of each tile. To get optimal readings from the camera without having the fiducial marker show through the translucent acrylic, we chose to cut the markers out of a pale IR-blocking film (IR-70 NR Film from Apex Window Films; normally used for auto glass and home window coverings; this solved earlier design issues where we were simply using black stickers for the fiducial markers, which was very distracting when trying to write on the tops of the tiles). To protect the IR film stickers from being scratched off, we etched a relief area into the bottom of the hex tiles, and covered them with a layer of acrylic tape.

4.4.4 Form

We wanted to ensure that our tiles were comfortable to pick up and gratifying to handle. To make them easier to grip, we scalloped the edges slightly, but only did so on the middle layer of acrylic so that we did not sacrifice any of the writing surface area (we found that some users like to write across multiple tiles, and therefore run into problems if the connection between tiles is not continuous). After experimentation with tessellating shapes to encouraged building on others ideas, we chose hexagons as the simplest and most useful option. The tile size (4 inches in diameter) is designed to preserve the surface area of a Post-it. For more about our exploration of tile form factor, please see Design Development.

4.4.5 Supplemental shapes

Early testing demonstrated that users needed more variety in the shapes they could create as they connected ideas (most users ended up with large sheets of honeycomb structure, which were not ideal for sophisticated arrangement and sorting of their work). In response to this, we created a limited number of extra connector shapes - small triangles and chevrons - which fit with the geometries of the hex tiles but could be used to point out special connections and break up the monotony of the structures. For additional shapes we considered, see Design Development.
Figure 4.17: We added the above new shapes - chevrons and triangles - to allow new configurations that help users better organize their work.
4.4.6 Color tiles

Another request from users that we found very valuable in the system was the ability to change the color of the light on a tile. This allows for many different organizational possibilities - including assigning each user a color to keep track of his idea or turning the lights 'off' (black) on a tile when downselecting ideas. We tried to choose bright colors that would be visible in all lighting conditions; orange worked particularly well.

Figure 4.18: We added special tiles which are not meant to be written on but can be used to change the color of the spotlights on any other tile by tapping with the colored edge.

4.4.7 Manufacturing process

After several rounds of test layups and experimentation, we came up with a manufacturing process of laminating acrylic with embedded magnets. We laid up the laminations in sets of 4 tiles because this was the largest quantity we could handle per batch before running into issues with the acrylic curing too quickly.

We started with one sheet of 1/8" (true thickness .110") acrylic, which we cut holes in to allow the embedded magnets, as well as oval relief shapes for the scalloped edges of the tiles (see cut A in figure below). Since the height of the magnets was slightly larger than the thickness of the acrylic it was embedded in, we also needed to etch out a relief space in the layers of 1/16" acrylic that sat above and below this (see etch B in figure below). To achieve precise alignment of all the layers, we etched hairlines and cut small pinholes through which we stuck alignment pins.

We laminated the first two layers together with TAP Plastics Free-Flowing Acrylic Cement (Fast-Setting), an acrylic solvent (composed primarily of methylene chloride and trichloroethylene). Once these had been clamped and allowed to set for at least 15 minutes, we laid the magnets in with alternating polarities, and then laminated the top layer on, again using the alignment pins to ensure that the layers stacked perfectly. We clamped this and allowed the layup to dry for at least 24 hours.

Once cured, we used the alignment hairlines to position the layups in the laser cutter, and then cut out the final hex shapes (see Cut and etch C in figure below). We etched the bottom of each tile to provide the relief space for the fiducial marker.

We then laser cut the fiducial markers out of the IR-blocking film and transferred them on to the relief spaces on the hex tiles using extra heavy duty packing tape. In order to protect the IR film from peeling off, we left the packing tape on the tiles. Each tile then went through a quality control check to make sure that the fiducial could be read properly by our system.
4.4.8 Future manufacturing

While laminating and laser cutting was ideal for the quantity and finish we desired, it will not be feasible for making large quantities of hex tiles going forward. In future iterations, we expect to have these CNCed from acrylic, or, if demand is high enough, injection molded with magnet inserts. We will also need to develop more sophisticated jigs to insert the magnets in the appropriate orientations: while we tried a number of different jigs while developing our manufacturing process, we were unable to find a successful design and ended up placing each magnet by hand.
Figure 4.20: Images from our hex manufacturing process: laminating the layers together with acrylic cement and heavy weights, and cutting the holes for embedded magnets and scalloping on the laser cutter.
4.5 Bill of Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Specs/Quantity</th>
<th>Vendor</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hex Its (60 pc)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acrylic (1447 white)</td>
<td>1/16&quot; thick 48&quot; x 48&quot;</td>
<td>ePlastics</td>
<td>74</td>
</tr>
<tr>
<td>Acrylic (1447 white)</td>
<td>1/8&quot; thick x 48&quot; x 48&quot;</td>
<td>ePlastics</td>
<td>37</td>
</tr>
<tr>
<td>Neodymium Magnet</td>
<td>(1/16&quot; x 1/8&quot; x 1/2&quot;) (720 pc)</td>
<td>K&amp;J Magnetics</td>
<td>180</td>
</tr>
<tr>
<td>IR blocking film</td>
<td>3 sqft</td>
<td>Apex Window film</td>
<td>13.6</td>
</tr>
<tr>
<td>Acrylic Packing Tape</td>
<td>(2&quot; roll) (1 pc)</td>
<td>Stanford Bookstore</td>
<td>3.49</td>
</tr>
<tr>
<td>Acrylic cement</td>
<td>1 bottle</td>
<td>TAP Plastics</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total ($)</strong></td>
<td></td>
<td></td>
<td><strong>316.09</strong></td>
</tr>
</tbody>
</table>

**Table: Tech Hardware**

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Vendor</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEC U300X Projector</td>
<td>1</td>
<td>Amazon</td>
<td>870</td>
</tr>
<tr>
<td>Microsoft LifeCam</td>
<td>1</td>
<td>Fry's</td>
<td>60</td>
</tr>
<tr>
<td>Zeikos 0.45x lens</td>
<td>1</td>
<td>Amazon</td>
<td>15</td>
</tr>
<tr>
<td>IR LED Spotlights</td>
<td>5</td>
<td>Amazon</td>
<td>42.5</td>
</tr>
<tr>
<td>MicroITX Computer</td>
<td>1</td>
<td>NewEgg.com</td>
<td>350</td>
</tr>
<tr>
<td><strong>Total ($)</strong></td>
<td></td>
<td></td>
<td><strong>1337.5</strong></td>
</tr>
</tbody>
</table>

**Frame and top**

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Vendor</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acrylic 1/2&quot; clear</td>
<td>1/2&quot; x 50&quot; dia hex custom cut</td>
<td>Platinum Water Jet Cutting</td>
<td>970</td>
</tr>
<tr>
<td>Stainless steel panels</td>
<td>Custom cut shapes (6pc)</td>
<td>Platinum Water Jet Cutting</td>
<td></td>
</tr>
<tr>
<td>Aluminum 80/20 Frame (8ft)(11pc)</td>
<td></td>
<td>McMaster Carr</td>
<td>172.37</td>
</tr>
<tr>
<td>80/20 Connector Pieces, addtl aluminum for custom connectors &amp; projector mount</td>
<td>Right angle extended brackets; (12&quot;x12&quot;x 1/4&quot; aluminum plate)(2pc); Drop-in nuts(20pc); Extra heavy duty corner brackets (10pc); 180 degree perpendicular pivot(8); Nuts (50 packs of 4)(1/8&quot; Thickness, 3/4&quot; X 3/4&quot; Legs, 8&quot; L)(2pc)</td>
<td>McMaster Carr</td>
<td>376.35</td>
</tr>
<tr>
<td>Aluminum L-Channel</td>
<td></td>
<td>McMaster Carr</td>
<td>28.72</td>
</tr>
<tr>
<td>Floor pads, Foam pads for table surface</td>
<td>12 floor pads, 36&quot; Foam tape</td>
<td>McMaster Carr</td>
<td>29.28</td>
</tr>
<tr>
<td><strong>Total ($)</strong></td>
<td></td>
<td></td>
<td><strong>1576.72</strong></td>
</tr>
</tbody>
</table>

Figure 4.21: BOM for IDÉUM
4.6 Design Description: Opportunities

Discussions with users have raised a number of exciting potential new applications for our system. Some of the most promising include:

- **Data mining**: Design researchers could use the software to track teams design behaviors. With very simple programming, there is a huge amount of information that researchers could collect:
  - *Rate of idea generation*, rate of building on others ideas, rate of introducing new unrelated topics and ideas, or rate of returning to old ideas
  - *Enthusiasm about ideas* (assuming that tiles which teams are more enthusiastic about get touched and moved more, we could track the amount of movement each idea experiences)
  - *Individual contributions* (using pre-tagged tiles to tell which user added which idea, and study, for example, the correlation between an individuals engagement and the groups energy)

- **Programming games**: In the future, we are planning to add simple games that are commonly used by facilitators to teach brainstorming. Facilitators could be given an arsenal of special tiles which would trigger the code to run customized games they wished to introduce.

- **Mapping process**: Teams could keep track of when ideas were added and later get a playback of their idea generation process. By taking a single image at the end of the brainstorming session and mapping each tile to its corresponding fiducial, we could generate timelapses of the entire session and highlight areas of outstanding energy. We could assign a special fiducial marker that teams use to tag moments or ideas in the session that they would like to revisit later.

- **Instances of randomness**: to help serendipitous idea generation, we could introduce random stimuli (highlighting certain ideas, drawing connections randomly between ideas, changes in mood via light/motion/color) that could shift the teams direction and energy when the table sensed that the team’s idea generation was slowing down.

- **Use in K-12 Education**: While this was not part of our original design intention, there is the potential to add simple code that would allow this table to become a teaching tool for young children learning geometry, math, and other logic and visualization tasks.
Figure 4.22: Among the potential other applications of our table that we’ve identified is the opportunity to use it in elementary education. Children find it delightful.
Chapter 5: Design Development

5.1 Overview of Fall and Winter Quarters

5.1.1 Timeline

The path to IDÉUM was far from straightforward, jumping between needfinding, prototyping, and testing, multiple times throughout the year. This nonlinear process was broken up time-wise into Fall, Winter, and Spring academic quarters, each ten weeks long. We travelled to Sweden before the start of Winter and Spring quarters, for user testing, interviews, and full Stanford-Global meetings.

The Fall quarter was focused on exploring the problem space through needfinding and benchmarking. The Winter quarter was focused on exploring the design space through constant prototyping at increasing levels of resolution, arriving at a rough but functional prototype to be carefully improved upon in Winter quarter. The results of user testing in the Spring trip, however, spurred us to change directions at the start of Spring quarter, even shifting the needs we focused on. Thus, during Spring quarter we rapidly traversed from rough prototyping through to a polished prototype. Though this was certainly hectic, it was very much worth the effort.

Development of IDÉUM during Spring quarter, despite being a pivot from the previous direction, greatly benefited from many of the learnings in the Fall and Winter quarters. These learnings are summarized here in the Overview – for more details please refer to the Fall and Winter documents; this document will focus primarily on the Spring quarter development of IDÉUM.

5.1.2 Fall Quarter

The needfinding phase included user interviews, benchmarking of existing solutions, and a site visit to Kungshall.

In Fall Quarter, we visited successful design spaces in Silicon Valley. The details and results of these visits can be found in more detail in the Appendix; a summary is included here. From our visit to SAP Apphaus, where we talked to Philip Skogstad, we learnt the value of a ‘special forces feeling’ – teams that feel like they are elite tend to perform like they are. We also learned that teams function best when they are co-located, and have the flexibility to customize their physical space as they desire. We also visited IDEO, where we learned that best designers don’t expect much from their space – just a simple place to work in, and an abundant supply of pens and Post-Its. From both these places, we learned that there isn’t an established way to keep track of the design process in even the most experienced and elite of firms – it is left up to the designer and is often messy, and assumed a priori to be tautologically intractable.

The places we visited all had advanced tools like the Smartboard that are meant to make keeping track of work easier. However, users reported that they most often went unused, because they had too high of a barrier to entry. Teams would use a regular whiteboard instead, as it was easier and intuitive. Although using the Smartboard would have paid off over time, as the work grew and keeping track of it became more important, the added value at the time is too low to make the annoyance worthwhile. Benchmarking a few of these tools ourselves (described much more thoroughly in the Appendix), we found a similar result. This lead us to the important criteria for process capture tools of have the incremental added value be larger than the incremental added annoyance:
\[
\frac{\Delta Value}{\Delta Annoyance} \gg 1
\] (5.1)

In December 2012, we visited Sweden. There, we visited established creative spaces to understand the existing solution space and the local business environment. We talked to a number of users, including Peter Wallin, an Innovation Portfolio Manager at Volvo CE. He described these Technology Working Groups as being formed by picking individuals from several departments who had often never worked on the project before, or with each other. They start out with no ownership of the problem or design space, and also have to continue doing their daily tasks which leaves little to no time for the project. Scheduling is a huge issue, and they tend to meet once a week for perhaps an hour at best. Being head of the Groups, he had the authority to set criteria for what a ‘useful’ space – one they would actually send a team to – would consist of. He would like some ability to measure the output of Kungshall, something to show that value is being added there, rather than just a soft workshop where skills are developed. For more about the interview with Peter, please see the Appendix.

The Critical Experience Prototype (CEP) and Critical Function Prototype (CFP) were early explorations of the design space conducted in the Fall Quarter.

During the fall quarter, we began to broadly explore the design space with the Critical Experience Prototype, more usefully known as ‘The Brainhurricane Room’, and the Critical Function Prototype, the ‘Scrolling Table’. The development, testing, and lessons from these prototypes are described in detail in the appendix; the most relevant details are summarized here.

For the ‘Brainhurricane Room’, we walled off a section of the ME310 Loft with curtains, and set up a projector and speakers to create ambient environmental stimuli. After testing a number of different scenarios with both semantic and non-semantic stimuli geared to help teams brainstorm, we learned that trying to help teams with semantic cues was very difficult, but inspiring the designers themselves with non-semantic stimuli – such as upbeat music and colourful videos – can have a large positive effect on team performance.

For the ‘Scrolling Table’, we covered an IKEA table with a roll of writable whiteboard material and a scrolling mechanism. Work done on the table didn’t have to be erased – you could advance the scroll by turning a winch, and then write on the new material. A digital camera located under the table could be commanded to take a picture of the old material. We were aiming to discover whether the physical experience of writing on a whiteboard could be preserved, and we found that it could even be enhanced: the physical act of advancing the roll was gratifying. Using the digital camera to take photographs of the rolled material was a first crude exploration of automatic capture of work; we found that it should be automated and smart to truly help.

### 5.1.3 Winter Quarter

Three prototypes were built during Winter quarter to explore the space of documentation tools. Influenced by our results from the CEP, we built the Dark Horse Prototype, to investigate the question, “How might we directly inspire users to prototype earlier? We built a simple toy train system to constantly introduce new prototyping materials to a team as they worked on a design prompt we provided. Through extensive user testing and surveys we learned that, ‘one persons inspiration is someone elses distraction – that a strong environmental stimulus, such as the noise of trains, that helps one person work more effectively will more than likely annoy another person
any stimulus should be subtle and restrained. Furthermore, we also saw that owning a common goal—even one as simple as keeping a toy train on its tracks—helped teams of random strangers quickly band together and thus improve their design performance.

The next two prototypes addressed the need for team ownership of the problem and design space, and the need to ease the burden of keeping track of information.

The Venturoom prototype consists of Venture Branding, a team formation activity that teams entering Kungshall will go through, and the Verkroom, a smart room that automatically takes photographs of work done by the team and saves it to the teams Dropbox in a meaningful way.

Through Venturoom, we learned that automatically capturing work to the cloud, succinctly termed ‘Work-To-Cloud, is important and useful, but that users desire more structure and meaning than just tagged photographs. Importantly, we also learned that having a specific room to work in is very restricting—users want to Work-to-Cloud from everywhere. Finally, we also confirmed, albeit with just one test case, that a unifying brand identity helps to improve team spirit and motivation.

Our next prototype, the Functional System Prototype, sought to specifically address the discovered requirements from Verkroom. In order to Work-to-Cloud from anywhere, our system must be everywhere. Cognizant that work is usually done in either a horizontal format—on a table—or a vertical format—on a whiteboard—we decided that our product must be both. Thus we built ‘Verkholmen, a smart table that can be transformed into a whiteboard and vice-versa. We incorporated the features from Verkroom into Verkholmen, and added several software features, including design templates, meeting notes templates, and playback of old work.

5.1.4 The Pivot

In March 2013, armed with a plan for Wizard-of-Oz testing of the Verkholmen concept, and excited to meet our users for the first-time, we travelled to Sweden again. We projected PowerPoint worksheets on a whiteboard, and used a simple point-and-shoot digital camera to capture the written information. The PowerPoint presentation was then manually updated to show the entered information.

We first met with a Volvo CE innovation team in Munktell Science Park, Eskilstuna. There, Andre led a day-long session about innovation benchmarks that had been previously scheduled, and modified to incorporate the Verkholmen worksheets. While users seem to appreciate these features, they were far from excited about it: its effect was entirely forgettable—after they had been reminded that it existed during user interviews, they simply didn’t think it would add that much value. It was a “I supposed it could be useful,” rather than the “Wow!” we were looking for.

Testing the Venture Branding prototype provided interesting observations. When prompted to invent a name and identity for themselves, they responded with silence. Despite the facilitator’s continual insistence, suggestions were few and far between, and were anyhow met with a lukewarm reception. The most exciting parts of the Venture Branding activity—the tangible branded t-shirts and other paraphernalia—are explicitly not allowed by Volvo CE’s rules, so the low energy about this specific activity is understandable. But this general pattern of disengagement from brainstorming—of low energy and lack of excitement, of ideas fizzing out immediately upon utterance because no one is there to grab it and run with it—was seen throughout the day’s work. This contrasted starkly from their high-level of engagement with Andre’s lectures, interview questions, and idea selection.
The interviews also revealed more detail about the problems they were facing at work. The needs identified earlier were very real. They are very busy: One team member told us how at meetings at Volvo headquarters, he would always be thinking about the computer simulations he was performing at the same time, and constantly running back to check up on them. Even being in Munktell Science Park, a mere 20 minutes away from Volvo HQ, helped them focus on the task at hand. They do feel the need to take ownership of their design space – they constantly feel like they are doing things to meet Key Performance Indicators, rather than acting towards a common goal they feel passionate about. Yet they didn’t really feel that these problems were unique to innovation teams or truly held them back – they were the reality of a corporate environment, systemic issues that everyone has to deal with. Throughout all this, though, a nugget caught our attention: Almost all of them said something along the lines of, “Volvo is just not an innovative company. We are not like Google, we are not creative and don’t know how to do this.”

This lack of creative confidence was also strongly felt in our workshop with Läreda Mekan, in Hässleholm. Läreda is a contract manufacturer of car seats, primarily for Volvo. They are a small company of 150 people – most of whom are blue collar factory floor employees – and do not have anything that resembles an R&D department. Recent changes in the market have convinced them of the need to innovate rapidly and radically, and to move up their value chain. As part of a consortium of contract manufacturing companies in the automotive sector, they see the potential to combine broad engineering and manufacturing expertise to create a product that they can offer to Volvo and other companies, rather than relying on being sought out to simply manufacture a designed part. However, they need a design direction, and so our one-day workshop with three of their senior executives brought them through the entire design process.

The diverging phases consisted of creating a persona, benchmarking, needfinding, and brainstorming, while the converging phases consisted of idea selection and formulating design requirements. We found that while they were comfortable with the less ambiguous parts of the process like benchmarking and needfinding, brainstorming was a serious bottleneck. Again, they had difficulty simply putting ideas on the board, and, when they did, they were well-formed, detailed designs that were minor perturbations to existing seats. They also had trouble building on others’ sketchy, headline-only ideas. After some impromptu demonstrations of this kind of behavior by the facilitators, however, they started to get a hang of things, and to build enthusiasm and momentum. In interviews after, they reported having an eye-opening experience, that began as dubious and ended as thrilling.

From analyzing and discussing this user testing, we decided to pivot, and refocus on two newly discovered needs that really excited us and that we thought could really help our user. They need to feel more confident about their creative abilities, and they need idea generation to be less stressful and more rewarding. From this starting point, we began Spring quarter.

5.2 Spring Prototyping

As in Winter Quarter, the development of IDÉUM during Spring quarter is a story that can be told through the motivations, workings, and learnings of several prototypes of increasing resolution.
5.2.1 LightFoam

Motivation

From benchmarking, we realized that the d.School’s ‘Rules of Brainstorming’ are a well-established set of guidelines that have been shown to produce better and more rapid idea output. From this, we asked, “How might we show these rules, rather than telling them?” We quickly honed in on two main rules, and, incorporating various learnings from previous prototypes, effects we could use to establish them.

Defer judgement Don’t block teammates’ ideas; put them up, because they may be useful for building on later.

From the BrainHurricane room prototype, we found that users found it really encouraging when they thought their ideas were ‘lighting up’. What if their ideas actually lit up when placed on the work surface? (Subtly though – we learned from the Dark Horse Prototype that too much can be a turn-off!)

Build on the ideas of others This is especially useful when the team feels stuck, and helps to leverage the diverse perspectives of multidisciplinary teams.

