Advanced Graphics and Interaction 2015: Lecture 7

Mario Romero 2014/09/18

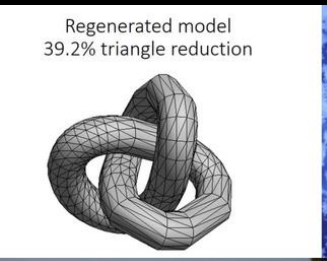
KTH VETENSKAP OCH KONST

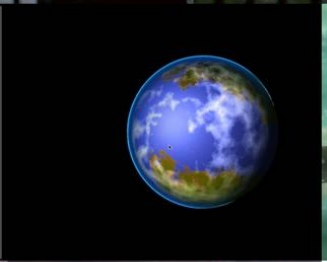
VICSTHLM
VISUALISATION INTERACTION COLLABORATION

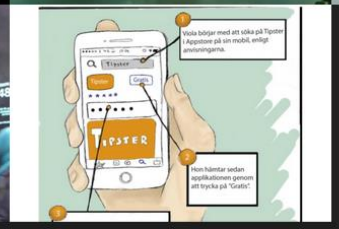
AGI15 Calendar: link

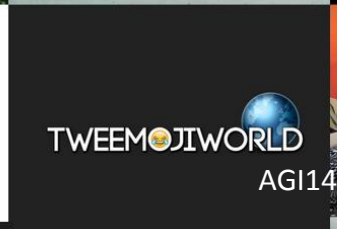
- Mon 31 aug 15:00-17:00 — Lecture 1 – Introduction
- Tue 1 sep 13:00-17:00 — Lecture 2-3: Forming Groups and Brainstorming
- Mon 7 sep 15:00-17:00 — Lecture 4: Proposals
- Thu 10 sep 10:00-12:00 — Lecture 5: Discussion based on Proposals
- Mon 14 sep 15:00-17:00 — Lecture 6: Hello World Demos
- Thu 17 sep 10:00-12:00 — Lecture 7: Discussion based on the Hello World Demos
- Tue 22 sep 10:00-12:00 — Lecture 8: Preparing ForskarFredag 2015
- Fri 25 sep 8:00-16:00 — ForskarFredag
- Mon 28 sep 15:00-17:00 — Lecture 9: Reflecting on ForskarFredag
- Mon 5 oct 15:00-17:00 — Lecture 10: Agile Development 1 towards Comic Con - Gamex 2015
- Mon 12 oct 15:00-17:00 — Lecture 11: Agile Development 2 towards Comic Con - Gamex 2015
- Fri 30 oct 9:00 – Sun 1 Nov 16:00 — Comic Con Gamex
- Mon 2 nov 15:00-17:00 — Lecture 12: Reflecting on Comic Con Gamex
- Tue 3 nov 13:00-17:00 — Lecture 13-14: Forming new groups and brainstorming project 2
- Tue 10 nov 10:00-12:00 — Lecture 15: Proposals Project 2
- Tue 17 nov 10:00-12:00 — Lecture 16: Hello World Demos for Project 2
- Tue 24 nov 10:00-12:00 — Lecture 17: Agile Development 1 for Open House
- Tue 1 dec 10:00-12:00 — Lecture 18: Agile Development 2 for Open House
- Fri 4 dec 15:00-19:00 — VIC AGI15 Open House