What if the work surface made building on ideas tangible, intuitive, and fun? Drawing inspiration from childhood favorite Lego, we envisioned roughly Post-It sized whiteboard tiles that ‘clicked’ together somehow, and that invited clicking together based on its physical form.

LightFoam is a rough prototype built to explore these questions.

Design and Construction

LightFoam consists of two subsystems: the Tile, and the ReedSurface. For the Tile, we prototyped various materials ranging from foamcore to acrylic, and sizes ranging from 3 inches to 8 inches. We tested both puzzle-piece clicking and magnetic clicking, as well as various magnetic clicking strengths. We prototyped both square and hexagonal shapes. A photograph of several Tile prototypes is shown in Figure 5.1.

The ReedSurface lights up when a Tile is placed on it. A purely analog system, it consists of an array of Reed switches that activate a nearby LED when a Tile – with embedded magnets – is placed on the surface. The components are embedded in a three-layer laser-cut foam core structure. A photograph of the ReedSurface is shown in Figure 5.2.

Learnings

Learnings from user testing with other 310 teams and with random people in the Atrium of the d.school helped shape future prototypes.

Tile

- Hexagonal shape is preferable to square shape. When tested without magnets, hexagonal shape invites building through its form alone, whereas square shape are treated like regular Post-Its.
• Magnetic clicking is preferable to puzzle pieces. It is easier to put together and take apart, and the ‘pulling together’ of the magnets, as well as the clicking noise, is very gratifying. An intermediate magnet strength was chosen by informal poll.

• A 4 inch hexagon is the optimum shape for headlining. Smaller sizes don’t allow enough words, larger sizes encourage longer sentences rather than headlining. 4 inch hexagon also fits well in the palm of most users’ hands. Not coincidentally, it is close to the area of a standard Post-It.

• Plastic rather than foam core. It feels more solid, and the heft makes for a better tangible experience.

Table

• Resolution is important. The reed switches and LEDs are spaced about 1 inch apart, which is about 1/4 of the width of the hexagon. This means that the lights don’t read to users as ‘following’ the hexagons enough.

• Reed switches are fragile. They have glass cases and so when users dropped the tiles on the surface they would shatter.

Overall, we were very encouraged by these results, and decided to continue on this development path.

5.2.2 ProjTable

Motivation

Driven by the Table findings from LightFoam, we wanted to prototype a higher resolution and more scalable Tile illumination solution.

Benchmarking similar systems unearthed Reactivision, an open-source API for tracking tangible objects. It was originally written for Reactable, a synthesizer with a tangible object interface. It uses a webcam operating in the infrared range to keep track of fiducial symbols on the bottom of the objects. The objects are placed on a translucent surface, and are illuminated by infrared lights. A projector displays an image on the same screen.

ProjTable is a quick-and-dirty implementation of Reactivision, with the goal of testing its efficacy for our use case.

Design and Construction

ProjTable was designed to be built as quickly as possible – it took about four hours to construct from start to finish. A spare piece of 3/8 inch thick acrylic was sanded using an orbital sander to create a translucent surface, and then bolted to pieces of 2x4. A Microsoft LifeCam is used, with pieces of developed exposed 35mm negative film acting as an infrared filter. A wide-angle lens for 35mm wideangle SLR cameras is mounted on an everyday digital projector. IR LEDs are purchased and used for infrared illumination.
Learnings

User testing of ProjTable among ME310 teams and with random strangers in the d.School atrium helped us gather insight. A photograph of ProjTable in action is shown in Figure 5.3.

- Reactivision has high tracking performance. Despite the makeshift nature of the prototype, Reactivision was able to track the fiduciary symbols well.

- Projector with Reactivision achieves high illumination resolution. Spotlights followed Tiles well, convincing users that the symbols were being followed.

- Even IR illumination is important. Hotspots on the surface prevent reading of fiduciary symbols.

- A sense of magic is exciting. Users didn’t expect lights from an ordinary looking plastic table-top – this makes the effect much more exciting.

- Gratifying tactile finish promotes sliding ideas around. The sanded acrylic had a surface that felt smooth and nice to the touch. Importantly, its low friction encouraged sliding and moving of idea tiles.

- Table size is important (this was too small). This table was much too small, yet the projector screen size was already enlarged with a wide-angle lens.

- Table height of 38in is a good height for tile-based brainstorming. It felt intuitive to users to write and move tiles around at the height of our prototype, which was based on other standing workspaces.

Overall, this quick prototype allowed us to confidently pick Reactivision as the development path to take. It is simpler, more flexible, and better performing than a large array of Reed switches or hall effect sensors.

5.2.3 Part X: Hex tiles

5.2.4 Motivation

The next step was to completely define the hex tiles for our final prototype. Having already chosen a shape, material, and magnetic strength in the LightFoam prototype, we set out to refine the manufacturing process, edge finish, and to integrate the Reactivision fiduciary markers.

5.2.5 Learnings

We quickly iterated through several possibilities for each attribute. Photographs of a selection of these prototypes is shown in Figure 5.5.

- **Edge Scalloping** We found from earlier testing that the smooth edges of the plastic hex tiles were not grippy enough for some users. We prototyped one large round divot, three round divots, and many small round divots. The one large round divot proved to be most attractive on both tactile and visual levels. A comparison between many small round and one round divot, as manifest in an intermediate vs. final part X, is shown in Figure 5.4.
• **Manufacturing Method** We tested 3d printing vs. laser cutting, and found that the former quite simply had too poor of a surface finish to be marker-compatible without an excessive amount of finishing work. Additionally, while you could achieve non-planar shapes with the 3d printer, it was found that it did not add very much to the product. In order to hide the magnets, have a scalloped edge, and also have good edge finish, three laser cut layers were used. Internal details were first cut on each layer, and then the hexagonal outlines were cut after the layers were laminated together with acrylic cement. Placing all of the magnets in the proper orientations (alternating polarities around the perimeter of the hexagon so that two adjacent hexagons always attract each other) was a struggle, and we experimented with a couple of different jigs to achieve proper alignment and prevent the magnets from escaping from their slots when jostled during the laminating process. Two of our experimental jigs are pictured below, but these ended up being impractical and so we ultimately placed the magnets by hand for final manufacturing.

• **Material and Thickness** Letting the right amount of light through, while maintaining good readability, is critical. Surface feel and heft are also important. We tested various thicknesses of varying acrylic opacity, and decided on 1/4” thick Sign White 2447 (35% light transmittance).

• **Fiduciary Marking** It is important that the fiduciary be clearly visible to the camera, but we also want it to not obscure the illumination of the hex tiles. Additionally, it should be robust to a lot of sliding around on the table surface – that is, the fiducial marker should be inset into the tile such that it does not rub against the surface. We tested black acrylic inlays, vinyl stickers with an etched square inset, graphite-rubbed etchings, inked etchings, paper stickers with an etched square inset. Vinyl stickers provided the least light-blocking and construction simplicity, but were still more visible under back lighting than we liked. A materials search turned up IR blocking window film, designed for car and house windows, that blocks large amounts of infrared but lets most visible light through. By laser cutting this window film, we were able to achieve more than satisfactory levels of illumination blocking.

5.2.6 Paper Prototyping: Table Size and Shape

**Motivation**

The size and shape of the table is critical to the experience of the user, as well as to the engineering design of the table itself. Ergonomics defines a set of constraints. A table that is too large makes it hard to interact with tiles in the middle, and makes other team members too far away for good conversation. A table that is too small feels cramped and stifling. The aesthetics should confer dynamism and encourage conversation. There should be space for users to fit their legs and feet comfortably while standing at the table. Finally, the setting of the table within the history and space of Kungshall should be considered.

Specifications of the projector defines another set of constraints. In order to get a projection width larger than 30 inches, while avoiding complicated mirror setups, we hoped to choose an ultra short throw projector. The NEC U300X was the best choice in the acceptable price range. With a throw ratio of 0.377:1, and a 55 degree cone angle, the placement of the projector and projection cone defined hard constraints on the form of the table.
Exploring the design space defined by these two sets of constraints is a daunting task, that required rapid iteration and testing through paper prototypes, as well as concurrent form creation and engineering planning in CAD.

**Learnings**

Several cardboard table top shapes were cut out (Figure 5.7), and tested with other teams from 310 and by ourselves, while CAD of the whole table was constructed concurrently (Figure 5.9). Our tabletop shape tests included shapes that did not satisfy the projector placement constraints – if they were very strongly preferred, we would have to figure out a complicated mirror setup to allow it.

1. 60in Circle – Too large, can’t reach things in the middle, too far from teammates. Projector placement constraint not satisfied.
2. 50in Circle – Good size, but shape is ‘boring’. Projector placement constraint not satisfied.
3. 50in Hexagon – Good size, but shape is still too ‘boring’. Projector placement constraint not satisfied.
4. 25in, 50in Square, Trapezoid, Hexagon with lobe on one side – User at end opposite the lobe feels isolated, because they are not facing a person directly. The projector is placed inside the lobe.
5. 50in Elongated hexagon – Interesting shape, good people placement for interaction with table and others. Dynamic, exciting form. Projector placement satisfied. An unacceptable number of people thought it looked like a coffin.
6. 50in Extended hexagon – Interesting shape, good people placement for interaction with table and others. Dynamic, exciting form. Projector placement satisfied. Form echoes hexagon shape strongly, which integrates well with tiles. Coffin-similiarity extinguished.

After considering CAD and user testing, we decided on the extended hexagon shape. A last full-size cardboard prototype was constructed (Figure 5.8), and was met with excitement by the team and with testers.

**5.2.7 Penultimate Prototype**

**Motivation**

After the form and size of the table was set, work began immediately to make it real, focusing first on the essential elements to achieve the core functionality: a robust frame that would support the acrylic table top and the projector; a camera system that could see the entire tabletop; even infrared illumination; and a sanded acrylic tabletop. A prototype of the exterior paneling was also explored.
Design and Construction

An annotated photograph of the penultimate prototype is shown in Figure 5.10.

- We chose aluminum 80/20 as the frame material for its combined strength, cost, and ease of construction. A wood frame of the same strength would have blocked too much of the projection cone. A steel square-channel frame would have been very difficult to assemble.

- The same Microsoft LifeCam, from the ProjTable prototype, was used, with a wide-angle lens for digital SLRs and an infrared filter.

- The table top was ordered water jet cut from 1/2” clear acrylic, and sanded by hand using the same techniques shown to work in the ProjTable.

- Infrared illuminators for CCTV cameras were used.

- 26 gauge stainless steel was chosen for the exterior material. The shape of the material can be achieved using 6 pieces of bent sheet metal, so it is the more efficient choice when compared to plywood construction. Aluminum would have been too unforgivingly brittle for hand bending, and a thicker gauge of steel would have been really difficult to bend. A plain 2B finish was chosen for its color.

- Laser-cut 0.25in birch ply was chosen for the hutch material, for ease of construction and quality of finish.

Learnings

The learnings from the penultimate prototype were incorporated into the final EXPE prototype explored in detail in Design Description.

- Infrared illumination still has hotspots, corresponding to reflections of the individual LEDs on the acrylic. They should be moved so they can’t be seen by the camera.

- CCTV infrared lamps usually have a light sensor that allows them to only turn on at night. This should be blocked.

- The 80/20 frame flexes more than feels comfortable. Reinforcements should be added.

- The 26 gauge steel was very easy to bend, and less strong than anticipated. Epoxying wood panels to the inside of the panels reinforced the steel while creating creases for the bends.

- Rolling an edge to hang the steel on the frame was much easier than anticipated. Future prototypes of the exterior will incorporate this into the design.

- Hutch design evidently failed to account for aluminum mounting plates, and needs to be redesigned. As well, plain birch is too light-colored. It should be stained darker.
Figure 5.1: Some tested Tile shapes. Clockwise from bottom left: White acrylic, 4in; Foamcore, 5in; White acrylic puzzle piece, 6in; White acrylic puzzle piece, 5in.

(a) Top side of ReedSurface, showing Reed switches and LEDs.

(b) Bottom side of ReedSurface, showing connections.

Figure 5.2: ReedSurface
Figure 5.3: Users testing out the ProjTable prototype.
Figure 5.4: Left: Intermediate Part X. Many small round divots edge scalloping, 7508 opaque white acrylic. Right: Final Part X. One small round divot, 2447 sign white.
Figure 5.5: Photographs of Part X prototypes. Clockwise from left: Foamcore + printed paper fiduciary; White acrylic with magnets for ReedSurface; Clear bottom layer + white top layer + circular click magnets + paper fiduciary; Clear bottom layer with black acrylic inlay; Etched fiduciary layer outline with vinyl fiduciary sticker; Foamcore; Circular click magnets; Acrylic inner hexagon with 3d printed outer retaining ring; Top view of etched inlay; Fully 3d printed
Figure 5.6: Two of the jigs we experimented with for aligning magnets as we embedded them in the hexes; neither was efficient enough to be used in final manufacturing, and further development of these designs will be needed when we scale up our manufacturing process.

Figure 5.7: A selection of cardboard tabletop cutouts exploring the table form
Figure 5.8: Final cardboard form prototype.
Figure 5.9: A selection of CAD renderings exploring the table form
Figure 5.10: Annotated photograph of the penultimate prototype.
Chapter 6: Planning

6.1 Spring Quarter Plan

At the beginning of Spring Quarter we developed a plan of action, reflected in the Gantt Chart in the foldout. Having a clear list of deliverables helped us stay on track this quarter, and we were able to achieve most of our goals.

6.2 Distributed Team Management

Being that our Swedish team are PhD candidates with diverse backgrounds and experience with innovation modelling, they took the lead on developing the Kungshall Center Concept. refer to Chapter 8: Concept for more information. The Stanford team has lead the prototyping and development of the IDEUM system and the various subsystems that comprise it.

6.3 Project Budget

The allocation of resources for spring quarter is summarized in Figure 6.1.
## ME310 Expenses Spreadsheet - Spring Quarter AY13

### Team Name: Kungshall

<table>
<thead>
<tr>
<th>Reference*</th>
<th>Date</th>
<th>Vendor Name</th>
<th>Description of Expense</th>
<th>Pre-tax Amount</th>
<th>Shipping &amp; Handling (if any)</th>
<th>Amount Incl Sales Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/10/2013</td>
<td>Fry’s</td>
<td>Webcam + Electronics for Prototype</td>
<td>$76.56</td>
<td></td>
<td>$82.97</td>
<td></td>
</tr>
<tr>
<td>4/8/2013</td>
<td>Jameco</td>
<td>IR Illuminator for Prototype</td>
<td>$27.90</td>
<td></td>
<td>$30.24</td>
<td></td>
</tr>
<tr>
<td>4/9/2013</td>
<td>Amazon</td>
<td>Webcam for Prototype</td>
<td>$52.94</td>
<td></td>
<td>$58.50</td>
<td></td>
</tr>
<tr>
<td>4/10/2013</td>
<td>TAP Plastics</td>
<td>Acrylic for Hex Prototype</td>
<td>$132.00</td>
<td></td>
<td>$143.06</td>
<td></td>
</tr>
<tr>
<td>4/24/2013</td>
<td>ePlastics</td>
<td>Acrylic for final Hexes</td>
<td>$173.00</td>
<td></td>
<td>$187.49</td>
<td></td>
</tr>
<tr>
<td>4/28/2013</td>
<td>Mouser Electronics</td>
<td>Alcohol Dispenser for Prototype</td>
<td>$29.94</td>
<td></td>
<td>$32.40</td>
<td></td>
</tr>
<tr>
<td>4/25/2013</td>
<td>K&amp;J Magnets</td>
<td>Magnets for final Hexes</td>
<td>$187.00</td>
<td></td>
<td>$202.66</td>
<td></td>
</tr>
<tr>
<td>4/15/2013</td>
<td>K&amp;J Magnets</td>
<td>Magnets for Prototype</td>
<td>$34.30</td>
<td></td>
<td>$37.30</td>
<td></td>
</tr>
<tr>
<td>5/6/2013</td>
<td>Amazon</td>
<td>80/20 Aluminum for EXPE Prototype</td>
<td>$243.59</td>
<td></td>
<td>$263.99</td>
<td></td>
</tr>
<tr>
<td>5/6/2013</td>
<td>McMaster</td>
<td>Accessories for 80/20 Aluminum</td>
<td>$392.30</td>
<td></td>
<td>$425.16</td>
<td></td>
</tr>
<tr>
<td>5/10/2013</td>
<td>Grainger</td>
<td>T Slotted Extrusion</td>
<td>$146.00</td>
<td></td>
<td>$158.23</td>
<td></td>
</tr>
<tr>
<td>4/23/2013</td>
<td>Amazon</td>
<td>Projector for EXPE Prototype</td>
<td>$847.00</td>
<td></td>
<td>$917.94</td>
<td></td>
</tr>
<tr>
<td>5/7/2013</td>
<td>Apex Window Film</td>
<td>IR Blocking Film for Projector</td>
<td>$103.50</td>
<td></td>
<td>$112.17</td>
<td></td>
</tr>
<tr>
<td>4/1/2013</td>
<td>Jameco</td>
<td>Electronics for Prototype</td>
<td>$43.33</td>
<td></td>
<td>$46.68</td>
<td></td>
</tr>
<tr>
<td>4/3/2013</td>
<td>Amazon</td>
<td>Magnets</td>
<td>$22.30</td>
<td></td>
<td>$24.17</td>
<td></td>
</tr>
<tr>
<td>4/24/2013</td>
<td>Amazon</td>
<td>Lenses for Camera</td>
<td>$48.00</td>
<td></td>
<td>$52.02</td>
<td></td>
</tr>
<tr>
<td>4/8/2013</td>
<td>Jameco</td>
<td>Electronics for Prototype</td>
<td>$69.03</td>
<td></td>
<td>$74.81</td>
<td></td>
</tr>
<tr>
<td>5/13/2013</td>
<td>Amazon</td>
<td>Expo Markers for EXPE</td>
<td>$24.03</td>
<td></td>
<td>$26.04</td>
<td></td>
</tr>
<tr>
<td>5/13/2013</td>
<td>Amazon</td>
<td>IR Illuminator for Prototype</td>
<td>$49.86</td>
<td></td>
<td>$54.04</td>
<td></td>
</tr>
<tr>
<td>5/6/2013</td>
<td>Platinum Waterjet</td>
<td>RFQ Acrylic + SS</td>
<td>$820.00</td>
<td></td>
<td>$941.86</td>
<td></td>
</tr>
<tr>
<td>5/13/2013</td>
<td>Platinum Waterjet</td>
<td>Steel</td>
<td>$247.00</td>
<td></td>
<td>$260.69</td>
<td></td>
</tr>
<tr>
<td>5/6/2013</td>
<td>Newegg</td>
<td>Computer</td>
<td>$320.00</td>
<td></td>
<td>$346.80</td>
<td></td>
</tr>
<tr>
<td>5/15/2013</td>
<td>Amazon</td>
<td>Coctail Nuts + Bolts</td>
<td>$85.25</td>
<td></td>
<td>$92.34</td>
<td></td>
</tr>
<tr>
<td>6/2/2013</td>
<td>Home Depot</td>
<td>Plywood</td>
<td>$200.00</td>
<td></td>
<td>$210.68</td>
<td></td>
</tr>
<tr>
<td>6/2/2013</td>
<td>Home Depot</td>
<td>Wood</td>
<td>$230.00</td>
<td></td>
<td>$249.26</td>
<td></td>
</tr>
<tr>
<td>6/23/2013</td>
<td>Mi Pueblo</td>
<td>SUDS</td>
<td>$162.00</td>
<td></td>
<td>$175.57</td>
<td></td>
</tr>
<tr>
<td>6/23/2013</td>
<td>REA</td>
<td>Black Curtains</td>
<td>$92.46</td>
<td></td>
<td>$100.14</td>
<td></td>
</tr>
<tr>
<td>7/5/2013</td>
<td>Meyer Library</td>
<td>Posters</td>
<td>$200.00</td>
<td></td>
<td>$200.00</td>
<td></td>
</tr>
<tr>
<td>6/23/2013</td>
<td>American Apparel</td>
<td>T-Shirts</td>
<td>$120.00</td>
<td></td>
<td>$129.05</td>
<td></td>
</tr>
<tr>
<td>5/13/2013</td>
<td>Amazon</td>
<td>Epoxy</td>
<td>$30.30</td>
<td></td>
<td>$34.71</td>
<td></td>
</tr>
</tbody>
</table>

**Total** | $5,565.16 |

**Rollover balance from Spring AY13** | $1,885.75 |

**Spring Allocation** | $9,080.75 |

**Available Balance** | $320.59 |

---

*RPO Number, Requisition Number, IOU Transaction Number*  
*Décor budget: Up to $75/year of the team project budget may be spent on loft decor items*  
*Please see your Budget Monitor (Course Assistant), George Toye or Manny Hundal if you have questions. Thanks!*
6.4 Next Steps

At EXPE we got positive responses from both our sponsor Mikael Blomqvist and our liason Tobias Larsson. We also garnered interest for the product within the Stanford community and the Bay Area tech community. Mikael Blomqvist has now shown interest in moving the project forward and getting the tables manufactured for sale to large corporates. At the end of June he will be back at Stanford to meet with us discuss steps in moving to a manufacturable product. We have come up with a plan for the next 3 weeks leading up to the meeting. Our first priority is to tackle publicity. So, we will be setting up a basic website with information about the product and will become the first point of contact for the project. This is to spread the word in the Bay Area and gauge possible interest in the product. By July 17, we expect to have a website up and running. The next week will be focused on putting in place a mechanism for easy booting up of the system, and ensuring that every time the product reboots it does so to a fully usable mode. The third week will then be spent on programming a game into the system. This is so that we can showcase the platform and the potential for expanding the feature set. At the end of July, based on the results of our meeting with Mikael Blomqvist we will formulate a plan to take the project forward.

6.5 Reflections and Goals

6.5.1 Eva Hoffmann

I am incredibly proud of our team’s work this quarter: there was a definite upswing in energy as we found a direction we all felt strongly about. For me, the major turning point in the quarter was when Jon (inspired by Chris Gerdes’ lecture in class) posted the very simple question is this the coolest thing we could be doing? I think we had all felt restricted during winter quarter when we were working on documentation - we knew that we were addressing an important need, but didn’t feel particularly passionate about it. Having the chance to lead the workshop at Lareda Mekan in March suddenly made our motivation and direction so much stronger, and more fun.

Over the course of the year, our team has gotten much better at dividing up work: I feel that we struck a healthy balance of cooperation and independant work, each focusing on what we were best at. Although I wish I had pushed myself to venture into areas I’m less familiar with - coding and complex CAD - there simply wasn’t that much time to do so, and I think we made the best use of our limited resources. Working on this project was one of the most valuable and educational experiences I’ve had. I’m really excited to see it into the next phase and continue learning!

6.5.2 Aditya Rao

Another quarter, another missed trip to Sweden! The begining of spring quarter was a time of big change for our team. The rest of my team had just come back to school fresh from their trip to Sweden and had all new insight into our user needs. Ans so, we decided to completely change the direction of our project 61 days before EXPE. This turned out to be the best thing possible for our team. We had gone from a project we weren’t exactly excited about to one that was all about building and making pretty things! I think overall our team did a great job of managing time and working efficiently this quarter especially considering that we went through the whole design process in less than 10 weeks. Although there were times when we really pushed the limits (for
eg - finishing the EXPE presentation only 3 hours before the actual presentation), we created an exciting, magical piece of art that I am extremely proud of. Oh, and to top it all, we bent steel!

ME310 has truly been an amazing learning experience. Its hard to tell what the most important thing I learnt from the class is but what I will take away are the people I have got to meet and spend countless nights with (sober or otherwise) in the loft. Here’s looking forward to another epic year for ME310, but this time from the other side!

6.5.3 Jonathan Goh

If a picture is worth a thousand words, then a real object must be worth $1000(3/2) = 31622.77$; so in the refrain so often heard in the final weeks before EXPE, I simply implore you, kind reader, to, “Just look at it man...”

If you happen to be Adi, then your autonomic reply would certainly be, “Yeah, dude... Yeah.”

Indeed, this familiar conversation succintly captures my mood this foggy morning – it is one of satisfaction, of a job well done, of having added some small quantum of beauty to this unforgiving world. It encompasses a parable that is fundamental to 310: thou shalt keep things tangible. Because, at the end of the day, despite, for example, running out of time to write a reflection, you will always have something concrete to point to.
Chapter 7: Resources

7.1 Vendors

- **Apex Window Films**: Source for IR-Blocking window film.
- **ePlastics**: Source for acrylic sheets used to make hex tiles.
- **KJ Magnets**: Source for Neodymium magnets.
- **Platinum Water Jet Cutting**: Vendor for water jet cutting (and sourcing material) of steel side panels and acrylic table service. 33220 Western Avenue, Union City, CA 94587, Phone: 510-441-6172
- **Reactivision website**: Homepage of Reactivision tangible object tracking API.

7.2 Contacts

- **Andy Switky Senior Designer at IDEO**: Insights on space design requirements and process recording for IDEO design teams. aswitky@ideo.com
- **Philipp Skogstad Director of SAP’s AppHaus**: Started SAP’s AppHaus, insights on design to promote team collaboration. philipp.skogstad@sap.com
- **Neeraj Sonalkar Design Group graduate**: Studied team dynamics, now a coach at a startup incubator in Hyderabad. sonalkar@stanford.edu
- **Bob Smith Technology coordinator, Wallenberg Hall**: Insights on incorporating technology into spaces, experience with innovation and academics in Sweden. bobsmith@stanford.edu
- **Andy Milne Design Group graduate; CEO, Tidebreak**: Creating software to help with distributed team interaction dynamics. amilne@tidebreak.com
- **STPLN, Malmö, Sweden Hackerspace**: Interesting government-funded center that provides free tools and space for hackers and artists.
- **MEC - Media Evolution City, Malmö, Sweden Rental space for Swedish startups** (contact: Jonas Michanek, +46 734 340030)
- **MINC, Malmö, Sweden Start-up incubator**: Helpful overview of the start-up environment in Sweden and the resources available to innovators
- **The Hub SF Rental space to encourage innovation for entrepreneurs** (contact: Kathy Bruin, kathy@hubbayarea.com)
- **Jenny Elfsberg Innovation coordinator at Volvo CE**: Experience with leading satellite teams from large companies; insights on what a large company like Volvo would require from Kungshall.
• Jonathan Edelman Design Researcher at Stanford University: Insights on teaching students how to be creative and encouraging creative behavior during brainstorming.

• Läreda Mekan, Hässleholm, Sweden Car seat manufacturer for Volvo: we facilitated innovation workshops with them, during which they provided very valuable insights into the attitudes of small corporate design teams. Contact: Christer, +46 706 90 08 11

• Mikael Blomqvist Michano AB: Insights on expectations for Kungshall, experience with entrepreneurs and venture capitalists. mikael.blomqvist@michano.se
Chapter 8: Concept

This section is the concept for the Kungshall model which was developed by the BTH team. It explains, in detail, what Kungshall offers its users and partners. This text is meant to be distributed, in detail, to potential collaborators.

8.1 What is Kungshall?

8.1.1 Mission

Foment Innovation at individual, local, organizational and global levels by:

• Supporting the development of innovation capacities (individuals and teams)
• Guiding individuals and teams through focused innovation process
• Connecting inventors and inventions with investors

8.1.2 Kungshall’s Concept Features

Kungshall supports the development of innovation in all of its levels. From challenge/insight to solution well implemented. For this purpose, the concept features below have guide the development of the concept.

8.1.3 Bring the world to Kungshall

Kungshall is a magnet factory for innovative people and companies. All of those who have methods, tools, ideas and interest on developing innovation find a role to play within Kungshall. This design criteria is about connecting people that can work together to make new ideas to develop.

8.1.4 Developing Innovation Capabilities

Those want to improve their capacity to innovate feel a tangible improvements after passing through Kungshall. They are inspired and learn different ways to approach the innovation process, in addition they become more aware of innovation dynamic. They are better equipped with material, contacts, and spaces for bringing about innovation from insight to implementation in society.

8.1.5 Connecting the dots

Different motivations guide people to Kungshall. Some persons want to be informed by the state of the art for their investments or to find a solution to a current challenge. Other persons have seen opportunities and improvements they want to develop solutions to. Kungshall is a meeting point for investors and inventors so innovations can find a pathway to be born in society.
8.1.6 The feeling of being in Kungshall

Getting in to Kungshall people will get a variety of impressions. At entrance they will feel inspired and welcomed by the design which is modern and at the same time restful (anthroposophic). When getting a tour people will find different rooms. Some are more dreamlike, others invite for planning while some rooms resemble a factory floor with its tools, machines and prototypes spread. Its is noticeable that all rooms are full with props and number artefacts that can be used. Technology mix seamlessly into the room, integrated into a beautiful design. In some rooms there is a buzz, people talk around a table, or looking at board with post it. Others are using the props available, some groups even have a prototype in the middle of the room. In some other rooms people are focused thinking or building a prototype. The place is full of curious things happening. People are happy with the opportunity to be at Kungshall. The most common feeling is the excitement of going through a creative process from ideation to prototype, and quite often implementation. Some people come here as individual or independent groups to turn their ideas and dreams into prototypes; they know investors are in the lookout to finance ideas with potential, and that combination is exciting and scary. Other individuals are excited (with one skeptical here and there) to be there with their teams, having them to build their innovative capacity while developing ideas that are relevant for their daily work or future work. Other groups are returning after a basic training. They felt improvements on their work, they also feel the advantages of the structure and materials available. Furthermore they feel they can improve their innovation practice making it smoother. Some of this groups have the help of the facilitators connected to the Kungshall network. Others bring their own experts. All in all the place is alive with good ideas and inventions growing. Coming to Kungshall is a burst of hope for getting ideas into practice.

8.1.7 The Whats in an overall aspect:

Kungshall is build on the spirit of Inspiration, Ideation and Implementation. At Kungshall we eat and breath creativity and our mind is made of innovation. Inspiration, Ideation and Implementation is brought to you by the atmosphere within the building itself, from the beautiful environment that is surrounding Kungshall and from the services that is available at Kungshall. It doesnt matter why you visit Kungshall, you will leave with a happy face and your mind full of new ideas. You can come for developing your or your companies ideas into prototypes or products. In addition you can also be inspired by participating on one of the many events, such as, conferences, exhibitions and matchmaking. Take a look at the program and fill your calendar with exciting events you will visit. At the same time that each event has clear differences they are similar in two ways, they all contribute to encourage innovation and creativity and the partners representing different events are carefully selected by Kungshall.

8.1.8 The How in an overall aspect:

Kungshall is unique in the sense that the best of the best is connected into one place. One might ask, how is that possible? Well, Kungshall apply open innovation in a way that other doesnt do, attracting the best people and the best companies to work together for you, with you and your ideas. Whoever you are, whatever you want to accomplish Kungshall can support you to develop an solution or idea that is yours. Our aim is to be as effective as possible, at the one hand we believe that is best for companies and individual to have their capacity build so they can be a innovative force. On the other hand we know that time to market is essential, meaning that time from idea
to concept to products and services is the key to get to the market faster than competitors do. Our facilitators are at Kungshall for you, so you can be cost effective in your innovation work. 360-working-hours, partners around the world secures that work is in progress all the time. At Kungshall all partners know their role in the innovation process and long distances do not exists. Even though our partners are spread out in the world all members (including partners) are in the same place thanks to interactive technique. From the same room we have access to i.e illustrators, workshops, patent ofices, engineers and of course 3d printing. To keep the spirit up and alive there is an in-house restaurant and patisserie providing high quality food, coffee and pastries, of course based on creativity and innovation.

8.2 What are the needs?

8.2.1 Different levels of isolation: Companies

There is a need to become innovative. The world is more competitive, and being the market leader today tells nothing about tomorrow. Having a wide idea pipeline, selection process, and prototyping are common terms among text books, although companies are still struggling with this implementation on a day-to-day basis.

Such approaches have a few assumptions:

- Ideas just happen. Lets focus on ideas first, ideas just happen, and partly they do. The dissemination of innovation is a great challenge.

- Sufficiency and Focus on formal processes. Stages, gates and phases as description of innovation process.

- Lack of focus on individual and teams: The flip side of the focus on process. People are those who innovate, not managed process, they capability is key for everything working smoothly.

In Kungshall we acknowledge that ideas are not necessarily a problem and that a process is indeed helpful to foster innovation within a company. However, challenges related to the mind set and ability to perceive and implement innovation process is a part missing on the equation. Kungshall want to be the space in which such capabilities can be build and practiced.

We believe that employees are interest and passionate about innovation. However these elements are not enough to lift innovation. In order to lift innovation it is needed to create a strong innovation climate with people that know by experience the joys and hurdles of the process, hence employees need capabilities that will hold them through that process. Kungshall is such a training ground.

8.2.2 SME

SMEs face an additional challenge. They often have a small capacity for Product Development and R&D. Hence, there is a good opportunity for them to work more collaboratively with other SME and Researchers at Kungshall. We believe that Kungshall’s activities, such as challenges and fairs, are a great way for these companies to enhance their innovation capacity. And of course the ideas and partners involved could be trained within Kungshall as well.
### 8.2.3 Other challenges for companies

What prevents innovation of being fostered within companies? In addition to the difficulties mentioned above, common challenges include: Need support

- To see opportunities
- To stay with the innovation process and uncertainty
- Social diffusion of innovation

**Culture**

- Too much focus on lean and incremental
- Cost driven
- Risk Driven
- Time Scarce for innovation (+Overload)
- Too much focus on technical issues (radical technology)
- Closed in their world (what are others doing)
- No user/costumer interaction
- Low continuity and impact of ideas generated
- Innovation work is perceived as fluffy
- Too many middle managers
- Difficulty to motivate the innovation benefit
- Bureaucracy around innovation work
- Slow Follower of competitors

In short, the main needs that follow from these context are: * Need of practices that allow people to - endure the innovation process - see the value and results of their efforts * Need of interaction and collaboration at individual, team and organizational level

### 8.2.4 Inventors

Inventors are visionaries and doers as they see opportunities and wish to take action to seize it. Sometimes it can feel hard to be an inventor, even if they see the gold pot, it might be hard to communicate it or prove its value. We, at Kungshall, want to help to make visions and opportunity tangible.

Currently, there are a number of incubators in Sweden. Mostly such incubators are for business ideas, and the ideas are somewhat formed. Other places like science and technology parks often offer an open space with some tools, but the support is somewhat missing. At Kungshall we aim
to gather people with ideas from the early stage, ideas with vision and potential, people will be supported from the beginning when needed.

Many times the inventor puts a lot of personal time alone, with small resources in his/her garage. Dedication is always needed, moreover, Kungshall aims to provide a place in which people can exchange ideas and support each other.

8.2.5 Investors

Investors can range from individual, such as venture capitalists, crowdsourcing and big multinational companies. In any case, they are looking for ideas that worth their investment. Either because they are looking for solutions of current problem, or some idea enhance their product/business, or simply because an idea has a potential of becoming useful for society and becoming profitable at the same time.

To find such ideas/solutions it require a mining work and some luck. We want to increase the odds of inventor and investors finding each other by creating two poles of a magnet, on one side visible ideas and at the other side needs for solutions and interest for investment.

8.3 Benefits for Kungshall Users

8.3.1 Networking

Establishing meaningful relationship and exchanges is a core benefit at Kungshall. When working with idea development, Kungshall users find it easy to exchange ideas and build on each others perspective, whether they are a corporate team or an individual inventor. They find people interested in and capable of collaborating in a win-win style. In addition, users have access to the network of specialist that might help them with feedback in areas that are not their expertise. Such support is helpful on ideation to more advance prototyping.

Another aspect of networking can happen in any stage, and it is the connection of the ideas with potential investors. Different channels allow such networking, from simple online catalogues (portfolio) from innovation fairs. Investors are delighted to have such support and companies and investors are please to find ideas they see potential.

A great network of partners connected to Kungshall is not visible at first sight, which also is a part of the unique solution at Kungshall. As different customers have special needs, we customize the Kungshall process to include the network appropriate to the situation.

8.3.2 Prototyping

A great part of the innovation process is dedicated to prototyping. Sometimes it is not easy due to the complexity, nor a common practice simply because is somewhat not a usual thing to do. At Kungshall we value the learning impact that a prototype can have. For this reason we are equipped with materials and machinery from rapid prototyping up to 3D printing, the most easy used ones are physical placed at Kungshall and more advanced equipments and machines are located at partners connected to Kungshall. Which one to use is based on where in the innovation process a customer is.
8.3.3 Specialists

Users are supported by a range of specialist that can enhance their current capabilities. From 3D printers and patent offices specialists, to facilitators, researchers and students they all bring their talents and skills to accelerate and deepen the innovation experience. (see more in Chapter 5)

8.3.4 Learning in a Creative Environment

The benefits of having out-house workshops is well known. Participants are more easily held loose from old un-functional habits, and the focus on the task at hand increases. In addition to this natural advantage, at Kungshall people find that the environment is build according to their need. Rooms are adaptable to group size and innovation phase they are in. Some of the areas are inviting for interaction and experimentation, while other call for reflection or decision making.

Another inspiring feature of the environment is that people learn (or remember) how to be innovative by following the example of creative behaviours in the space. Users wont be the odd sheep, or the person who is trying to be different. Instead, they will be in contact with innovative behaviour, not only explained as well as modelled. Being immersed in a culture that blossom innovation is a great way of learning how to be innovative. Most importantly they will be able to try out the behaviour in a safe environment. We at Kungshall believe that such feature is essential for accelerate innovation and the build up of innovation capabilities.

8.3.5 Inspiration

At Kungshall there is always an inspiring event going on. A company working there can, if they like to, take a break and visit an ongoing exhibition or gallery and let the new impressions be transformed into new ways of seeing their own process. In some cases, events at Kungshall can actually be used as inspiration to create new ideas in the early phase of the innovation process. In other cases, the inspiration can happen on a more personal level when realizing what it takes to innovate, or simply by seeing how other inventors have connected different ideas, or even by empathizing with challenges famous people had a product implemented accomplished a task they worked with for a long time.

8.4 What do we do?

Different people look for Kungshall for different reasons, some want privacy of their own group, while others look for open collaboration. We aim to capture the main lines of working with Kungshall according to streams, and the services according to offerings packages.

8.4.1 Streams

The Kungshall concepts is complex, the different partners, clients and user can be interact in many different ways, and come up to Kungshall with different interests. On the one hand, the parts involved interact according to the offerings, at the different events and services provided. On the other hand, the different interests can be synthesized streams that are going in parallel, and that can be mutually reinforcing. The streams are: A. Private - Companies and organization work mostly with their own resources. Contracts of secrecy may apply to Kungshalls facilitators and partners participating on this stream. In this offering companies have their capabilities enhanced
while developing Innovation. The outcomes is directly related to the amount of training. (P.S. A large company can also participate on semi-open to independent stream by posting challenges to university and independent people) B. Semi-open Organizations look to develop innovation in partnership with individuals, as well as, other organizations. Medium and Small enterprises might not have the capacity to have an R&D department. Hence Kungshall would act like it. It would be an Space in which member of such companies com come to as if this was their R&D facilities. The semi-open aspect is that they can invite students and experts, and other companies to work with them. Some fairs, and matchmaking can follow under this category. C. Independent - People from all ages and background can come and learn how to be innovative. They can use the facilities to prototypes stuff. The outcomes and participation of this stream can overlap with other streams, however they are likely to overlap with the investments stream. D. Investment - Ideas developed inside and outside Kungshall are displayed for future investment by companies or investors that want to carry an idea further

8.4.2 Offering Packages

- Solution packages (we have problems we want to solve) Companies face challenges. They might want to have one of their teams to be guided through a process that focus on the specific challenge. Depending on the amount spent on this task the team can reach different results. From mapping the variables, assumptions and possible ways forward - up to have developed a whole new concepts and functional prototype.

Alternatively, the problem owner can create, a challenge through Kungshall network, calling researchers, experts students and youth to try and solve the problem. At the same time that such crowdsource like event might provide insights, it can also help to identify potential talents for the company.

- Concept development (we have ideas we want to develop) Companies and individuals might have ideas they want to develop. Again, they can come to Kungshall just to use the innovation inducing environment. In addition, similarly to the solution package interested parties can join a guided process in which they can develop from inspiration and initial design requirements up to functional prototypes depending on how much time they want to spend at Kungshall (1day-2months)

- Educational Packages (we want to learn innovative related methods) Customers might be interested in building their capacity in a more conscious manner. In such package people join workshops, in which they bring problems and solution they are going to work on like in the previous packages. The difference is the additional pedagogical element to the time people spend at Kungshall. Participants (users) will not only be guided through the process, they will also reflect and get more input about the nuances and options they have when they want to do it on their own.

- Innovation climate building Package (we want to be an innovative company, both on- and off-site) This offering is a long term commitment. It will require an assessment and the establishment of a good partnership to improve a companys innovation climate. This work is done in partnership with consultants and/or researches that are on the forefront of innovation, and each case must be analysed in its particularity.
• Events (matchmaking, fairs etc) These events are most often open, and they include many
different kinds of events for any customer or private visitor to enjoy. The events differ a lot
in content but they all serve as inspiration and networking to everyone who is at Kungshall.
They also help to have a glance of what is going on and feel the pulse of activities and energy
generated and latest development in technology and processes. To be updated on upcoming
events one can take a look at the program or join the Kungshalls community.

8.4.3 I3 D2- Inspiration, ideation implementation - I3 D2
Whatever need or reason a customer comes to Kungshall the services that the place provides are
based on inspiration, ideation and implementation. All of these ingredients are embedded in all
services at Kungshall in different ways, and one can see them as three phases looping in circles
during an innovation process.

What tool to use differs from customer to customer and depends on what preferences, needs
and aims the customer have, and also the amount of time available for working. Even though the
innovation process itself looks the same, the content of the activities run at Kungshall will differ
and will be depending on a mutual agreement between the facilitators and the customers.

The process is not linear, the categories within the process suggests aspects to pay attention
to. In reality, elements of one phase might be included on the other phases might overlap. The
process is interactive, hence in any decision gate (at any point it is possible to explore a previous
or coming phase directly.