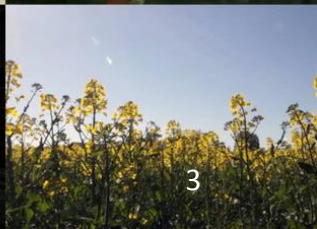
Prelude Videos: C Awards 2015











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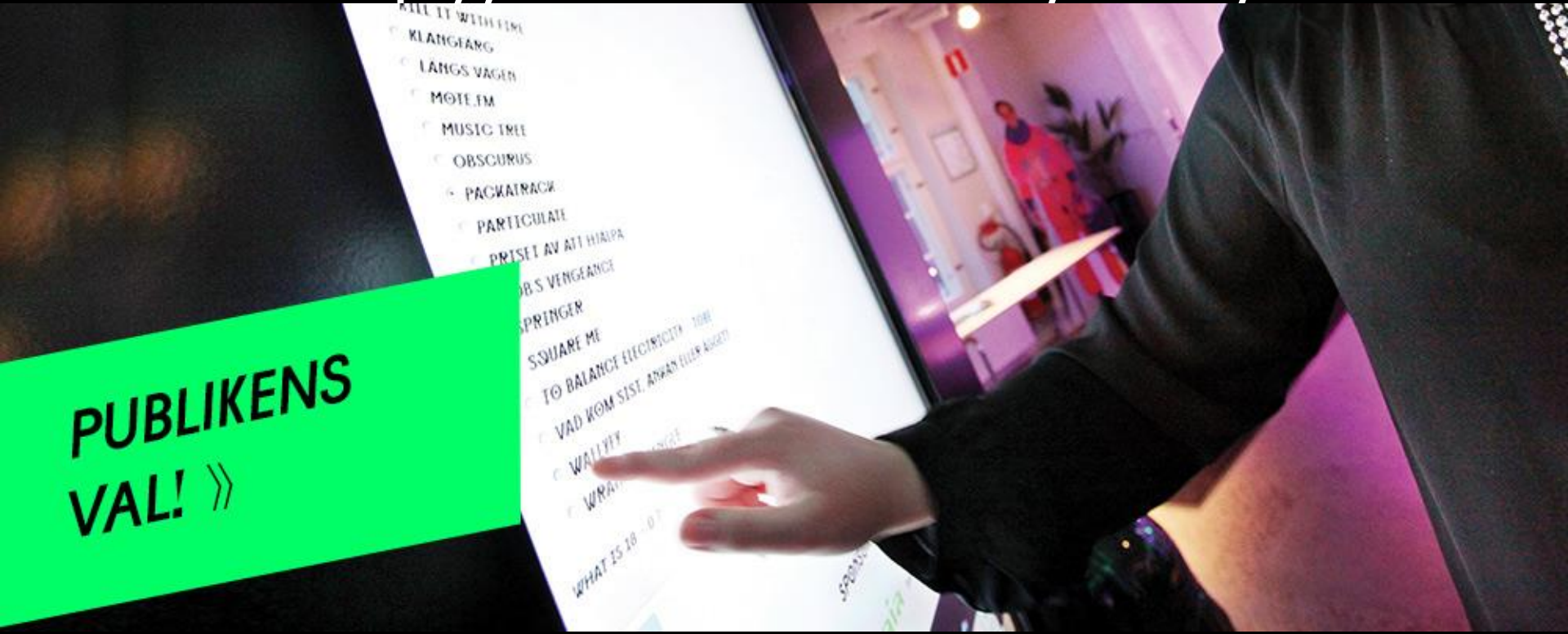
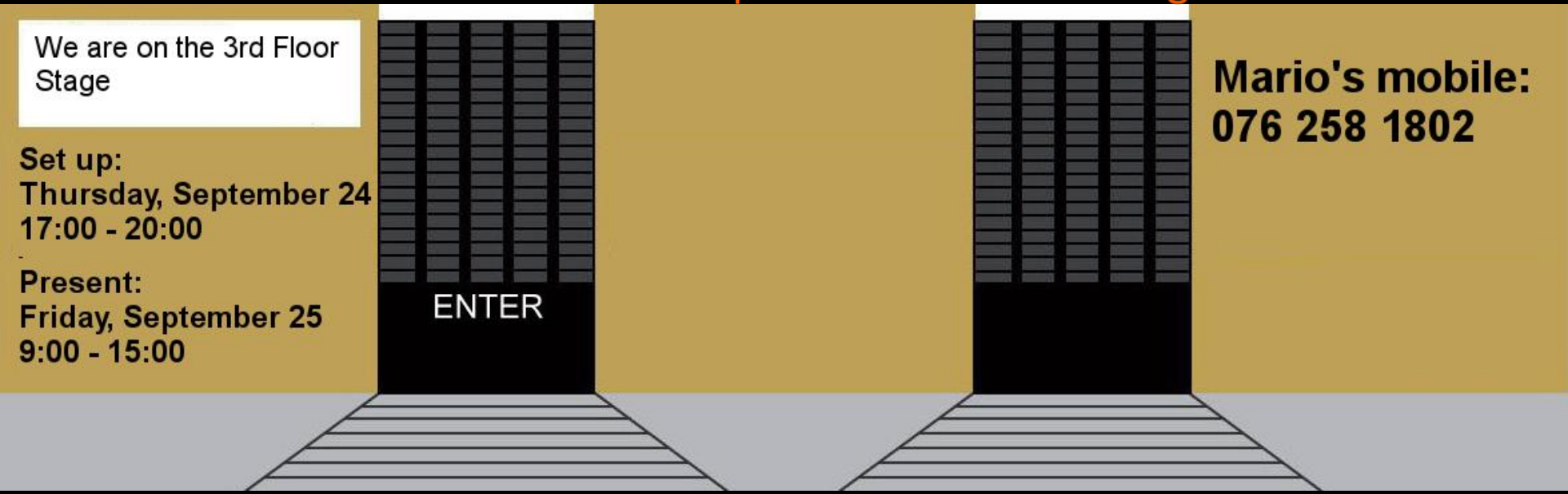