**Inspiration** - The overall aim of the inspiration is two folded. On the one hand it aims to create
the sense of possibility (and hope), i.e. that it is possible for anyone to introduce new products
and services. On the other hand it can support giving a sense of direction comes out of i.e. events
going on, lectures, success stories, networking, or by experiencing tools and methods, such as rapid
prototyping process. In addition, this phase can deal with inspiration through need finding or
creating visions or scenarios for the desired innovation, which increase knowledge about customers
and their challenges.

**Ideation** - At this phase possible ideas are developed and promising ideas are selected from
newly generated ones. In this work ideation could include a more thorough problem identification
in addition to problem solving and concept development. Here the term covers the wide arena
of idea generation activities in its different aspects and formats (i.e post-it race, business model
canvases).

**Implementation** is the last phase in the innovation process, here is the actual product or service
taking shape based on the previous work. Considering that the work is iterative and non linear,
during this phase we might revisit return to the inspiration and ideation phase as most often theresa
need of modifying the choices made earlier. Kungshalls facilitators are very aware of the eagerness
customers have to reach this phase as quickly as possible, but, if passing the prior two phases too
fast the implementation phase will be based on what the companies already knew when they came
to Kungshall.

8.4.4 DECISION gates
Between each phase there is a decision gate, this part of the process support selection the strategies
and other choices that are necessary to create convergence of ideas and explore next steps. A
pre-decision gate happens in conversation with the customer/user before the visit. The aim of this first gate is to understand the needs of those who reach for us and suggest an appropriate offering package and stream.

The first gate happens after inspiration, and it is related to the application of the elements explored on the Inspiration phase. It represents a grounding of the inspiration and it can be used to explore how the gained inspiration can be used to reframe the challenge at hand, or simply to wrap up lessons learned. The second gate happens after ideation, and relates to the selection of ideas developed and explored. It can include the use of tools such as SWOT analysis, Quality Function Deployment, or Pugh matrices. Finally the process ends with an evaluation of the prototype or the user test.

The list below shows areas of work for each one of the phases described above, as well as, possible tools to be used within each area.

### 8.4.5 Inspiration

#### Need finding
Existing problem searching.
Competitor copy.
Customer complains.
Ethnographically customer and User observation in IRL.
Customer and user visit Kungshall to do workshops.

#### Problem defining
Why, why, why (Toyota model).
Value proposition canvas/Personas (pain, gain, action).

#### Visioning
What if one could
What if dont exist. What would we do?
Trend watching.

#### Input for inspiration
3d printing (demo).
Inspirational videos.
Cases.
Fairs and conferences.
Competitions.

#### Decision what is Issue, scope, and/or vision? *Quality Function Deployment.
Dotmocracy.
Innovation architecture.
Devils advocate.

### 8.4.6 Ideation (some examples)

#### Brainstorm
Post it race.
Brain writing 6-3-5.
*This project will fail because of...
Sketches, simple models and drawings
BAD (Brain Aided Design)
PAD (Pencil Aided Design)
MAD (Model Aided Design)
CAD (Computer Aided Design)

Concept exploration
Six thinking hats
SWOT

Customer identification
*Existing or new customer segments

Market identification
Existing or new market

Decision select ideas to develop further
Quality Function Deployment
Dotmocracy
Devils advocate
Pugh matrices -

8.4.7 Implementation (some examples)

8.4.8 Key design features of Kungshall- what makes the place unique

8.4.9 Connecting the Dots

What are the events about?

Exhibition

- **Breakthrough Innovation** - exhibitions at Kungshall Innovation Center are a mix of physical and interactive artifacts where a specific theme unite what can bee seen and experienced. Personnel is available for any questions, but the visitor is in charge. As a visitor, you will see and experience innovations that are in the front exhibition focus niche.

Visitors, experts and inventors and can easily reach to partners and sponsors who are connected online and in person, - the conversations and ideas flow intensively leading to partnerships.

- **Back to the Future - Reflections and Forecasting** - exhibitions at Kungshall is similar to a time-travel, both back in time and forward to the unknown. At these exhibitions you can experience the major leaps in technology, and you will see the inventions that made a great difference at the time they were used, present products, next generation and science fiction of the same products.

The aim of this exhibition is to give you time to reflect about what we all take for granted today was science fiction not so long ago. We aim to take people through the process of how the ideas and information available at the time were connected and developed in order to develop the invention in focus.

--- Fairs Meet the frontier of companies of their niche. At Kungshall's fairs, there are only carefully selected companies present. The application form is available during a limited time of
three weeks one year in advance, followed by interviews of selected companies and carefully planning of the fair.

The companies are in charge of clarifying what audience they are aiming for and Kungshall provides expertise to attract these to visit the fair. Similar to the exhibitions, some companies are at the fair in person and other are present via interactive devices (such as persona-bots), enabling more connection and interactions.

———- Matchmaking

- **Private innovators meets commercial partners and investors.** Twice a year there is an opportunity for private innovators to find commercial partners and or investors. There are three categories for which the private innovators can apply: Ideas as concepts, Ideas with rough prototypes and Ideas with working prototypes.

  The presentation of the innovations are made both as physical objects and via interactive devices to i.e. demonstrate special functions, make clarifying drawings, showing videos and taking notes.

- **Business meets commercial partners and investors.** Similar to when private innovators meets commercial partners and investors there are two occasions for established companies to do the same. The criteria for application is that the company has an i.e. an idea, technology, developed product or service for which they search for partnership or capital to i.e. develop further or to expand on the market. The matchmaking is open for Micro companies, SME and companies on the stock market where KIP serve the same purpose as for the private innovators, e.g. to explain and demonstrate the proposition to the (hopefully) becoming commercial partner or investor.

———- Hackaton

This is the opportunity to get acknowledgement for being to show that you have extraordinary skills when it comes to programming. This event is not an ordinary dream hack, this is a chance for the Hackatoners to win big money, get a job, a new career and earn respect. The event is free of charge and you can participate from all over the world. Companies hand over their i.e. copyright protection, encrypted codes or security system to Kungshall Hackaton to be hacked by the best Hackatoners in the world. All participating Hackatoners enter the Kungshall Hackaton-portal where the challenges are provided. The challenge is easy: Break the code, demonstrate how it was done and create an improved system that is not hacked by some other participant during the event wins. The prices differ, but minimum USD 2.5 million or 15

Both participating companies and Hackatoners have to apply to be a part of the event where a board at Kungshall Innovation Center select maximum 20 companies based on a mix of business areas. Hackaton is also open for i.e governments, municipalities, public sector as well. The number of Hackatoners are unlimited but last date to apply is 1 April as the contest starts on 7 April, there is no other restrictions than a confirmed ID and postal address.

———- Gallery

The gallery is a combination of illustrations and artifacts from a specified theme where artists, visionaries, inventors or anyone having ideas of how to interpret the theme into something visible.

———- Conference

Unrevealed Innovation Capacity - by Scientists and Practitioner is an annual conference with focus on the hidden treasures that could be found when innovation work is spread out in organizations. Most researchers agree on the benefits of involving large quantities
of employees and external networks in the innovation work. This conference is the hub for sharing experiences, methods and tools between researchers and practitioners.

- **The Innovation front line - by Scientists and Practitioners** is also an annual conference with focus on forecasting innovation. There are a lot of practitioners out there with self-made forecasting tools that suggests predictions of the future, on the other side there are researcher with knowledge from the past and this contradiction keeps the discussion alive and flourishing between the two parties. One part of the conference is dedicated to demonstrate the extreme future of agri-culture, transportation and sports where design students from sponsor-universities are welcome to show their interpretation of the future.

——— Simply Celebration events

- **Walpurgis Night (Valborg in Swedish)** - Walpurgis night is celebrated in most part in Europe where bonfires are lit to celebrate the arriving spring. The attraction to the citizens and visitors to Kungshall Innovation Center is natural thanks to the gigantic bonfires floating on the sea next to the facilities. Inside Kungshall the visitors can follow and participate in Walpurgis Night celebrations in other locations as i.e. Tartu in Estonia, Helsinki in Finland, Prague in Czech Republic or Berlin in Germany as large screens used for live broadcasting and interactions.

  Each participating nation is offering local specialties of food and drinks for the visitors to enjoy where interactive devices are enabling interaction with the represents and visitors at the other locations.

- **Midsummer Celebration & Party** - Midsummer is celebrated in the traditional Swedish way as a family event in the afternoon and a party in the evening. The family event is celebrated with the traditionally dancing around the maypole where fresh potatoes and herring is served with sour cream and chives. The party in the evening is open for those who have the minimum age of 18 years. DJ Sunnyday24 will get the best out of swedish music encouraging a great time when the swedish summer is at its best. Both events is of course in cooperation the swedish partners spread out in the world, accessible to anyone who will enjoy a piece of the swedish culture.

- **New Year Party** - 72 hour Rave Around the World, DJ: SuperNova & Co are ready to serve the world with the greatest party on the planet. The physical place at Kungshall is transformed into 4500 square meters of dancing area. Our partners is in every time zone, why the party starts in time to get Kungshall in party mood when New Zealand starts their celebrations and ending in Hawaii 22 hours later, as the earth is turning more partners are arriving to the party through the interaction technology in Kungshall and the dancing area of Kungshall is expanded into infinity and beyond. In every hour there will be a special celebration for each partner as the clock passes 24.00. Dance music is provided by DJ SuperNova and spread around the connecting partners and happy feet are everywhere dancing to the same music, this is a moment you cant miss. Be physical at Kungshall or at a local partner, enjoy.

——— Innovative Food Visitors being at Kungshall in person can enjoy the exciting environment and the fantastic food being served at Kungshall. The Kungshall Restaurant is driven in same spirit as everything else, e.g. by creativity and innovation.
In cooperation with sterj Gymnasium (a local restaurant school) a sustainable food-chain-system is developed where food is provided by local groceries and farms. Visitors, personnel and customers working in Kungshall have the opportunity to taste different dishes every day. The menu is unknown as students create new dishes out of the ingredients they are provided in the mornings.

The same is for the Kungshall Bakery where the students creates cookies and cakes depending on ingredients available in the morning when students start working. Two times a day there should be something to get from the bakery, at 10.00 o’clock and 15.00 o’clock therers fika-time, or coffee break in english. There are no limits in what the students can create but the judgements comes as feedback from the guests who comment taste of what is served, service and an overall impression that includes the feeling of the restaurant and bakery. In the evenings and weekends the restaurant is driven by local, special invited chefs, who creates food depending of what they find most fresh for today. The menu is created by the seasonal variation of grocery and what is locally produced at the time.

8.4.10 Bring the World to Kungshall!

This is a story of how Kungshall has helped a multifunctional team from Volvo Construction Equipment to develop a concept for the new generation of crawler excavators in a two days workshop, achieving impressive results in terms of cost reduction and value provided to the customer.

**First day** One team arrives from the Volvo CE division in Changwon-South Korea to Karlskrona (Sweden) with information about the excavators such as the current product and cost breakdown. The team is integrated with personnel from the VCE headquarter from Eskilstuna-Sweden in order to broaden the competences of the team necessary for the highly creative work that the task will require. In total, theres a multifunctional team (the team) of six members [REF] consisting of personnel from engineering- and market-department and one designer ready for a two day-workshop.

The team is supported by the Kungshalls facilitators, and the design team run team-bonding activities before starting working with a functional decomposition of the excavator using FAST (Functional Analysis System Technique) and Functional Trees. The team discovers that some information about the cost of some components of the excavator is lacking, so a request is sent to Volvo CE in South Korea, which was already connected on distance and so be able to provide the additional information in real-time. At the end of the phase, the team has a deeper understanding of the areas where great improvements can be achieved by the redesign activity.

During lunch the team is involved in a match-making activity with a big U.S based software company, which was at Kungshall for an own project with the purpose to find the next generation of cloud computing systems. During the activity the team members open their eyes getting to know future trends in that branch, having the ideas of the possibilities of integrating remote control systems to steer the excavator, and maybe start collaboration with the software company.

In the afternoon the team is involved in need-finding activities, with the customers lively involved from China (they were already advised and invited to the meetings). After this activity the team starts brainstorming session with hand made sketches. One of the equipment used in the brainstorm session is IDUM, a newly developed ideation tool which by its design encourage all team members to participate with ideas. The ideas are put in a Morphological Matrix. Late in the afternoon the team present the idea matrix to the executives in Eskilstuna and South Korea. The meeting was already planned for this task force event and thus they are connected on-line. The ideas are then discussed and the three most promising ideas are selected for the following proto-
typing phase. Potential novel functions are identified and discussed with representatives from Hynells Patentbyr who instantly starts searching in patent data bases for patents describing similar solutions to identify potential IP rights to be secured. The team at Kungshall call it a day, debrief and make reflections of the days work, now its time for dinner in Kungshall Restaurant (with some beers for some of the team members) and a good sleep ;)

Exploiting the time difference between India and Sweden, the sketches from the workshop is refined and sent to a 3-D cad division in Hosakote Karnataka India, which is one of the Kungshalls service partner connected to Solid Works. The 3-D cad company makes the drawings while the engineers at Kungshall are having dinner and sleeping. Depending of the design of the prototype, the completed drawing could be sent to either Kungshall or to Digital Mechanics (a 3-D printing partner in Vsters, Sweden) to be printed. In this case the drawings are sent to the 3-D printers at Kungshall where the rapid prototypes starts automatically.

**Second day** The morning session opens with a big surprise for the team working at Kungshall. The three ideas they have selected the day before have become physical prototypes. They can not only see the prototypes coming right out of the press, they can also feel and test them in real applications. Furthermore, they find another bonus. The 3-D company loaded the prototype in their Augmented Reality App, and the engineers can see their ideas through their smart phones, and play with them. (Reference: http://www.youtube.com/watch?v=StXtkgKuAu0) At this moment a report from Hynells Patentbyr arrives, demonstrating the eight most relevant patents to consider within the project at this moment. The team starts to refine the concepts they generated yesterday and feasibility analysis are run together with the test laboratories in Eskilstuna.

During lunch the team is invited to a matchmaking activity with a Worldwide-known Swedish furniture chain, the team increases their awareness of new business models in the furniture arena why discussions start regarding how to provide new business models in the Construction Industry.

The afternoon starts with the generation of new business models together with the Soft Product and Marketing department in Eskilstuna. The team uses Business Model Canvas to capture the essence of the generated Business Models where IDUM is used to organize ideas. The concepts (a combination of product and service offerings) are then presented to customers in China and Brazil. The concepts are composed of new technical solutions as well as the opportunity to provide the excavators with a new functional contract where the excavators are provided with a power by-the-hour formula (), where the customer pays only for the value-in-use of the excavator, and Volvo CE becomes responsible for the maintenance and offers training programs for the operators in order to improve the fuel efficiency of the excavator.

At the end of the day, the design team can present the refined three concepts to the executive managers in Eskilstuna and Changwon, as well as the headquarter in Brussels (Belgium), connected online for the meeting. The team discusses particularly around one concept. Compared to the others, this concept presents radical solutions that will require more additional tests in order to be verified. But, at the same time, this concept has attracted the interests of the customer in China and Brazil. The technical solutions combined with the power-by-the-hour offering will really meet their needs for the changing business climate they will operate within in 5 years. The team together with the managers can thus draw an idea roadmap for the excavator. The solutions that will reduce costs in the short term are approved (and thus the team will get rewarded for achieving the goal was set for them). At the same time, the team gets an additional reward for being able to find a new concept that will bring value to the customers in the next years.

Now for the team it is just time to celebrate and prepare to fly home! ;)}
The feedback to Kungshall was very positive. The team appreciated to work together remote from the ordinary offices. The new environment helped the members to focus on the task only, not being disturbed by colleagues, incoming e-mails or phone calls. Even though that problem could be solved anywhere, the team says that the entire atmosphere was inspiring and positive in a way that they hadn’t felt before. New impressions from other activities helped the team to think in new ways and finally, they were very impressed of the facilitators skills to keep a good pace during the two-day workshop and the rapid prototyping made possible by the connected partners in such a short time as in two days.

8.4.11 Developing Innovation Capabilities

A large manufacturing company contacts Kungshall because they are interested in improving their innovation capabilities. Between the organization first contact and the actual workshop, some pre-work was carried to define what was the best activity to do. In conversation with Kungshall staff they reach decide to start with a product develop team that will do a workshop in Kungshall. The team has seven employees from different departments and with different expertise. They are all very qualified people with a big knowledge about their field, however their dynamics is stressful for everyone involved, and affecting their performance as they are not used to work in a multifunctional way. In preparation for the workshop, the Kungshall facilitators find out that so often, veiled tensions between the personalities and background get in the way, and the manager is pressuring them to show results fast, as time and budget swipe away.

First day As the team walks into Kungshall they see nice gadgets around. They notice, some people working on their own, others in groups where some of the groups uses IDUM for categorizing or developing new ideas. The new coming team notice that the discussions in other rooms are intense but participants seem to be enjoying it, which is very different from what they used to with protocols and sick smiles.

In this particular case, the 3 day workshop was designed to open with inspirational talks about personal and group dynamics, due to the history of the team. Marc Lammers, who was a champion coach for the Holland feminine National Field Hockey coach, started with an inspirational talk, and after the team moved to exercises about the topic. Dito, as the team go through their own process they understand openness, and how to select bright ideas without categorising right from wrong, they learn to get the best of each idea and individual. Simply by being exposed to brainstorming rules, and techniques such as talking piece, they start to realize how they are stumbling upon each other, not giving space for an individual to express one mind and wisdom.

Despite the team has been experiences elements of the innovation process throughout the first day, at the last session of the day, the team is introduced to the innovation process, describing how the process is managed and highlighting the high level of divergence and uncertainty needed to accomplish an innovation project. The team is not used to the abstract and less concrete phases that starts up the innovation process, they want to decide what to do and go for it fast! There are some complaints from some of the members. Aren’t we suppose to work is heard from someone. However, the facilitators skillfully go around their comments, they know what they are going through.

Second day The second day starts with listening techniques such as active and deep listening. As the team go through the process they realise that they can interact more smoothly. Furthermore, they realize that now they have enriched their repertoire with tools and methods for innovation.

After the first day they now see how they were inspired and explored ideas during the first
day, diverging and multiplying the perspectives. By the end of the second day, they perceive how they are narrowing down the ideas to converge for an agreement about what to explore. All opinions are listen and considered, risk and opportunities become easy to identify when the dichotomy of right and wrong is substituted for a more inclusive approach that takes the meaning of every point of view to form a new picture. The team understands how different skills are a very important asset to innovative team work, hence they dont have to compete in being the best in the team, they are all the best and can therefore spend more time in helping and advising each other.

**Third day** The facilitators are thrilled with the team progress. The results are as they have intended, the two facilitators managed to merge their expertise in team dynamics and design thinking successfully. In addition to the facilitators expertise, the different layout of the room supported the participants experience during this 3 days workshop. The layout helped the facilitators and the team to make the most of each phase. For example, every time that a decision is needed they moved into a war room. The room is clean, with all the ideas developed (with pros and cons) are visibly projected on the wall and easy to visualize. At the same time, with the IDUM in the room they can edit and do any adjustments to the ideas they have developed so far.

It is very powerful to see the outcomes of a few days work, either if they are requirements, a cad model or a 3D printed prototype, quite often this gives a boost of energy and confidence in participants. In addition, participants feel they can not only build, but argue the value of their innovation, perhaps not in financial terms if the project is on an early stage but nonetheless, to show the value of the innovation and the opportunity to be seized.

The feedback to Kungshall was mostly related to the process that the team went through. The team members could recall themselves as being suspicious, doubtful and irritated in the end of the first day. The conflict was in the air and there was intense discussions of why they were at Kungshall at all, at the time they still thought it would be a waste of time. In the end of the third day they all felt relaxed and the conversation was fruitful in every discussion. Some people even apologised for their behaviour to some colleagues. They had started to understand the complexity of innovation work but also the simpleness that comes when people are helping each other. The summary of the feedback was very positive as they couldnt imagine that three days actually could change a mind so much. Lets go innovating was heard from the team as they left Kungshall Innovation Center.

### 8.4.12 IDÉUM- Stimulating innovation and creativity

An interesting tool present at Kungshall is IDÉUM, a hexagonal-shaped table especially created with the purpose to engage and delight users in the idea generation phases within a general innovation process. IDÉUM is build to stimulate and encourage ideation and creativity. The shape and size makes it easier for an innovation team (composed between from four to six people) to create, converse and interact with each other in a fruitful manner. A soft glow highlights ideas as they are added to the surface, reinforcing the value of each contribution. Spotlights follow tiles as they are slid around, injecting kinetic energy into the discussion. Its even possible to physically build on each others ideas, small hexagonally shaped plates magnetically snap together with a satisfying click. When clustering ideas they glow brighter and bigger as ideas are gathered together, echoing the mounting excitement.

Some of the additional features of IDÉUM include: * Projection of movies and images in its surface. * Users can draw on the surface of the table to complete the image or to sketch. * Drawings are automatically saved and timeline is possible to follow. * Recording user activities for group dynamic analysis. * Interacting with people at other IDÉUM
Such additional features allow participants to build on, and recover previous work, at the same
time it support facilitation and documentation of the content develop during innovation sessions.

IDÉUM can be designed to be used in many of the activities and events going on at Kungshall. Its use can go beyond the generation of new ideas toward new product where ideation and interaction between individuals is needed. IDÉUM enables the work to be both fun and engaging as its intuitive and supporting the work. Hence the tool can be used during the different events happening at Kungshall, such as exhibition and fairs and matchmaking events. The following description based on the program presented in paragraph 4.2 provide an overview of how the use of IDÉUM in specific moments at Kungshall might be.

**Exhibitions and Fairs** The exhibitions and fairs at Kungshall are focusing on the interaction of artists, inventors, investors and other visitors interested in innovations. Some of the artefacts at the exhibitions are physically being at Kungshall, others are visible via IDÉUM, enabling users and visitors to watch, rotate, assemble and dismantle what is seen. You can of course get more information of the details via IDÉUM but you can also meet the inventors in person and interact with other visitors that visit the exhibition online.

Participants in this event are invited and encouraged to imagine future products and services. When an idea or insight come to mind IDÉUM is available around the area to support visitors to explore new ideas right there and then, they can simply brainstorm or try to map out the elements of the ideas in their mind. Once the idea is somewhat clear, if you like to, you can even ask to pitch your idea to an investor.

For those who feel inexperienced in pitching (or in innovating) they can use IDÉUM to watch tutorials, staff are also available to help. In a short time you are ready to do the first pitch to an investor available in person or via an interactive device. Alternatively, other feedback channels are available, such as experts or universities students. We know that ideas come up when least expected, but Kungshall is ready, being there for you.

**Matchmaking** Matchmaking is an event for i.e. inventors and investors to find each other where IDÉUM could be used as a table where the the presentation is made on the screen, allowing both inventor and investor to i.e. make notes, comments or drawings right on the screen. All what is visible on IDÉUM is automatically stored by default in purpose to document what is done. However, IDÉUM is even smarter than that, it records the environment to store feelings and emotions connected to a presentation or a discussion as well. IDÉUM has the ability to recognize when positive energy appears to help both parties to ease finding each other. Another helpful tool for the inventor is the face recognition tool which tells the inventor if the investor is interested or doubtful, enabling the inventor to adjust the presentation in real time. A learning tool is build in to analyze a presentation and conversation, enabling a inventor to afterwords recognize where a pitch is successful and where the presentation needs some edge to be clear to an investor. A recorded discussion can be separated into each participating person where IDÉUM could analyze and suggest improvements to a presentation based on the recorded conversation.

**Hackaton** Hackaton is the event for computer lovers. Break the code and get rich, it is that easy. There are no other rules for the Hackatoners but to stay inside the Kungshall-portal specially build for this event, meaning that external softwares are not allowed to be used, but the Hackatoners can speed up their interactions during the context using IDÉUM. Furthermore, virtual IDÉUM are available through the on-line Kungsalls portal, thus the participants are encouraged to network and build ideas with participants all all over the World. The difference is that the virtual IDÉUM can, for a success fee of 5
The Hackaton-portal and virtual IDÉUM automatically store everything that is typed in terms of i.e conversation between competitors, programming, testing and when hacking the codes provided by the participating companies. During the contest all data is analyzed, the progression is provided to the participating companies and the new updated codes are instantly available to the competitors to hack.

Simple public events Some of the most important holidays in Sweden are the Walpurgis night, Midsummer and New Year eve. Kungshall offers dedicated parties to celebrate these holidays. IDÉUM is used in the event to stimulate creativity and let people interact in different ways as seen below.

Walpurgis Night (Valborg in Swedish) The great bonfires is by nature a place to gather around, to enjoy the heat and get lost in the dreamland of the fire is amazing. As Kungshall is connected to places in other countries also celebrating Walpurgis night, sharing their special dishes and traditions, IDÉUM enables participants to combine different specialties into new dishes and even to try them out. Meaning that the food that is offered in an interactive way on IDÉUM actually could be tasted as its served at Kungshall Restaurant during the event. If you feel that the result is a winner you can actually participate in the annual New dish contest winning prizes from the sponsors of the event.

Midsummer Celebration & Party Midsummer is celebrated in a traditional way with a lot of dancing, during the day and afternoon the Midsummer pole is in focus but in the night Kungshall invites to a party where you have to be an age of 18 to participate. IDÉUM are used to interact, of course, but also to create and order drinks from the bar. It very easy, IDÉUM itself turns into a bar table and invite to creativity. The ingredients available are visible on the hexagonal plates and then its free to be creative. Of course you can pre-pay your drink and get it served at your IDÉUM. If you like to, you can send a drink over to a person at another IDÉUM if you like, as a way of interacting that is. Your face will appear on the receivers IDÉUM to help start up a conversation but then its up to you...however, magic things happen on Midsummer. Have a look at the statistics of newborn kids :) 

New Year Party 72 hour Rave Around the World by DJ: SuperNova & Co is an awesome event. This is the greatest party on the planet. The physical place at Kungshall is transformed into 4500 square meters of dancing area. As Kungshalls partners are in every time zone the party starts in time to get Kungshall in party mood when New Zeeland starts their celebrations and ending in Hawaii 22 hours later, as the earth is turning more partners are arriving to the party through the interactive technology in Kungshall and the dancing area of Kungshall is expanded into infinity and beyond. In every hour there will be a special celebration for each partner as the clock passes 24.00. Dance music is provided by DJ: SuperNova & Co and spread around the connecting partners and happy feet are everywhere dancing to the same music, for a few hours the whole world is dancing together. This is a moment you cant miss as at this moment IDÉUM at the global partners are connected to each other, enabling conversations and playing games together. Enjoy.

Gallery As a visitor at Kungshalls galleries one can enjoy some of the artefacts as physical objects and some of the objects are available via interactive devices. Visitors can use IDÉUM when available and permitted by original designer to write comments and participate in the gallery by interpreting artefacts and redesigning them as sketches. Other visitors can build on others interpretations and in the end of the time for the specific Gallery there are enough new designs to be shown on a separate gallery. IDÉUM enables visitors to get very close to the objects, in some cases theres a possibility to interact with the artists and other visitors in person, asking.
questions and discuss with other visitors.

——— Conference Except for traditionally presentations at the conferences there are workshops where IDÉUM has a central role as its used as a communication center where i.e. two researchers and two practitioners can discuss and create new ideas of research areas and case studies to be made. There’s no doubt that successful researchers and practitioners have a lot to learn from each other. Researcher explain what is and practitioners demonstrate what is yet to come and give directions to researchers to follow up. As the hexagons are filled with new ideas of research areas, potential commercial partners and to-do-lists the IDÉUM also enables the researcher and practitioner to see each others as partners in business.

——— Food IDÉUM is the tool used when developing and presenting the dishes at Kungshall Restaurant and Patisserie. The students works in groups of preferable four to six people. The amount of ingredients are visible on the screens and the students starting the creative work by using the hexagons. As the new new dishes are created IDÉUM helps in calculating how much groceries there are left and can suggest dishes that can be made out of it. In the end there’s supposed to be starters, main course and desserts for approximately 450 people a day. As the students gets better in planning and creating dishes out of what is available, the less help will be provided by IDÉUM. In this sense, IDÉUM is a learning tool as the students gets points in how little help they need, e.g. IDÉUM stimulate creativity and innovation.

8.5 Partners

Kungshall’s success is due to its network of partners. Different experts work with Kungshall bringing the state of the art techniques and exercises to make the innovation process and its learning as strong as possible.

Facilitators Facilitators make the right workflow and the conditions necessary for each group to develop. A number of the Kungshall staff are good facilitators, nonetheless, a big network of facilitation practitioners is connected to Kungshall.

The facilitators have different specialities, one works with graphic facilitation while others are experts in design thinking, or group dynamics to mention a few. Each facilitator is selected according to the clients needs as a result of pre-interviews with Kungshall staff, or they can be chosen from the web profile, or by recommendation.

The same way clients can also bring their own facilitators/consultants to use Kungshall facilities, the inverse is also possible, facilitators are thrilled when they can conduct their workshop with us. Some examples networks and practitioner involved are:

- SLS Network for Strategic Planning for sustainability
- Art of hosting network for process of change radical innovation
- DrawMore by Anne Madsen for Graphic Facilitation

Universities, research, and educational centres Researchers and students also bring their expertise to Kungshall. The first bring models and theories that are made practical to offer results, at the same time they gather results that help them to improve their theories. The later bring enthusiasm and a fresh mind, that can question old assumptions and energise the group dynamic, at the same time they get experience, as well as they get a good chance to get a job.
One example of such partnerships is the collaboration with Blekinge Institute of Technology, bringing its expertise in applied sciences to develop innovative solutions with partners on the areas of engineering, IT, and sustainability. The same applies to the partnership with the D.School at Stanford University, which brings its knowledge in design thinking to support the innovation process at Kungshall.

**Civil society (retired and youth)** Retired people are a great resource, always willing to get engaged in several kinds of activities in society, and at the same time find space and like to do things and be helpful. Kungshall works together with seniors acknowledging their experience, knowledge and lessons learned during their lives.

On the other side of the spectrum, we work with youth building their capacity to work with design thinking and increase their entrepreneurship skills and drive to take actions. Working with youth can be very enthusiastic and creative for everyone involved. They are the most likely ones to naturally cross-traditional limitations, which is a good trait for innovation. Companies get to see future challenges and radical ideas germinating. Companies get good visionary (as well as concrete) ideas through challenges and contexts in which youth participates. The youngsters learn and develop skills that will be helpful in their professional and personal lives. Companies find great talents in these exercises.

**Other Partners**

One of the services available at Kungshall is to develop ideas into concepts and products, where rapid prototypes and IP-rights are of interest during the whole innovation process. One of the strategies applied in Kungshall is to collect and cooperate with the best companies in the market, providing their expertise in the right time, comparable to JIS (Just In Time) or open innovation when it comes to Kungshalls services. In that matter there are several strategic service provider partners introduced to the overall concept of Kungshall, who all agreed on the great opportunity it is to be involved in Kungshalls different service.

- **Digital Mechanics** is the largest rapid prototyping company in Sweden and one the five prominent companies in Europe providing 3D-printing and additional technical advice. The business idea of Digital Mechanics is to as cost effective as possible provide customers with the best prototypes possible matching their demands which requires the company to focus on creative solutions, meaning that they put extra effort in helping their customer to find the right technical solutions. Fredrik Finnberg, CEO and co-founder of the company found the Kungshall concept really interesting right from the beginning as he understood that they could be a part of the early stages in a customers technical developing process, helping the customer to solve many upcoming problems down the road in the early sketches and prototypes. Kungshall actually contributes to their business idea, e.g. to be a cost effective partner.

- **Tech Network** is a network of companies in the close area of Kungshall, consisting of a mix of technology driven companies in the business of i.e manufacturing of all kinds, engineering and consultancy services. Their aim is to support entrepreneurs with technical knowledge and to stimulate companies development, why Tech Network is a great resource to Kungshalls customers when participating in i.e. workshops, matching ideas to other companies or create new joint ventures. Mats Svensson, is together with Mikael Blomqvist two of the souls of fire, making the network growth, securing the long term commitment to Kungshall.

- **Hynells Patentbyrs** expertise is IP-rights, i.e. patents, trademarks, designs and domains. Peter
Kylin, Manager Director of Hynells Patentbyr, has been an examiner at both PRV, Stockholm, and EPO in Munich and has many years of experience as a IP manager in industry. Peter has been a board member of PRV (The Swedish Patent and Registration Office) and SFIR (The Swedish Association for Protection of Intellectual Property), and chairman of SEPAF (The Association of Intellectual Property Law Firms in Sweden). When the opportunity arises he teaches patent law at the Universities of Karlstad and rebro. Peter really liked to be a partner to Kungshalls service. Being a part of customers early stages in their technical development enables that possible IPRs could be detected and developed simultaneously as the product is developed, avoiding to develop what is already known and therefore waste money and time, or in worst case get into a lawsuit. To be a part of a creative workshop in distance through interactive devices is right in time according to Peter, it saves travel time and we can do a cost effective work, benefiting the customers interest.

• **Solid Engineers** is partner to Solid Works, having partners and technical support spread around the world. Solid Works provides applications suitable for all kind of engineering as i.e constructions, production, plastic, simulation, electrics etc. In additional to the software, the partners also provide services where they become a part of a customers technical development. In Kungshall this diversity of competence in different time zones fit the purpose of Kungshall as one service is to process rapid prototyping to a higher level. Johanna von Dorn, representing Solid Engineer in Sweden, saw themselves as a possible partner to Kungshall, where long distance working on virtual basis is a great opportunity to speed up processes and be cost effective to Kungsalls customer.

• **stersjskolan** is a restaurant- and patisserie school close to Kungshall, educating students with focus on not only the skills in cooking and baking but also focus on economy and total environmental effects from the restaurant and patisserie businesses. One of the challenges the students meet is to combine high quality dishes without wasting groceries. Hans-Peter Nilsson, responsible for the restaurant education at stersjo really liked Kungshalls approach to stimulate innovation and creativity by letting the students practice in live, serving to real customers with high demand. This is exactly what I have been asking for in years, says Hans-Peter Nilsson when hes introduced to Kungshall and its environment. As a complementary service to stersjskolan, e.g. to serve food and cakes on times when the students doesnt work i.e. on weekends and holidays, Hans-Peter Nilsson will be helpful in finding and selecting established restaurants whose personnel will use Kungshalls kitchen to create inspirational dishes of all kinds.

• **Hyper Island** - It is a media and communication design school. Their students are well know for quickly adding value to companies they partner with. In addition, Hyper island philosophy is close to Kungshall ideals, making this a great partnership. Their students are connected to Kungshall to support users communicating their ideas. At the same time that users learn ways to communicate and show the added value and uniqueness of their ideas, students at hyper Island gain practice, increasing their portfolio.

• **Arbetsfrmedlingen**, is the Swedish stated-owned agency to deal with unemployment issues. Arbetsfrmedlingen has offices in many cities and covers the entire Swedish territory with its services, with no costs for the users. They can provide grants for relocation of people in the market. They are another important partner as Kungshall collaborates with organizations
working as employment mediators. We aim to reduce unemployment by supporting people to become more innovative. One branch of this partnership is focus on youth, training the to be on the market (see civil society) hired as innovators or as entrepreneurs. As similar program also exists for people who already been on the market.

8.6 Next Steps

Three of the next steps are to focus on the business model, design of the internal space in detail, and testing of space and methodsl. In the following pages we brainstorm a few models and show a few considerations for the space

8.6.1 How does Kungshall makes its money?

Kungshall is an ecosystem where companies and individuals use the space in different manners. To enable this ecosystem to be self-sustainable financially, having money flows is important.

Believing in the attractiveness of the concept on the global market, opportunities for adopting a radical innovative business models at Kungshall (following the example of companies such as Ryan Air, LinkedIn or Spotify) can be many. One example of business model could be based on results and activities rather than membership. However, the generation of new radical business model has been intentionally reserved for future areas of exploration by the Kungshall project members.

Yet, some conventional financial channels have been discussed and explored, and some examples of how Kunghall makes its money can be described in the following.

Companies pay

- for signing up to one of the offerings packages, to increase their innovation capabilities
- a membership fee to get support using the Kungshall community as they see fit, in order to get a wider network of supplier and customers
- for sending their team and use the space and the supporting partners as they see fit, to develop their own ideas
- for sponsoring particular events and parties: the companies have a return on their image, and can use it as advertising campaign, or to have feedback on their products or services.
- for internships by having student talent, who were trained in Kungshall

Individual pays

- For using advices of personal innovator coaches and facilitators
- a percentage of profit or grant money, if getting investments within matchmaking events or after free open trainings.

It is to be noted that individuals working on personal project will be free of charge at any time, as well as the use of general services (i.e. internet, restrooms).

Universities pays

- for having students doing some parts of educations at Kungshall. In this case Kungshall will act as spin-off part of the university partner, offering lectures and workshop on-demand.
State partnership pays

- When participating in any of the offering packages applied to the area of public innovation (for example, collecting doctors, nurses and hospital technology equipment purchasers in a three day workshop around healthcare innovation on a national level)

- To use the services provided at Kungshall as an employment mediator. For example, the state pays a fee for every unemployed that got a job in one of the Kunghalls matchmaking events.

- Sponsoring particular events related to public innovation, and having the opportunity to present achieved new value-adding solutions in the public sector to a wide audience.

- For specific trainings offered to state employees in order to increase their innovation capabilities (i.e. hospital directors, politicians).

- State employment office pays a fee for people in social security income to participate in Kungshall activities

8.6.2 Brief Consideration about rooms design - function vs. flexibility

There is no straight answer. We can only consider advantages and disadvantages. Flexibility: One advantage of having a flexible space setting is that one can arrange the space, in terms of dimension, functionality etc.. according to the groups and its needs. Pre-set rooms would be looked into their limits (size, colour lighting) and function (this is for ideation that is for prototyping)

Another advantage of flexible rooms is that we don't limit the number of team working in a possible phase. I.e. the disadvantage of fixed spaces is that if we have 3 ideation rooms, we can only have 3 teams on such a phase at a time.

The advantage of pre-set room is that they will speak for themselves. In their settings is embedded a whisper that will influence the dynamics of the team that is supportive of the process phase their are in.

One advantage of the set room is that set-up time for the room is drastically reduced, and Facilitators don't need to worry about how to set up as much as they might with Flexible spaces. Hence, the disadvantage is that we need someone to know the process and create the changes according to the group momentum (reflexive, ideation, brainstorming prototyping), which beyond expertise might take time.

The advantage is that having a beautiful pre designed aesthetically pleasant place is that we can have pre-set the use of furniture, color and light to create the mood corresponded to the process phase being developed on that moment. It might also be harder to create a pleasant aesthetic feeling if the room is too flexible. In addition, if the room is too flexible we count on the expertise of participants or facilitators to create the right aesthetic feeling.

The advantage of having a more rough workplace is that people will feel more authorized to used, and less worried with not breaking stuff

Having to move from one space to the other might be an advantage for the creative process
8.6.3 Testing

One of the aspects we are most interested in is to start conducting different workshops and exhibitions within the Kungshall space, in order to learn what works well, and what can be done differently, in terms of process, space usage, and partnerships.

8.7 Process for concept development

8.7.1 BTH Concept development process

The Kungshall project started in October with a general problem statement by the project’s main clients, the Swedish entrepreneur Mikael Blomqvist, owner of Kungshall, and Jenny Elfsberg, director of Emerging Technologies at Volvo Construction Equipment.

8.7.2 The Challenge, early design criteria and constraints

- The more crazy the better [Mikael Blomqvist, 28 February 2013]

Business incubators are facilities established (mainly in the last decade) to support the need of young entrepreneurs to receive help and guidance in developing, growing, and commercializing their ideas on existing and new markets. Business incubators are everywhere now, and Mikael Blomqvist owns one himself, Michano Business Center AB based in Karlskrona, Sweden. The challenge he gave to the team was to come up with a concept for Kungshall that was different than usual business incubators. The place should help to foster new ideas, creativity and innovative solutions ready and attractive for the following steps of incubation and commercialization on a global scale. Shortly, to come up with a concept that give aid to innovators in the steps BEFORE, or in different ways than the incubation process.

Jenny Elfsberg is the Director of Emerging Technologies at Volvo Construction Equipment (VCE), a Worldwide construction equipment company. Jennys and VCE’s vision is to become the most innovative company in the branch. How to foster and build innovation capabilities within the company is the main challenge that Jenny gave to the team. Jenny asked to come up with a concept taking Kungshall as study case, where some of the key success elements could be implemented in different facilities worldwide at VCE. At the same time, Jenny is interested to have Kungshall as a magnet for highly innovative projects within the company, where different design teams will meet and collaborate worldwide, being physically in the place or not.

We started by getting acquainted with the space. A site visit was conducted with the presence of Mikael Blomqvist and Tobias Larsson. The space at Kungshall impressed us with its huge potential.

During the visit we got to hear a bit more the motivations for the challenge, as well as explore different pathways for the future concept design for the space. We learned from that conversation that there might be a gap between the initial idea development and the start at business incubator; later we came to believe that a correlated gap happens between insights within the company and product development, as a microcosm of what happens in society at large.

Another lesson learned was that the place should be alive helping to build innovation capabilities. A place which invites people to try things out and be creative, supporting the different dynamics and moments of the innovation process.
One constraint we had was that we are not supposed to think about the physical space in
details, as a designer, but in general criterias of the concept of what the space could be.
A personal interview with Mikael Blomqvist followed.

8.7.3 Need Finding: hear, observe, listen.

With the stanford team we did a small benchmark looking at innovation centres, such as IDEA
Lab, Media Evolution City, MINC, IDEO, STPLN, Media Evolution city and Hyper Island. We
had found that the services provided were in a few categories:
* Consultancy and designing solutions
* Office space
* Capacity building to create business plan
* and other management skills
* Mingling opportunities (that were not focused)
* Concentrating creative business (not necessarily increasing their interaction)
* Education in a subject field

Within this phase interviews were conducted with potential stakeholders, in order to collect
information to be able to refine and scope the problem. (add or refer to interviews) (Mikael
Blomqvist, Jenny Elfsberg, Peter Wallin, Tobias Larsson, Jonas Michanek (@idealab), Finnur Sver-
Risson(@minc),)

Part of this process has been also based on the Swedish team own experiences and research
with innovation teams, design thinking, empowerment, and decision making (costs- vs. value) in
different kinds of organizations. The team members have exchanged information, knowledge and
own experience through weekly meetings.

This phase has concluded with persona generation, general design criteria and the general
vision/purpose for the Kungshall project.