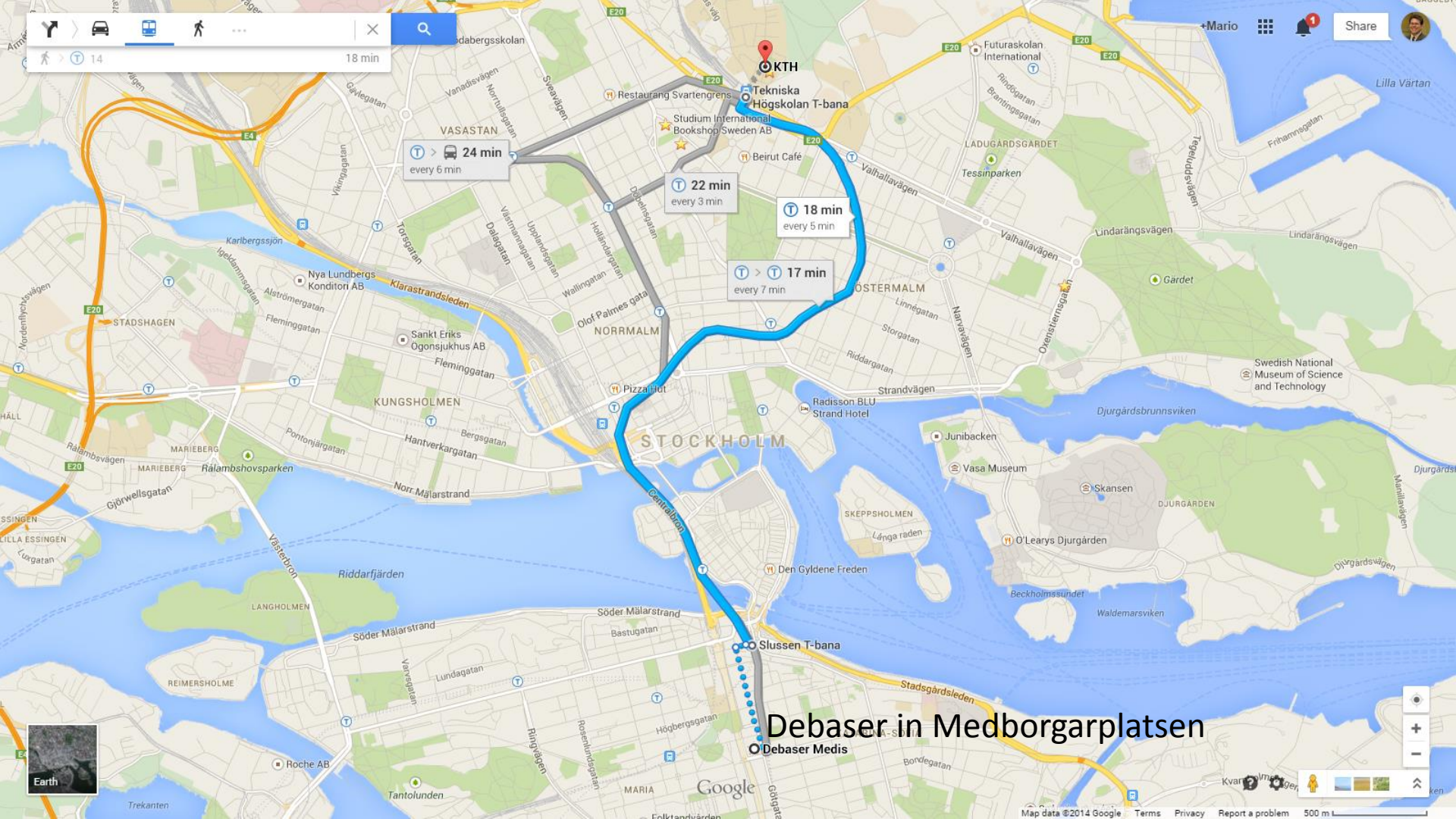
Agenda

1. Preparing ForskarFredag
2. Update from projects
3. Demos next lecture
4. Discussion

FORSKARFREDAG

En del av europeiska Researchers' Night




KTH
Tekniska Högskolan T-bana
Restaurang Svartengrens
Studium International Bookshop Sweden AB
Beirut Café
24 min
every 6 min
22 min
every 3 min
18 min
every 5 min
17 min
every 7 min
VASASTAN
NORRMALM
ÖSTERMALM
KUNGSHOLMEN
STOCKHOLM
STADSHAGEN
LADUGÅRDSGÄRDET
Tessinparken
Gärdet
Nya Lundbergs Konditori AB
Sankt Eriks Ögonsjukhus AB
Pizza Hut
Radisson BLU Strand Hotel
Swedish National Museum of Science and Technology
Junibacken
Vasa Museum
Skansen
DJURGÅRDEN
O'Learys Djurgården
Den Gyldene Freden
SKEPPSHOLMEN
Slussen T-bana
Debaser Medis
Debaser in Medborgarplatsen
Riddarfjärden
Djurgårdsbrunnsviken
Beckholmssundet
Waldemarsviken
LANGHOLMEN
REIMERSHOLME
MARIEBERG
LILLA ESSINGEN