8.7.4 Parenthesis - The meetings within our process

One difficulty for the meetings was distance. The US team was 9hrs away and the sweden team
itself was not collocated. The two teams met 3 times in person. The meetings were essential; The
presencial meeting also helped us to get on the same page and plan the next steps.

The swedish team itself realized that they needed also to meet in person, and we met twice
for a few days. In addition, we had virtual meetings, most of the time using adobe connect with
Mikael on one side, and Massimo and Andre on the other. At first these meetings were harsh and
unproductive. As the meetings went on we learned how to use and facilitate the interaction between
the white board on one side and virtual participant on the other with positive outcomes.

The lesson learned from this virtual meetings are: * It requires lot of attention from both sides,
which reduces the number of productive hours. * Documentation and Visualization of ideas is
crucial to have during the talk. * Everything needs to be Narrated, when referring to ideas on
the board, as well as to ideas mentined before and small discussions and comments between the
collocated persons

Google docs and occasional printing of our documents in order to sorting ideas was essential to
get a grasp of how much we have done and organize ideas. In addition, the blog as an exercise to
clarify and registers ideas were used.
8.7.5 A Vision, a Process for Kungshall and testing

Prior to the first meeting we had a vision, feeling of kungshall to work on. During the first in person meeting of the swedish team, the challenge was rephrased, the needs and possible pitfalls were considered.

We started to consider what kind of offerings we would have and what kind of services. As a conclusion from this exercise, we thought we should define a process that would frame the Kungshall experience.

We began exploring the process, and despite we defined a process after some work, on the way we had learned that such processes are well known and documented. Hence, it would be hard to innovate or distinguish our initiative by focusing on such process. Although innovation processes are still core within the Kungshall process we realized that the main concepts was beyond it.

Just before this realization, it was time to meet the Stanford team in person again. We had a few workshop to test our process, and their tool. The bottom line is that our process was focused on building innovation capabilities and their tool was focus on documentation within such workshops. Although we had decided already to take the focus, the meeting were set. We decided to conduct them as a test for the tool, as well as, a simulation of how a workshop would be held in Kungshall.

Both workshops were encouraging and gave us confirmation we were on the right track with the concept. (see blog post)

During the meetings that followed we had intense discussion about the nature of our work. On the one hand we realized that us a Swedish team we were developing something concrete, however in a more conceptual/service way. Such concept involved broad design criteria. On the other hand, the stanford guys need a more specific and clear criteria to focus on their tool.

At first we have thought that this criteria should be about documentation of the work done during the innovation process. We agreed that documentation was an important aspect of it, however they wanted something with a kick and wow factor. After a long process we concluded that a good possibility was to help people feel innovative. Stanford team described their task as creating something physical and functional. The task to go deeper in what makes people being creative is also challenging. One cannot just say to somebody do be creative, one needs help in someway. Their task was to design how such a tool could look like. Despite the current focus for the board functionalities, we describe features that are tangible for IDEUM to have. The tangibility of such ideas has been discussed with the Stanford team, even though they are not implemented in the working prototype, they are feasible.

We mapped what we had so far, and started to explore what offerings and who we should contact as a possibility, The process went crazy blooming with ideas. We were contacting partners and people who would be involved with soon we would be drowning in a myriad of concepts. We realized it was time to converge.

Due to the complexity of the concept, we went through a number of iterations about the different personas and their relations, as well as the added value, novelty, as well as, offerings. In one of our meetings we classified stuff in WHY, HOW & WHAT. After, we refined the design criteria that were underlying our ideas. A number of structures were created until we realized we had the right design. We gathered the elements we had explored according to the criteria. We decided that a booklet would create a great structure to capture the concept so we started mapping the chapter and all the elements were organized a bit more

During the last week at Stanford we continued to refine the concepts with the Stanford team feedback, as well as by bringing together their tool and the concept. We learned to take in consid-
eration what the tool can do now, as well as to delineate its huge potential.
KUNGSHALL INNOVATION CENTER CONCEPT

MISSION
Foment innovation at individual, local, organizational and global levels

BY
Developing innovation capacities of individuals and teams
Guiding individuals and teams through a focused innovation process
Connecting inventors and their inventions to investors

MAKING IT HAPPEN
Kungshall’s concept features

Bringing the World to Kungshall
Kungshall is a magnet for innovative people and companies. Anyone who has methods, tools, ideas or interest in developing innovation finds a role to play within Kungshall. This design criteria is about connecting people that can work together to make new ideas to develop.

Developing Innovation Capabilities
Those want to improve their capacity to innovate feel a tangible improvements after passing through Kungshall. They are inspired and learn different ways to approach the innovation process, in addition they become more aware of innovation dynamic. They are better equipped with material, contacts, and spaces for bringing about innovation from insight to implementation in society.

Connecting the Dots
Different motivations guide people to Kungshall. Some want access to the newest technologies to invest in or to find a solution to a current challenge. Others have seen opportunities and improvements they want to develop solutions to. Kungshall is a meeting point for investors and inventors so innovations can find a pathway to be born in society.

Figure 8.1: A summary of the Kungshall concept.
1. **Solution Package**  
*We have problems that we want to solve*  
When companies face particularly sticky challenges, they can send small task force teams to Kungshall to tackle them quickly and creatively. Alternatively, they can post a challenge to the Kungshall network to crowdsource inspiration.

2. **Concept Development**  
*We have ideas that we want to develop*  
Users that have specific ideas they would like to develop can come to Kungshall for coaching and access to resources to make their concepts into reality.

3. **Educational Package**  
*We want to learn innovation methods*  
Some customers do not have a specific challenge in mind but are interested in building their innovation capacity in general. Workshops teach them tools for bringing more creativity into their personal work.

4. **Creative Climate Building**  
*We want to be an innovative company, both on- and off-site*  
For companies looking to make lasting changes in their corporate environment, this is a longer-term commitment. Consultants or researchers who are partnered with Kungshall will do customized need assessment and strategy.

5. **Events**  
*We want to network and socialize*  
Usually open to the public, these events introduce new perspectives to increase inspiration and networking in Kungshall. They help the Kungshall community keep a finger on the pulse of the newest trends and technology.

---

**INCOMING STREAMS**

- **Semi-Open**  
Organizations looking for inspiration work to develop concepts in partnership with individuals as well as other organizations.

- **Individual**  
People from all ages and backgrounds can come and develop concepts. They use the facilities to prototype and network.

- **Private**  
Companies and organizations work mostly with their own resources. Kungshall’s facilitators and partners may sign non-disclosure agreements when working with these users.

- **Investment**  
Ideas developed in Kungshall are displayed for future investment by companies or investors that may want to carry an idea further.

---

**PARTNERS**

- UNIVERSITIES & EDUCATION CENTERS
- FACILITATORS
- CIVIL SOCIETY (retired & youth)
- GOVERNMENT INITIATIVES
- LEGAL SERVICES
- PROTOTYPING FACILITIES

---

Figure 8.2: A summary of Kungshall’s offerings, and the streams of users that will come into the space.
| JAN | Exhibition: “Medical - Breakthrough innovations”  
Saturday 4 and Saturday 25, 10.00am - 20.00pm |
|-----|-----------------------------------------------|
| FEB | Matchmaking: Private innovators meet commercial partners and investors  
Monday 10 - Thursday 13, 10.00am - 16.00pm  
Matchmaking: Business meets commercial partners and investors  
Monday 17 - Thursday 20, 10.00am - 16.00pm |
| MAR | Fair: Digital technology  
Thursday 6 - Sunday 9, 10.00am - 18.00pm  
Fair: Health care  
Thursday 13 - Sunday 16, 10.00am - 18.00pm  
Fair: Nano technology  
Thursday 20 - Sunday 23, 10.00am - 18.00pm  
Fair: Electric vehicle technology  
Thursday 27 - Sunday 30, 10.00am - 18.00pm |
| APR | Hackathon: “Break-in-challenge”  
Monday 7 - Wednesday 30 (Final at Walpurgis Night)  
Walpurgis Night: Final Hackathon & “Bye-Bye Winter/Welcome Summer”  
Wednesday 30, 17.00pm - 02.00am |
| MAY | Gallery: From idea to market - Inventors’ own story in personal photo-journeys  
Monday 5 - Friday 9, 10.00am - 20.00pm  
Push Conference: “Unrevealed Innovation Capacity: Scientists and Practitioners”  
Keynote: Aziz Neer, Laparoscopic surgery instruments  
Monday 12 - Thursday 15. Sign in Monday 6am - 10am.  
Gallery: Future solutions - Paintings & illustrations by artists interpreting the future.  
Monday 19 - Friday 25, 10.00am - 20.00pm |
| JUN | Exhibition: “Communication - Breakthrough Innovations”  
Monday 2 - Sunday 22, 10.00am - 20.00pm  
Mid Summer Celebration & Party: The Best of Sweden  
Friday 21, 18.00pm - 20.00am Midsummer Celebration (Family event)  
20.00pm - 02.00am DJ: Sunnyday24 (Min. age 18) |
| JUL | Exhibition: “Life Science - Breakthrough Innovations”  
Monday 30 - Sunday 27, 10.00am - 20.00pm |
| AUG | Exhibition: “Agriculture - Break-through Innovations”  
Monday 4 - Sunday 24, 10.00am - 20.00pm |
| SEP | Fair: Education - Study & Research  
Thursday 4 - Sunday 7, 10.00am - 18.00pm  
Fair: Entrepreneur - Business Start-up  
Thursday 11 - Sunday 14, 10.00am - 18.00pm  
Fair: Job - Recruitment of graduates  
Thursday 18 - Sunday 21, 10.00am - 18.00pm  
Fair: Careers - Climbing the corporate ladder  
Thursday 25 - Sunday 28, 10.00am - 18.00pm |
| OCT | Matchmaking: Private innovators meet commercial partners and investors  
Monday 6 - Thursday 9, 10.00am - 16.00pm  
Matchmaking: Business meets commercial partners and investors  
Monday 13 - Thursday 16, 10.00am - 16.00pm |
| NOV | Push Conference: “The Innovation front line - by Scientists and Practitioners”  
Keynote: Niklas Zennström, Inventor and founder of Skype  
Monday 10 - Thursday 13. Sign in Monday 6am - 10am. |
| DEC | Exhibition: “Back to the Future - Reflections & Forecasting”  
Monday 1 - Friday 5, 10.00am - 20.00pm  
New Year Party: 72 hour Rave Around the World, DJ: SuperNova & Co  
Tuesday 30 - Thursday 1, 18.00pm - 12.00am (non-stop rave) |

Figure 8.3: A sample calendar of a years worth of events at Kungshall.
Figure 8.4: Sample posters for innovation conferences that might be hosted at Kungshall.
Appendix A: Definition of needs for Corporate splinter teams and their management

The following list of needs was developed during our December trip to Sweden, and addressing these was a top priority for all of Winter quarter. However, after our return trip in March we came to identify more pressing needs, and chose to address these instead (see Chapter 2: Context).

From their own perspective, ventures entering Kungshall need to:

- **Feel autonomy and control over their project.** Many innovation projects have been assigned to teams by higher levels of management, and innovation teams have trouble feeling excitement about their work because the given requirements for the project are so strict that teams do not feel ownership of the idea. This environment is stifling to innovation; leaving the naturally oppressive office environment (where there are always higher managers around, and even with the best intentions will end up controlling the project direction) empowers teams to define the direction of their project and work on something that they feel strongly about. This helps them work with a level of passion that they would be unable to achieve at their parent office.

- **Effectively communicate the value of the work they have produced.** Innovation teams that come to Kungshall face a number of barriers when bringing their work back to the parent companies: in addition to the stress of being expected to deliver innovation is the challenge of justifying the validity of these radical ideas and communicating both the value of the work which yielded them and the value of the design thinking process in general. Users in Sweden have repeatedly voiced the need to communicate to outsiders that Kungshall is not just about having fun: design thinking often does not appear particularly serious or sophisticated, and it can cause tension when users try to bring ideas back to their parent companies and implement them. This compounds a preexisting challenge that we have heard voiced by other users: the momentum problem. Especially when there are not clear roles for who is responsible for taking the project forward, or the company structure has not set time aside for designated employees to work on implementation, it is common for these sorts of projects to ‘fizzle out’ when team members return to their normal schedules. (See glossary: Momentum problem) The final aspect of this need is to be able to efficiently communicate ideas that were developed along the way during the design process, so that they do not become lost at sea. A huge amount of energy and potential is lost in ideas that do not get carried forward, and there are no structures currently in place for rescuing these ideas. This could ease the transition back to a parent company when management does not support the direction that the team chose at Kungshall: having access to earlier iterations of ideas could be hugely valuable so that the time and work at Kungshall did not feel wasted. (See glossary: Lost at sea)

- **Work more efficiently as a team than they could at their parent company** In everyone we interviewed, there was agreement that certain factors universally make it hard for a team to work at maximum efficiency. Among these are scheduling a time when the team is all available to meet; maintaining a high level of focus on projects that are not top priority
(especially given the stress of other projects that seem more urgent and stressful); and the
time and effort spent catching the team up and recalling where they were when they left off
at the last meeting. Exacerbating this problem in many innovation teams is the fact that
the team members often have not worked together before, or even met each other. Getting
used to each other’s workstyles, understanding motivations, and aligning goals can take a huge
amount of time and energy. (See glossary definitions for Meeting initialization time and
10HM; to see how we have addressed this need, skip ahead to Prototype. Venture branding
activity).

These needs can be seen as limiting factors - things that frustrate team members, block co-
operation, and make it challenging to move forward with the project - or they can be seen as
opportunities to leverage the physical move to the Kungshall space to ‘start over’ and change atti-
tudes to make teams more innovative and successful. Being co-located can help teams focus more
intensely, reduce time wasted navigating scheduling conflicts; and introduce a new level of auton-
omy by physically separating them from their parent company. Much of our prototyping effort
this quarter was focused around leveraging and enhancing these advantages. See Venture Branding
Activity for a further discussion of how we explored this.

The needs from the parent company’s perspective, as deduced from conversations with Volvo
CE employees, iGroup facilitators, and our liaisons, are slightly different:

- **To find solutions which demonstrate clear value to the customer** Discussions with
  the manager of Volvo CE’s Innovation Portfolio manager indicated that this would be his
  biggest priority when sending teams into the space. For him, the main draw of the space
  would be to help his teams stay in touch with their customer’s needs, and he would need to
  see clear demonstration of this in the work coming out of the space. (See Appendix 1A. Notes
  from discussion with Peter Wallin)

- **Increased clarity around what employees are doing in the Kungshall space and
proof that being in the space makes them more productive** This is actually a need
voiced by all stakeholders in our project: our sponsors and liaisons want to be able to demon-
strate the value of sending teams to the space; customers want to demonstrate that they have
been working effectively and not just ‘goofing around’ with design thinking; and companies
want confirmation that their investment (financial, and of their employees’ time) in sending
groups to this space was worthwhile.

- **To reinvigorate employees and convert them to design thinking evangelists within
their normal work environment** The material and attitudes they learn during their time
at Kungshall should extend beyond just their time at Kungshall. There is potential for the
investment to pay itself back many times and have a much larger influence if alumni of the
Kungshall space can continue to spread the work they’ve done. From the perspective of the
Kungshall space, this need is also extremely important: in order to stay relevant on a global
basis, Kungshall must maintain its influence and ties beyond just the people in the space at
a given time.
Appendix B: Notes from December 2012 Sweden trip

Interview with Peter Wallin

Peter Wallin is the Innovation Portfolio Manager for Volvo Construction Equipment in Sweden.

We had the chance to sit down with him briefly and discuss how he might make use of a space like Kungshall, what his top priorities for innovation projects are, and what he feels is missing from the innovation culture at Volvo. Below are some relevant excerpts from our interview notes.

What is the structure for proposing and implementing innovation projects at Volvo? Technology working groups (TWG’s) create the ideas that go into their innovation portfolio, and then his responsibility is to sort through and prioritize these. Kungshall would probably come even before these, to come up with the kernels for innovative ideas.

- Each tech working group: 4-5 ppl, incl. 1 technology planning manager (director of the area) + 1 specialist
- Working groups produce Technology area plans but these aren’t usually for radical innovations, just focusing on incremental improvements over what they currently have

What prompts would you send a team to Kungshall with?

He’d prefer to send them with a challenge to address rather than with an idea - being forced to work with an idea is too limiting for creativity. Setting a target of 10 Most important results he wants to see from Kungshall?

Key focus = providing value to the customer; we need to demonstrate the value that we’d add.

Biggest challenges to using Kungshall?

- Scheduling - getting people to take an entire week off. Most important to the success of Kungshall is getting the right people to go.
- Scheduling is always a problem for TWG - can’t meet that often, and when they do it’s not always efficient. Ideal would be to find a way to make their 10 1-hour meetings over the course of the year act as one day-long meeting, but that’s just not really possible. Spend so much time just trying to figure out when to meet.

How would you measure the competency of a place like Kungshall?

- Trial phase, looking at how it worked out for other companies
• Ability to work with other teams and network outside of Volvo (He is fine with competitors using the same space - just sign an NDA or something beforehand)
• Measure competence of staff based mostly on personal relations

Meeting with Mikael Blomqvist
Mikael Blomqvist, our corporate partner and the founder of the investment firm Michano AB, is interested in stimulating innovation in the Blekinge region. In our first meeting with him, we were able to get his vision for Kungshall, his opinions on what makes innovation in Sweden - and specifically in Karlskrona - unique, and how he would define success for the project. What are your main goals for the Kungshall product?
Creating a culture of making' in the area. Make something happen - stimulate growth in his home region. BTH has done a lot to help this. This region has always been really strong in manufacturing.

What about the Swedish environment is unique for entrepreneurship?
Production and software - Ericsson, Spotify - different than Silicon Valley because people are more easygoing, and there is more hierarchy. Companies in general will grow stiff and die if they don’t reinvent themselves, and Swedish are really great at reinventing (but it’s a struggle to even convince a lot of companies that they are too rigid and need to evolve). Export has always been essential to the economy, so it’s something that they do well/have a great infrastructure for - and anything we do needs to have a global focus - has to be scalable and can’t be cloistered in Sweden. Other initiatives in Sweden are not thinking large-scale enough. He wants to create connections between Lund, Copenhagen, and Gothenburg - and then to the world.

How does ALMI play into the equation?
It’s just not on the scale that we are capable of - they’re too local, can’t make a $6m investment at the drop of a hat. Not having that flexibility can really harm companies. ALMI is good for some investments - it’s easy money to get, and you can’t lose too much. For larger investments it’s important to discriminate much more.

"If you don’t lose anything, then you haven’t tried” How does investment here compare to Silicon Valley venture capital?
He wants to import the SV attitude, but only parts of it and in a very structured way. Swedish are calm and considered, rather than aggressive elevator pitches. In SV, people tend to lose interest so quickly, so it’s necessary to be that aggressive. This attitude does not work in Sweden. Is there anything you wish you could offer the companies you’ve funded that you haven’t been able to?
Honestly, no - the biggest challenge is just to find companies that are worth investing in. Hard to push people into the global mindset and to think on bigger scale - most Swedish want to make their daily bread and not more.
Main goal = to make the d.school in a more European way, on a global basis. Wouldn’t want teams to come here to go through a fixed set of steps - too structured. He’s expecting to attract people here to spend an entire year in Karlskrona. This should be the first of many - wants to see more of these built over time.

What’s unique about Karlskrona?

Politicians aren’t thinking big enough here, and he wants to change that. Karlskrona’s not that big, you can always fix things. Really strong sense of equality here that he really likes.
Appendix C: Fall Quarter - Space Benchmarking Visit Notes

IDEO, Palo Alto - Andy Switky

- Focus on the creativity that happens between functional spaces: this is an issue that keeps coming up. Don’t underestimate the importance of collaboration that happens through accidental meetings, etc.

- They have no definite or simple method for process capture - everyone is responsible for recording their own brainstorming sessions, etc, and Andy was doing it by taking photos on his phone. Anything about the process they want to save just gets stored in file boxes or on their server; so documentation varies dramatically from designer to designer. We see a huge opportunity here.

- Presentations are a huge focus for them, because their clients are paying a ton of money for these services; they really believe in making these flawless. The try to make them look simple and clean but it actually takes a ton of work to do this.

- When asked whether new clients seem overwhelmed by their space/process, he emphasized the importance of having newcomers go through the design process once and experience the satisfaction that comes with the 'wrap-up' at the end of a cycle, where all of a sudden, the ideas that seemed crazy get pulled back together into something exciting and innovative. Formalizing this process will be really important for communicating to funders or to the large companies which satellite teams come from.

- Importance of having a common language between different offices - anywhere you go in the world, you’ll have these little baskets of sharpies and post-its available throughout the office. This is super important to support creativity anywhere, and is nice as a connection between offices in really different cultures.

SAP AppHaus, Mountain View - Philipp Skogstad

His key requirements for AppHaus space:

- Multidisciplinary, top notch, co-located people (co-location essential to move fast enough on their projects, arrange meetings etc.)

- Extremely short design cycles (he started AppHaus because needed to design something in 90 days and couldn’t achieve this at slow-moving large company (he calls this ”oil-tanker” corporate culture); especially important that everyone is physically close to make things move faster.

- Support the people and the process (space needs to be FLEXIBLE, EVOLVING, and INSPIRING)

- Space needs to 'give permission’, so people not afraid to mess it up and take ownership (team defines their own space) - he achieves this by looking unfinished
Challenging questions for us to address:

- How will we build a persistent culture, and make people feel truly engaged and responsible for the space, if we have a high turnaround? In general, if teams are rotating, their efforts may be more halfhearted because they feel that everything is only temporary.

- Consider HPI - teleboard for remote collaboration benchmarking - whiteboard+skype+recording - but the technology is a little complicated and for this to be feasible you’d need a devoted tech person. Who wants to put in that much effort/should you really have to?

- Key to AppHaus has been letting things go, allowing the space to grow organically (really hard for some cultures, especially Germans who like to plan).

- AppHaus works because it achieves the 'special forces' feeling on a team, making them perform a lot better. They need a sense of contrast between where they normally work and our 'special forces team' space.

- Importance of Kungshall coaches having a stake in the teams success: 'design services team’ did coaching for SAP teams around the world but never worked out very well; teams saw them as outsiders, low engagement. *(Opportunity here: can the space act as a coach that subtly pushes teams in a direction? With coach, teams will 'nod-and-ignore', but space might have a unique advantage if 'pushes’ are subtle enough...)*

- One key for our space is peer learning. We should take advantage of shared space, and teams with seemingly unrelated projects may have a lot to learn from eachother. Should be able to see/hear into other teams’ spaces. *(But: need to think carefully about privacy/IP issues with both startups and corporate teams - maybe make the entire space subject to non-disclosure agreement? Or everything open source?)*

Wallenberg Hall, Stanford - Robert Smith

- Tools like Copycat for auto-documentation of brainstorming sessions are just not working. Not transparent and a lot if people feel it is not worth investing the time to learn. Either need technologies that are ultra simple and approachable or else need some guarantee that they will stay the same over time (or, need it to be so widespread) that investment to learn them now is worth it.

- We need to be careful not to cloister the technology we develop in Karlskrona - how will we make this a truly international place? Or go for the other extreme - pitch this as a retreat really away from all distraction. But then be aware that people won’t be staying here for long.

- It’s important that people don’t worry they’ll break the technology in the space, especially in Sweden where people tend to be a lot more polite. *(Or if they do break it - that’s good! We want to know what went wrong to create better technology!)*

- Our space may want to have 'design practitioners'/gurus who are always there, and responsible for being constantly ‘meta’ like an IDEO deep dive team that is always around to help people out.
• Making people happy/comfortable/unthreatened is far more important than technology - do this and then all that’s important is basic technology to support them.

• Potential for technology to make teamwork more democratic/avoid having one leader. They arrange setups with multiple screens so everyone works simultaneously, and find that the students are much more engaged if they are simultaneously doing tasks related to the teacher’s task.

• It is crucial to have a space that will adjust to future technology - cable trays in Wallenberg mean it’s really easy to rewire everything when new technology comes in. Otherwise building gets outdated when the tech does.

• Importance of having teams learn from each other. The teachers in Wallenberg benefit a ton from learning how other teachers have incorporated technology into their classes. Maybe we should consider designing an apprenticeship program where students or entrepreneurs can work with a company’s satellite team and learn from them.

Neeraj Sonalkar, Stanford Design Group PhD Graduate

• There has been a lot of research into concept generation patterns, and a lot of research into designers’ interpersonal behaviors on teams, but very little research connecting the two.

• The traditional idea, both in improv and in design, is that ‘blocking’ behaviors on teams are necessarily bad. But this is not necessarily true; it is much more important to look at how other teammates negotiate blocks. What differentiates good versus bad teams is not the existence of blocking behaviors, but rather how they negotiate those blocks. Maybe rather than influencing how teams interact overall, we should focus on training members to negotiate blocks better.

• Responding to a question about giving teams feedback - during his PhD research, he wasn’t giving feedback, but does do that in his current work and a lot of teams respond well. He hasn’t tried negative feedback yet about their behaviors, though - only encouragement, and intervening in situations where he sees that something’s not working. It’s awkward at first, but he got used to doing it quite fast.

• Improv theater is a great place to get inspiration for design team dynamics in general - deals with the same question of what do you do in a space of not knowing, where the only option is to build on team members until you collaboratively find a direction for the team to move.

• Being aware that these dynamics exist is enough to change the way people interact on teams - his researchers feel this in their own work. Maybe we should consider sensitivity training for incoming teams?

Volvo Construction Equipment - Jenny Elfsberg interview by Mikael Johnsson, Munktell Science Park

Requirement/Demands: What requires would you have on Kungshall if they say they have an creative environment?

• Freedom to do what ever is needed on site.
• The less predefined the better for creativity, maybe an empty white space with hidden resources that could be used when they are needed.

• Easy to see what’s going on in a nearby industry, being a place in the reality or very good Internet connection.

**What competences would you require on site?**

• The character of a multifunctional/multidisciplinary group.

• A process you can trust on, that handles chaos.

**What requires would you have on the environment?**

• Have to be a relaxed place. Ordinary meeting rooms kill creativity. Tables, if needed, should be round.

*Positive approach: What would motivate you to send an iGroup to Kungshall?*

• If I knew there could be there, being focused on the tasks.

• Resources on site

• Processes and process managers. A person who can guide a group in a systematic way where chaos is OK.

• From sketch to demonstrator which could be made of clay or a virtual model

**What offers would you expect from Kungshall?**

• The facility by itself.

• The facility + process.

• Educating of process.

• Annual conference on creativity.

*Delivery: What would you expect an iGroup to bring back from Kungshall?*

• Education = competence

• Concept (might take a few times) = concept descriptions, illustrations

_Can you imagine VCE to visit Kungshall to get conceptualization in terms of illustrations and models if the total time was 1 week? _Yes, it doesn’t need to be a working prototype, model that explains functions would be good._

**Approx. how much would you spend on a week like that?** 200.000 SEK

_Can you imagine VCE to visit Kungshall to develop a prototype (pre-stage to production development) of e.g. steering device if the total time was 2 month? Yes_ **Approx. how much would you spend on two month like that?** 1.000.000SEK

_Can you imagine VCE to gather a strategic team and visit Kungshall in purpose to conceptualize strategic directions during a time of one week? Yes_ **Approx. how much would you spend on a week?** 200.000SEK on product level 1.000.000SEK on company level if material can be used for marketing.

_Negative approach:_
• What problems do you see by sending an iGroup to Kungshall?

• Many would react on the remote location. Sweden is not the center of the world and Karl-
skrona in in the middle of nowhere.

• Make sure that you get something out of it. Specifications maybe

• Companies like VCE are driven by annual reports, events that doesn’t have obvious benefits
for the company will be cut off.

• Explicit that it’s not just for fun to visit Kungshall

*What would make you to not recommend Kungshall to someone?*

• If the concept were to unclear. I like innovative product development but not reports.

• Not so into team building events.

• Paper products like McKinsey proposing ’changes’ are of no value.

• If I’ve tried if a couple of times and doesn’t get any concrete I’d be unhappy.

*Except for VCE, what other companies would you expect to see at Kungshall?*

• Would like to see telecom, healthcare. Completley different from VCE.

• I would like to learn from others than our selves, we are moving from products towards
services so we have a lot to learn.

• I wouldn’t be afraid of competitors.

*What would make you recommend Kungshall to someone?*

• Imagine to send an iGroup where they work according to a process, the Raft-model maybe,
and after a weak they can present something. It doesn’t have to be a business case but they
come back full of energy. I’d love that and it would be so important for the members in the
iGroup.

*How did you find the questions?*

• Good, and it was fun

*Is there something you’d like to add?* It has to be a international feeling. VCE wouldn’t be very
interested if it’s not. I can compare of my situation of going to Brussels when I have to present
something.
Appendix D: Brochures from Spring SGM Presentations

D.1 EXPE Presentation
THE CHALLENGE

How might we transform this historic naval building into a cutting-edge innovation center?
USER NEEDS

Users do not perceive themselves as creative
Idea generation is cumbersome and stressful
HOW MIGHT WE

Build creative confidence and inspire better brainstorming?
IDÉUM
A workspace for building brighter ideas and better brainstorming behavior

TANGIBLE CONNECTIONS
Building on ideas becomes intuitive and fun
Tangible reconfiguring and clustering
ILLUMINATED IDEAS

Every idea deserves to glow
Moving lights inject kinetic energy
Bigger idea clusters are brighter

SCULPTED INTERACTION

Teammates face each other while working
Standing encourages movement and energy
Looks like a boat
SYSTEM COMPONENTS
Thank you.
D.2 EXPE Handout
TANGIBLE CONNECTIONS
Organize your ideas on hexagonal tiles that magnetically snap together with a satisfying click. Building on others’ ideas becomes intuitive, gratifying, and fun. Tangible ideas can be easily clustered and reconfigured, inspiring new structures and connections.

ILLUMINATED IDEAS
A soft glow highlights ideas as they are added to the surface, reinforcing the value of each contribution. Spotlights follow tiles as they are slid around, injecting kinetic energy into the discussion. They glow brighter and bigger as ideas are gathered together, echoing the mounting excitement.

SCULPTED INTERACTION
The dynamic hexagonal shape makes teammates face each other while keeping the work area within arm’s reach, ensuring equal and active engagement. The horizontal work surface and standing configuration encourages physical movement and energy.

THE NEED
Corporate teams tasked with innovation center around the fact compounded by the fact - and a touch of fun - that builds creative confidence.

THE CREATIVE ENVIRONMENT
IDÉUM is designed to be a innovation center in Karlshamn, Sweden. The site of the center is Karlshamn's Kungshall, a 19th-century naval warehouse constructed at the end of the 19th century. Kungshall's goal is to make their ideas real. IDÉUM generation and organization is a nexus that teams return to make their design process.
D.3 Penultimate handout
PENULTTABLE
The Ultimate Penultimate Table
On the other side:

Reactivision successfully reads (many) hexes! Hex + Table combination verified as working.
Integrated Table Subsystems:

- REFURBISHED LENOVO DESKTOP PC
- 80/20 FRAME
- IR FLOODLIGHTS
- CAMERA + WIDE-ANGLE LENS + IR FILTER + MOUNT
- BIRCH HEX HUTCHES
- SANDED WATERJET-CUT ACRYLIC HEXAGON
- NEC U300X PROJECTOR
- REFURBISHED LENOVO DESKTOP PC
- 80/20 FRAME
CONSTRUCTION  

*Clockwise from Top:* Adi drilling connecting plates; Eva gluing sheets of hexes; Completed camera mount; Eva machining connecting plates; Sheet of hexes being laser cut
Clockwise from Top: Adi and Jon assembling the frame bottom; Adi attaching supporting struts; Eva securing the top of the frame; A quick test with butcher paper before acrylic arrival; The finished penultimate prototype; Next steps: Adi inspecting the steel exterior sheeting
EXPE GAME PLAN

May 16-20
    Bend and reinforce SS panels
    Mount SS panels
    Make hutches
    Mount computer and cooling fans
    Add IR illuminators
    Ship hexes to Volvo
    Software
    Plan game with Swedish team

May 21-27
    Program simple basic game.
    Make software into an easy to use API
    Finishing touches to table (Sanding, Buffing, etc)
    Plan and implement On/off switch
    Testing - initial game and overall system
    Plan EXPE booth and order materials
    Work on Branding

May 28-June 5
    Final presentation - slide deck and brochure
    Make video
    EXPE Booth Build

VISION FOR EXPE BOOTH

Set up an enclosed space that creates a magical experience around the table.
Should be ‘Kungshall-Like’
Control the “experience” by having shows in addition to regular booth time
    Users go through a whole experience during the shows, rather than just playing with table

TESTING PLAN

Test with real design teams : teams in d.school classes, teams in ME classes, volvo(?)

Does it make people excited?
Does this excitement change the way people interact?
    Time lapse - activity
Quantify:
    Clustering and reclustering of ideas
    Fiddling

Game testing
    Does it make people feel like they better understand how to follow brainstorming rules?
    Does it actually make them better at following the rules?
D.4 X is done handout
PART HEX

Form and Manufacturing Process for Hexes

DESIGN EVOLUTION: Many, many prototypes. From laser cutting to 3D printing and back again.

TESTED FIDUCIARY VARIATIONS:  
- Acrylic inlay  
- Etched + graphite powder  
- Etched + inked  
- Paper  
- Paper sticker  
- Vinyl Sticker  
- Etched + vinyl sticker

TESTED GRIP VARIATIONS:  
- Big scallops, inset, small scallops

TESTED MANUFACTURING:  
- Pure 3D printing, 3D printed rim + laser cut middle, laser cut + glue with jig, laser cut + glue + laser cut again

DESIGN CONSIDERATIONS:  
- Snap together with the right strength. Can pull apart easily with two fingers. When up to 6 are stuck together, moving one hex moves all of them.
- Writes well with both EXPO markers and Sharpies. Erases well for dry erase markers and for Sharpies with alcohol.
- Fits nicely in palm of hand, and is good size for headlining.
- Fiduciary is clearly visible to camera, but not too distracting when viewed from the top.
- Feels magical – magnets shouldn’t be visible. Should have a nicely finished feel.
- Easy to pick up by gripping on sides.
- Withstand Larry testing.

NEXT STEPS:  
- ‘Hexes’  
- Final production run: correct translucency of acrylic, correct magnets  
- Irregular shapes and colors, some double-sized  
- Branching shape, shapes that won’t fit  
- Design a repertoire of ‘games’ - handbook or software?  
- Special fiducials to cue the software

Table  
- Order projector  
- Determine final dimensions of table  
- Dispensing mechanism for hex-its  
- Self-inking alcohol eraser
PART HEX
Form and Manufacturing Process for Hexes

DESIGN EVOLUTION: Many, many prototypes. From laser cutting to 3d printing and back again.

DESIGN CONSIDERATIONS:
Snap together with the right strength. Can pull apart easily with two fingers. When up to 6 are stuck together, moving one hex moves all of them.

 Writes well with both EXPO markers and Sharpies. Erases well for dry erase markers and for Sharpies with alcohol.

 Fits nicely in palm of hand, and is good size for headlining.

 Fiduciary is clearly visible to camera, but not too distracting when viewed from the top.

 Feels magical – magnets shouldn’t be visible. Should have a nicely finished feel.

 Easy to pick up by gripping on sides.

 Withstand Larry testing.

TESTED FIDUCIARY VARIATIONS:
- Acrylic inlay
- Etched + graphite powder
- Etched + inked
- Paper
- Paper sticker
- Vinyl Sticker
- Etched + vinyl sticker

TESTED GRIP VARIATIONS:
- Big scallops, inset, small scallops

TESTED MANUFACTURING:
- Pure 3d printing, 3d printed rim + laser cut middle, laser cut + glue with jig, laser cut + glue + laser cut again

NEXT STEPS:
‘Hexes’
- Final production run: correct translucency of acrylic, correct magnets
- Irregular shapes and colors, some double-sized
- Branching shape, shapes that won’t fit
- Design a repertoire of ‘games’ - handbook or software?
- Special fiducials to cue the software

Table
- Order projector
- Determine final dimensions of table
- Dispensing mechanism for hex-its
- Self-inking alcohol eraser
Appendix E:  Brochures from Winter SGM Presentations
We envisioned our dark horse to be a space that has a constant stream/flow of material (prototyping) through it, thus creating a constantly changing environment. We were interested in understanding how users responded to the stimulus, particularly in observing any behavioral shift in their approach to prototyping.

The Idea

Create an elaborate system of canals in Kungshall that would constantly circulate material (prototyping resources, inspiration, failed prototypes and in some cases people) in the building.

We quickly distilled our idea down to its critical experience of ‘moving material’ and implemented it by putting together a toy train system that carried a variety of prototyping material around a table. Users were then asked to participate in a simple team design exercise on the table.

The Motivation

Prototyping at a low resolution (or any resolution) is critical for moving the design process forward, so we wanted to lower the barrier of entry to prototyping and get teams to prototype faster and more frequently.

We also saw an opportunity in the constant change in environment to randomly inspire teams. Easy access to material to fiddle with makes it easy for users to keep their hands busy, further increasing the level of movement and activity in a group.

The Darkness

We saw this as a dark horse for a number of reasons. First, it was a completely new direction for us in the project, one that is mostly unrelated to all of the work we have done thus far. The idea seemed crazy because it could easily be distracting, gimmicky, difficult to maintain, and challenging to stock the correct materials that would feel relevant for all the teams in the space. It could lead to other, even more radical aspects, such as having a ‘DJ’ controlling and ‘mixing’ the streams of materials.

To actually build and maintain a system of indoor canals would be hugely expensive, and would certainly create a sense of awe -- but how useful would it be?
User Testing: Survey Results

Either small effect or **strongly bimodal effect**
(Number of surveys = 20)

User Testing: Discoveries and Takeaways

<table>
<thead>
<tr>
<th>expected outcomes</th>
<th>unexpected discoveries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOWERING PROTOTYPING BARRIER</strong></td>
<td>Constant stream of materials should make people prototype sooner</td>
</tr>
<tr>
<td><strong>GROUP DYNAMICS</strong></td>
<td>Movement on table should encourage movement in group</td>
</tr>
<tr>
<td><strong>PERSONAL REACTIONS</strong></td>
<td>People can be energized by movement, regardless of materials</td>
</tr>
<tr>
<td>(did not consider this)</td>
<td></td>
</tr>
</tbody>
</table>

**Potential paths forward:** Leverage the disruption of starting/stopping to manipulate team direction
Build sense of community - have team united by multi-person task
Opportunity for reframing: use trains as a tool to gauge personality types

138
**KUNGSHALL  funky system prototype**

<table>
<thead>
<tr>
<th>user</th>
<th>needs...</th>
<th>because</th>
</tr>
</thead>
</table>
| An inter-departmental satellite team from Volvo entering this unfamiliar space (environment and physical) | - **team unity**: To bond amongst themselves and have a clear sense of purpose  
- **space persistence**: To feel at home (comfortable and efficient) in the space - shouldn’t worry about losing their work when they leave the space  
- **information management**: To record their process, communicate their achievements, and stay in touch with Volvo HQ | they are tasked with delivering innovation on a very tight turnaround time. The tech in the space should support their creativity so they are not bogged down by details. |

**solution**

- Help large companies move like small companies through a *launch your venture* activity. Simultaneously give them the freedom to define their own goals and the unity that comes from agreeing what these goals should be. Cement this identity and foster a ‘special forces’ feeling through a **branding** activity with team gear.  
- Give the team ownership of the space by defining their ambient conditions (lighting settings) and by preserving their work via multimedia on a website. This saves time by **eliminating the time to initialize team space**/recall train of thought from past conversations.  
- Create **personalized persistent cloudspace** that is linked to the team’s physical the idea development process and helping to organize, summarize, and present concepts that are developed.

![Diagram of system components](image)
<table>
<thead>
<tr>
<th>built...</th>
<th>learned...</th>
<th>future/past...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clariant rebranding CEP</td>
<td>+ Emotional response far more powerful than expected</td>
<td>- Extend team feeling beyond cool paraphernalia customize space further than info display to make it feel more personal/relevant</td>
</tr>
<tr>
<td>d.flower = Visual communication of information health</td>
<td>As info grows, you should feel proud, not intimidated - Display should be kept relevant to the purpose (payoff) of tagging - Lag in system makes flower feel disconnected</td>
<td>- Positive reinforcement from ambient abstract stimuli - Needs to represent the connection between act of tagging and payoff (organization) - ‘Tree’ indicates branches that feel obscure and harder to access if not tagged - Display more information elucidating the connection between graphic+info - write the tags/topics? - Need immediate gratification/feedback - Create more pleasant UX, ways to tag as you work</td>
</tr>
<tr>
<td>Eraser = camera trigger</td>
<td>+ Feels good to click to advance (sense of achievement)</td>
<td>- Consider smart sensing, but preserve the physical experience</td>
</tr>
<tr>
<td>Archives display</td>
<td>- Need some persistent information</td>
<td>Suggests relevant ‘experts’ within Volvo? Some way of presenting team process; summary video How this communicates to boss - should Volvo have access to all information?</td>
</tr>
<tr>
<td>Overall experience of (physical) space</td>
<td>Helped us define the bare minimum of tech support needed in a space</td>
<td>- Incorporate this bare-bones technology into fun spaces - Achieve special forces feeling with room, not just rebranding gear - Incorporate movement and energy from CEP/Dark Horse</td>
</tr>
</tbody>
</table>
KUNGSHALL: FUNCTIONAL SYSTEM PROTOTYPE

WHAT WE DID

How can we make people more conscientious about their design process? For newcomers, this means teaching the design process; for more experienced designers we focused on how to improve team dynamics, raise intentionality, and discuss common goals.

HARDWARE:

The whiteboard system includes:
- vertical (presentation) or horizontal (table) mode
- screen behind whiteboard, controlled with trackpad
- webcam to capture team’s writing on the board and store it in cloudspace

SOFTWARE:

Four ‘modes’ that the user can choose between:

INSPIRE ME: Abstract ambient stimuli to energize a team; users choose a ‘mood’.
GUIDE ME: Templates to teach the design process, define goals, and structure documentation.
REMIND ME: Teams can pick up where they left off at last meeting, and search their history.
IGNORE ME: An essential feature is that it can be used as a normal whiteboard when ‘off’.

TEAM PROCESS MAPPING:

Led discussions with Clariant and Edeka, to map out their team’s progress this quarter. Can every design process be captured in an input and output box? How to identify the major parts of a team’s process? Can a structure help them recall and express it?

WHAT WE LEARNED:

Prototype 1
- Hardware: Picoprojector not bright enough. Hard to have good projection quality.
- Software: Raspberry pi is slow, especially for web-based app.
- Tableware: Extending legs is clunky, robustness is paramount for usability! Glass shatters.
Prototype 2:

WHAT WE LEARNED:
Electronics: Screen works really well, even in bright light. People seem more engaged but this might be initial excitement.

Tableware: Four-bar linkage works well for setting right table and board heights.

UI: Simple swiping was not robust; left/right click works well. Users always want more input modes (touchscreen, speaking).

- Camera: Users like the ability to capture prototypes and post-its. Users want to write over old work.

- Meeting Structuring: Works well the first time, but users quickly start to ignore prompt – need to incentivize writing goals (through mapping?).

Image review: Users expect the board to erase when you change screen.

NEXT STEPS:
Electronics: Lighter screen would be great!

Tableware: Need physical indicators of how to transform table. Transforming table should require less strength.

UI: Must be robust or users will stop trusting it. Users are intrinsically explorative – how can we use this to manage expectations, and smoothen learning curve?

Camera: Needs to be smarter about not taking photos of the screen (flash white?) and synthesizing. Really important to be able to overwrite old work. Needs higher resolution and better alignment.

Meeting structuring: Summary page needs to be interactive.

Image review: Need clearer indication of where the info goes.

Overall: Users want and expect more - they demand a whole ecosystem.

TEAM PROCESS MAPPING:
- Must allow for external influences that just have an output box (‘disturbances’ such as reality checks from discussions with experts, direction from sponsors).
- Meditative value of recapitulating team process: they struggled to find structure for summarizing their work, but talking through it made them more conscious about their decisions.
Build a streamlined physical experience and simple intuitive UI that uses the physical appearance of board to set up expectations for how to use it. Multiple boards to prototype the interaction between a ‘fleet’ of whiteboards that talk to each other, and to cloud (we need to define exactly what they ‘say’)

PRIORITIES FOR SPRING QUARTER DEVELOPMENT

- Spring break: test simple version with innovation groups
- Rapid software iteration - serious testing of UI. Making it intuitive (extensive paper prototyping)
- What do you expect it to do (touchscreen)? What do you want it to do? How does physical experience manage expectations?
- More refined capture - how we process and convert to text
- Cloud storage decision: web interface or use local host? Incorporate smartphones?

[ outside our scope: Optics/camera (CopyCat); the process that our board guides teams through (Swedes); reduced emphasis on tagging to focus more on defining goals and outputs. ]
To help teams embark on a radical design voyage, we welcome them to Kungshall with a Venture Branding Activity -- in this space, they shed the shackles of being a team within a large corporation, and are instead a lean and agile start-up, imbued with a name and spirit of their choosing.

2 Teams are surrounded by a fleet of enhanced whiteboards that can be gathered as needed, moved and reconfigured -- even turned into tables -- to shape the space as they want, when they want. Any work teams do on the boards, be it written, post-it, or digital, is automatically stored and logged in their Cloud Workspace.

3 In this way, the evolution of ideas is automatically charted as a series of connected meetings, and can be browsed as needed. The chart allows bosses to peer into the inner workings of the design process, and extract useful learnings and insights that might be otherwise lost at sea.

4 When teams return home, although this physical space is left behind, this Cloud Workspace remains the backbone of their project. In this way, the entrepreneurial spirit and rapid workflow developed at Kungshall endures.

STANFORD UNIVERSITY: ADI RAO, EVA HOFFMANN, & JONATHAN GOH

BLEIKINGE INSTITUTE OF TECHNOLOGY: ANDRE BENAIM, MASSIMO PANAROTTO, MIKAEL JOHNSSON, TOBIAS & ANDREAS LARSSON

OUR VISION A creative ecosystem to encourage meaningful & radical collaboration, anchored at a new innovation center in Sweden.
BACKGROUND

Kungshall, in the coastal town of Karlskrona, Sweden, was built in 1787 as a naval warehouse. Now, Volvo CE and Michano AB -- the former the very definition of a traditionally big company, and the latter the investment arm of the firebrand serial entrepreneur Mikael Blomquist -- want to turn it into a radically new innovation center that combines the best of both their worlds.

Teams from large, slow-moving companies that are tasked with delivering innovation on a short timeline face a stressful process: even if they come up with a great idea, communicating the value of the work they’ve done can be difficult. Employees have trouble focusing because these projects are only a small part of a portfolio of work they’re doing, and innovation projects often get overlooked to prioritize more immediate work concerns as they arise.

Innovation teams need flexible creative support that can help them focus; and the tools to make them as productive as possible, whether they’re away for a week-long creative retreat, or can only work on these projects for a few scattered hours or days. An essential part of this is finding a way to maintain quick access to the information they’ve generated, in a condensed and organized format.

DESIGN REQUIREMENTS

Low barrier to use: Our boards always also function as basic whiteboards and preserve the physical experience of writing with a marker. Any added smart features must be intuitive.

Pushes teams out of their comfort zone: We’ll force teams to explore new creative spaces together; this can be by reconfiguring their physical environment or through inspiration introduced by the board itself.

Improves design process conscientiousness: For novice designers, this means teaching the design process, while for more experienced users the focus is on helping them more consistently document their process.

DESIGN DEVELOPMENT

Introducing motion into a team’s space has a surprisingly strong influence on designers, but it can be both energizing and frustrating.

Creating a personalized team identity and a place that the team feels is their own can profoundly influence team dynamics.

Users demand more from collaboration tools than just writing surfaces or touchscreens; they expect a larger ecosystem of integrated design tools. But these tools must stay specific to be useful.

MOVING FORWARD

Extensive user testing will help us polish the software user experience. We’ll develop a physical product around our desired experience that sets expectations for use and generates excitement and energy for the design process.
Appendix F: Extra Materials from Trains Prototype

For our Trains (Dark Horse) Prototype, users were given the following prompt:

The electric toothbrush is an ubiquitous yet complex product that has to combine superb ergonomics and innovative mechanical systems in a user-friendly package. What could the next great electric toothbrush look like, and what would it do?

After completing the tasks under a number of conditions (trains on, trains off, trains turned on in the middle of the brainstorming session, etc.) they were asked to complete the following survey.
Age:

Profession/Major:

Design Experience (Check all that apply):
- Not interested in design whatsoever
- Interested in design, follow design trends
- Hobbyist - do electronics, crafts, woodworking, building things, art for fun
- Studying or practicing something related to design
- Other:

I tend to communicate ideas through (Check all that apply):
- Talking
- Writing
- Drawing
- Gestures
- Digital Media
- Physical Objects
- Other:

I tend to understand ideas best through (Check all that apply):
- Listening
- Reading
- Gestures
- Sketches
- Digital Media
- Physical Objects
- Other:

When I am in a team, I am most comfortable being the (Check all that apply):
- Leader
- Planner
- Thinker
- Builder
- Other:

When the trains are running, how did it make you feel?:

**Excited:** 1 2 3 4 5 6 7 8 9 10
1: Made me more bored 10: Made me very pumped

**Stressed:** 1 2 3 4 5 6 7 8 9 10
1: Was too relaxing 10: Made me very stressed
Overall, did you feel that the materials:

Helped the discussion: 1 2 3 4 5 6 7 8 9 10
1: Greatly hindered the discussion 10: Greatly helped the discussion

Were easy to pick up and use: 1 2 3 4 5 6 7 8 9 10
1: Too difficult to pick-up, prevented me from doing so 10: Very easy to pick up and use

Were easy to put back: 1 2 3 4 5 6 7 8 9 10
1: Too difficult to put back, prevented me from doing so 10: Very easy to put back

Was useful for physical visualization: 1 2 3 4 5 6 7 8 9 10
1: Not useful at all 10: Very useful for physical visualization

Inspired our brainstorming: 1 2 3 4 5 6 7 8 9 10
1: Too distracting from conversation 10: Provided interesting source of inspiration

Other Thoughts:
Appendix G: Fall Quarter Prototyping: Experience and Functional Prototypes

G.1 Critical Function and Critical Experience Prototypes (CFP/CEP)

G.1.1 Scrolling Whiteboard CFP Development

Site visits to design spaces revealed that augmented documentation technologies such as Smart-Boards, and meeting capture software such as Quinid, are rarely used: although they create great value, they interfere too much with the simple, intuitive, physical experience of simply writing on a whiteboard. It seems that because this value is assessed at a later time, when you actually need to recall the information (such as the author’s present predicament), in order to encourage use it is more important to minimize the degradation of the physical experience than to greatly enhance the value of the documentation. So we are concerned with making the ratio:

\[
\frac{\Delta \text{Value}}{\Delta \text{Annoyance}} \gg 1 \quad (G.1)
\]

In creating this CFP, we wanted to address the motivating question: Can we create a useful automatic, digital documentation system without degrading the physical experience? We also saw the opportunity to push it one step further, and ask: Can we enhance the physical experience of writing on a whiteboard?

The team does our brainstorming on a table with a plastic dry-erase surface, which we find to be very useful. During brainstorming about possible automatic documentation paths, we became frustrated about running out of space and having to stop, take a picture, and then erase the board. We realized that this frustration was itself a needfinding nugget, and this led to the wish, ‘I wish we had infinite whiteboard space!’ The team collectively became very excited about the idea of a ‘scrolling whiteboard’: after a series of ‘Yes And’ moments, in which interesting features of other ideas were synthesized into the Scrolling Table, a rough sketch of physical and functional requirements was created, as shown in Tables G.1 and G.2.

The prototype was built by combining an IKEA table with a 24’ roll of Go-Write Dry Erase surface, and a digital camera in a lightbox. A picture of the table shown in Figure G.1; a picture of it in use is shown in Figure G.2 More details can be found in ??.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Metric</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>There should be much more space to write on than the length of the table</td>
<td>Writing space should be at least 5 times longer than the width of the table</td>
<td>Maximize physical value</td>
</tr>
<tr>
<td>The writing surface must be dry-erase compatible</td>
<td>It should be as dry-erase compatible as a normal whiteboard</td>
<td>Minimize annoyance</td>
</tr>
</tbody>
</table>

Table G.1: Physical Requirements for Scrolling Table CFP
Figure G.1: Photograph of completed Scrolling Table CFP

Figure G.2: Photograph of Scrolling Table CFP in use
<table>
<thead>
<tr>
<th>Requirement</th>
<th>Metric</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing on the scrolling table should be intuitive, and feel</td>
<td>There should be zero learning or adjustment curve for someone who is</td>
<td>Minimize annoyance</td>
</tr>
<tr>
<td>the same as writing on a whiteboard.</td>
<td>familiar with writing on whiteboards</td>
<td></td>
</tr>
<tr>
<td>Scrolling action should be intuitive</td>
<td>Should be able to look at table and discern functionality</td>
<td>Minimize annoyance</td>
</tr>
<tr>
<td>Scrolling action should be bi-directional</td>
<td>Should be able to show previous work and advance to new blank space</td>
<td>Maximize physical</td>
</tr>
<tr>
<td>It must automatically capture written material</td>
<td>Should capture in digital form at high resolution – must be legible and</td>
<td>Maximize digital</td>
</tr>
<tr>
<td></td>
<td>high-detail.</td>
<td>value.</td>
</tr>
</tbody>
</table>

Table G.2: Functional Requirements for Scrolling Table CFP
G.1.2 Lessons Learned

Testing was done by using table during team brainstorms. As well, two other 310 teams tested the table. With regards to goal of minimizing physical annoyance, it was found that:

- Anxiety about having to erase material when running out of space was avoided (+)
- Writing on the surface was close to exactly like writing on a normal whiteboard:
  - Dry erase behavior was good (+)
  - Surface sometimes was wrinkly, and did not stick to table properly (-)
  - Physical scrolling action was intuitive (+)
  - Physical scrolling action felt good: It was gratifying to signify progress in physical action (+)(+)

With regards to the goal of adding documentation value, it was found that:

- Having a physical record was useful, since one could scroll to find old work (+)
- Digital photos of physical record were not ideal:
  - Lighting conditions were bad and camera moved – stitching photos together was hard and not best result (-)
  - Resolution was not high enough (-)
  - Stitched digital record was very useful (+)(+)

G.1.3 Key Insights

We found that we were able to successfully minimize physical annoyance. Additionally, we also found that we enhanced physical experience: the act of scrolling and signifying progress was gratifying. This leads us to ask, in future work, *How else can we use this positive reinforcement?*

The stitched picture (Figures G.3 and ??) was useful because it allowed us to review our work away from the table – we could put it on Dropbox and then look at it from anywhere. We could talk about it remotely through Skype with our partners in Sweden. In these usage scenarios, however, we found ourselves wishing that we could annotate the pictures. This inspired the question: *What else can we do with this 'idea timeline'?* This question is explored in the Annotated Timeline Mini-CEP.

G.2 Annotated Timeline Mini-CEP

G.2.1 Annotated Timeline Mini-CEP Development

Using the stitched together timeline from the Scrolling Table CFP, we wanted to see what else we could do with it. From our experiences using it to communicate and collaborate with the Swedish team, we formulated an informal wish-list of useful features:

- It should be automatically uploaded on the web
• Users should be able to interact directly with it on the web
• Users should be able to add comments to parts of the timeline, and add comments to comments
• Users should be able to add details, such as documents, pictures, video, etc. to specific parts of the document
• Users should be able to ‘tag’ parts of the timeline as belonging to a certain task or thread of development

Implementing many of these things would be an involved process. To prototype the experience of looking back on such an annotated timeline, we mocked up and end-result in InDesign. It is shown in small size in Figure G.5.

G.2.2 Lessons Learned

Having such a timeline appears to be useful to look back upon – our opinion is biased, but feedback from teaching team, TAs, and some 310 classmates indicate that the annotated timeline was much more useful than the timeline alone in understanding our ideation process. But it is clear that the user-user and user-timeline interactions that go into making the end-product is an important part of the experience – we need to figure out what about those are critical, and then prototype them next.

G.3 Ambient Stimulus CEP

In designing Kungshall, we wish to look further than just physical environment. One possible aspect of this is sensory environment.

Motivated by this, the most basic question our CEP investigated is: How significantly can ambient stimulus affect team dynamics and creativity?

There is a large knowledgebase for creating spaces that create either diverging or converging behavior – the hard part is knowing what kind of space the team needs, and then changing the space accordingly. If ambient stimulus does indeed affect team dynamics, then we can ask: Can we combine real-time information about team dynamics and ambient stimulus to create a feedback control system for team dynamics by actively changing the space?

We walled off a corner of The Loft with white curtains, and put speakers inside, and a projector on the outside. It can be seen in Figure G.7.

Implementing such systems would be incredibly complicated. To prototype this, we used a Wizard-of-Oz method to implement four different ambient stimuli scenarios:

**Dominance Feedback**

*How does knowing who is dominating a conversation affect team dynamics?*

**Mechanism:** Each person in a team is assigned a color band. At the start of the brainstorm session, they are all the same size. When a person starts talking, their color band starts to grow, and the others shrink. A screenshot of the colored bars is shown in Figure G.9. **Implementation:**
A moderator standing outside the room listens in and chooses which bar to grow in a simple software program.

Related Word Mapping

*Can word-mapping provide background inspiration to augment teams’ creativity with related keywords?*  
**Mechanism:** Project maps of words relating to keywords used in brainstorming sessions.  
**Implementation:** A moderator standing outside the room listens in and enters key words into WordVis.com, generating maps of related words. An example of a generated word map is shown in Figure G.10.

Inspirational Images

*Can we draw meaningful inspiration from images related to a conversation? How about unrelated images?*  
**Mechanism:** Project selection of related or unrelated images.  
**Implementation:** We prepared beforehand images that were related to the topics that the team was brainstorming, and projected them in a slideshow with 10-second durations.

Rhythmic Colors

*Can abstract color/movement/sound stimulate a team or steer its energy in certain directions?*  
**Mechanism:** Play either fast-paced and/or slow-paced music, with rhythmically synced video. Try to schedule pace so that it is fast-paced at beginning and then slow-paced in middle of sessions. Can choose to increase pace when energy is lacking.  
**Implementation:** We prepared the synced visuals/music beforehand.

G.3.1 Lessons Learned

Dominance Feedback

We tested this with Team Edeka, having told them what the bars mean beforehand, but not which color belonged to whom. Overall, it affected them greatly, but was a thoroughly negative experience:

- They found this to be extremely stressful and distracting: “I spent 25% of my attention thinking about it” (-)
- This stress caused them to panic or to want to say things that weren’t especially helpful, just to get their bar to grow (-)
- Some were more stressed when they weren’t talking enough, others were stressed when they were talking too much and ‘bullying’ others (-)
- They said that knowing speaking percentage as function of time could be useful.
- They found it to be a discouraging form of *negative reinforcement:* “It feels bad to see your bar getting smaller” (-)
While it was a very negative experience, it was encouraging that the magnitude of the effect was great. Taking into account things learned from the other scenarios, a path forward with this scenario could include:

- *Positive* reinforcement instead of negative
- Observation of other metrics, such as movement or sound
- Subtle and slower-moving indicators, such as light level

**Related Word Mapping**

We tested this with Team EMN, having not told them what was going to occur in the space. Overall, it had little to no effect, but was sometimes distracting:

- Because the word maps were peripherally projected on the curtain and was mostly blank space, it was easy to ignore. Which was actually a benefit: They didn’t have to pay attention to it until they were looking for inspiration. (+)
- However when they did look at it for inspiration, it wasn’t useful: The words weren’t radical or far away enough from the conversation. (-)(-)

The lack of utility in this scenario mostly stemmed from the ‘related words’ lagging behind the brainstormfront. A path forward for this scenario should include ways to amend this:

- Occasionally project unrelated words
- Occasionally project *antonyms* rather than synonyms
- A smarter related word system – but this almost amounts to an automatic brainstormer

**Inspirational Images**

We tested this with Team Microsoft, having prepared a collection of both related and completely unrelated images beforehand. Overall, it was interesting at first, but had little effect after the images started looping:

- Pictures were distracting at the beginning: they had to pause conversation to process images (-)
- After that, pictures had little impact – not useful but not distracting either (-)

It was encouraging that the images were useful before they started repeating, but discouraging that they were mostly distracting and interrupted the flow of the conversation. A path forward for this scenario should address this:

- Images can be shown only when group activity level is low (integrating feedback mechanism from Dominance Feedback)
- Images should never repeat
Rhythmic Colors
We tested this twice, once with Clariant, and then with SAP. The test with Clariant showed a relatively small effect:

- Reactions to music were very subjective: “Fast is energizing” vs. “Slow helps me focus” (-)
- Easy to ignore the visuals: “too dark and to the side” (-)

During the test with SAP, there were a few differences: it was at night, so the visuals were a lot brighter relative to the room. Additionally, one of the curtains slipped, and the visuals were projected directly on the whiteboard rather than the curtain, as shown in Figure G.8 This led to some very interesting findings:

- They really liked the feeling of the fireworks on the board: it “makes me feel like I’m doing something that is sparkling”, it was a “starry board of ideas”. (+)
- They related the fireworks with their idea formation: “It’s like think, think, more ideas coming out” (+)
- They warned that visuals could be distracting if they were semantic – it was good to not need to think about the images
- Music added energy and helped a lot when there were silences in brainstorm. (+)
- Music could be distracting when energy level was already high – makes talking over music harder (-)

These very encouraging results, though accidentally found, could (and should) be explored further in combination with findings from the other scenarios:

- Music should adjust to energy level – inject energy during silences, and quieten during active talking (feedback)
- Fireworks should somewhat be related to the brainstorming actions - for even better positive reinforcement, rather than just random patterns
- More immersive visuals and sound could be highly interesting
- Localized sound so that each person gets the kind of music that makes them energetic

Key Insights
Throughout all the scenarios, teams found the spatial experience of being within the curtains to be really beneficial. They liked the isolation, cosiness, and semi-privacy. It helped them focus, and get away from the craziness of the rest of the loft. This emphasizes the importance of space fundamentals. The cosiness is important, and suggests an important factor:

\[
\text{Cosiness Factor} = \frac{\text{Volume of Enclosed Space}}{\text{Number of People}}
\]  

(G.2)

The many findings from the scenario testing can be summarized by a few important insights:
• Ambient stimuli is indeed a very powerful tool

• Abstract cues are more effective and much easier to implement than smart semantic cues – they inspire the *idea creators* rather than the *ideas*

• And for inspiring people, positive reinforcement is much more effective than negative reinforcement

• Stimulus should depend on energy level of group – more when low, less when high; some form of feedback control could be promising.
Figure G.3: Timeline stitched together from photographs from Scrolling Table CFP
Figure G.4: Magnified view of a portion of stitched timeline
Figure G.5: Annotated Timeline CEP

160
Figure G.6: Magnified view of a portion of Annotated Timeline

Figure G.7: Photograph of CEP room
Figure G.8: Photograph of brainstormer interacting with projected fireworks board from Rhythmic Colors scenario
Figure G.9: Screenshot of colored bars from Dominance Feedback scenario

Figure G.10: Screenshot of WordVis.com generated map of related words, centered around innovation