MARIA
Roche AB
Futuraskolan International
Lilla Värtan
Valhallavägen
Lindarängsvägen
Strandvägen
Stadsgårdsleden
Centralbron
Klarastrandsleden
Norr Mälarstrand
Söder Mälarstrand
Hantverkargatan
Fleminggatan
Torsgatan
Sveavägen
Vanadisvägen
Odenplan
Linnégatan
Storgatan
Riddargatan
Narvavägen
Oxenstiernsgatan
Tegelbacksgatan
Frihamnsgatan
Brantingsgatan
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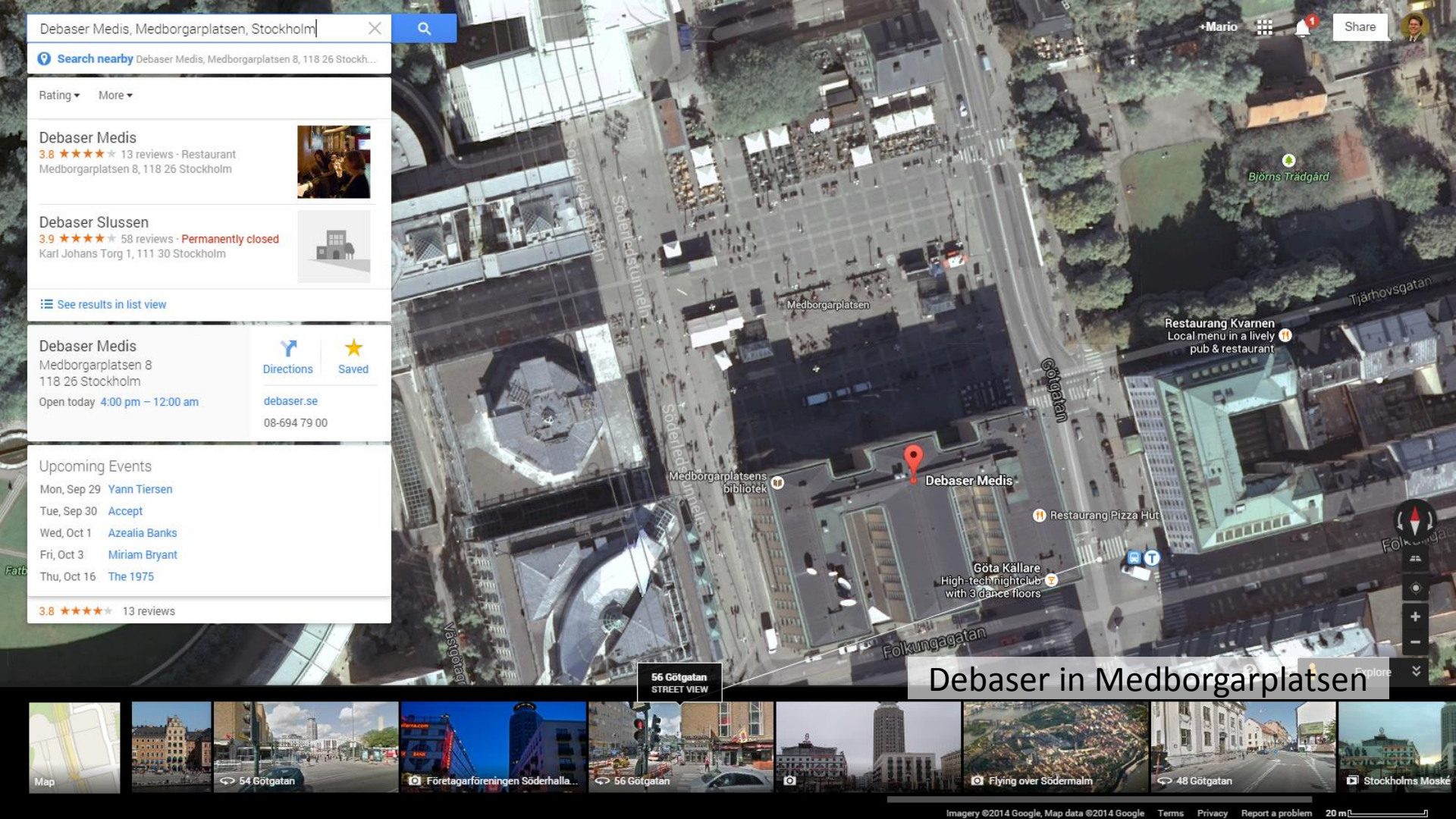
Debaser Medis, Medborgarplatsen, Stockholm
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Rating
More
Debaser Medis
3.8 ★★★★☆ 13 reviews · Restaurant
Medborgarplatsen 8, 118 26 Stockholm
Debaser Slussen
3.9 ★★★★☆ 58 reviews · Permanently closed
Karl Johans Torg 1, 111 30 Stockholm
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Medborgarplatsen 8
118 26 Stockholm
Open today 4:00 pm – 12:00 am
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08-694 79 00
Upcoming Events
Mon, Sep 29 Yann Tiersen
Tue, Sep 30 Accept
Wed, Oct 1 Azealia Banks
Fri, Oct 3 Miriam Bryant
Thu, Oct 16 The 1975
3.8 ★★★★☆ 13 reviews
+Mario
Share
Björns Trädgård
Medborgarplatsen
Restaurang Kvarnen
Local menu in a lively pub & restaurant
Tjärhovsgatan
Götgatan
Söderledstunneln
Medborgarplatsens bibliotek
Debaser Medis
Restaurang Pizza Hut
Göta Källare
High-tech nightclub with 3 dance floors
Folkungagatan
Västgötag
56 Götgatan
STREET VIEW
Debaser in Medborgarplatsen
Map
54 Götgatan
Företagarföreningen Söderhalla...
56 Götgatan
Flying over Södermalm
48 Götgatan
Stockholms Moské
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Aram Azhari
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Debaser 3rd floor stage

Debaser 3rd floor stage

ForskarFredag 2012

ForskarFredag 2012

ForskarFredag 2013

ForskarFredag 2013

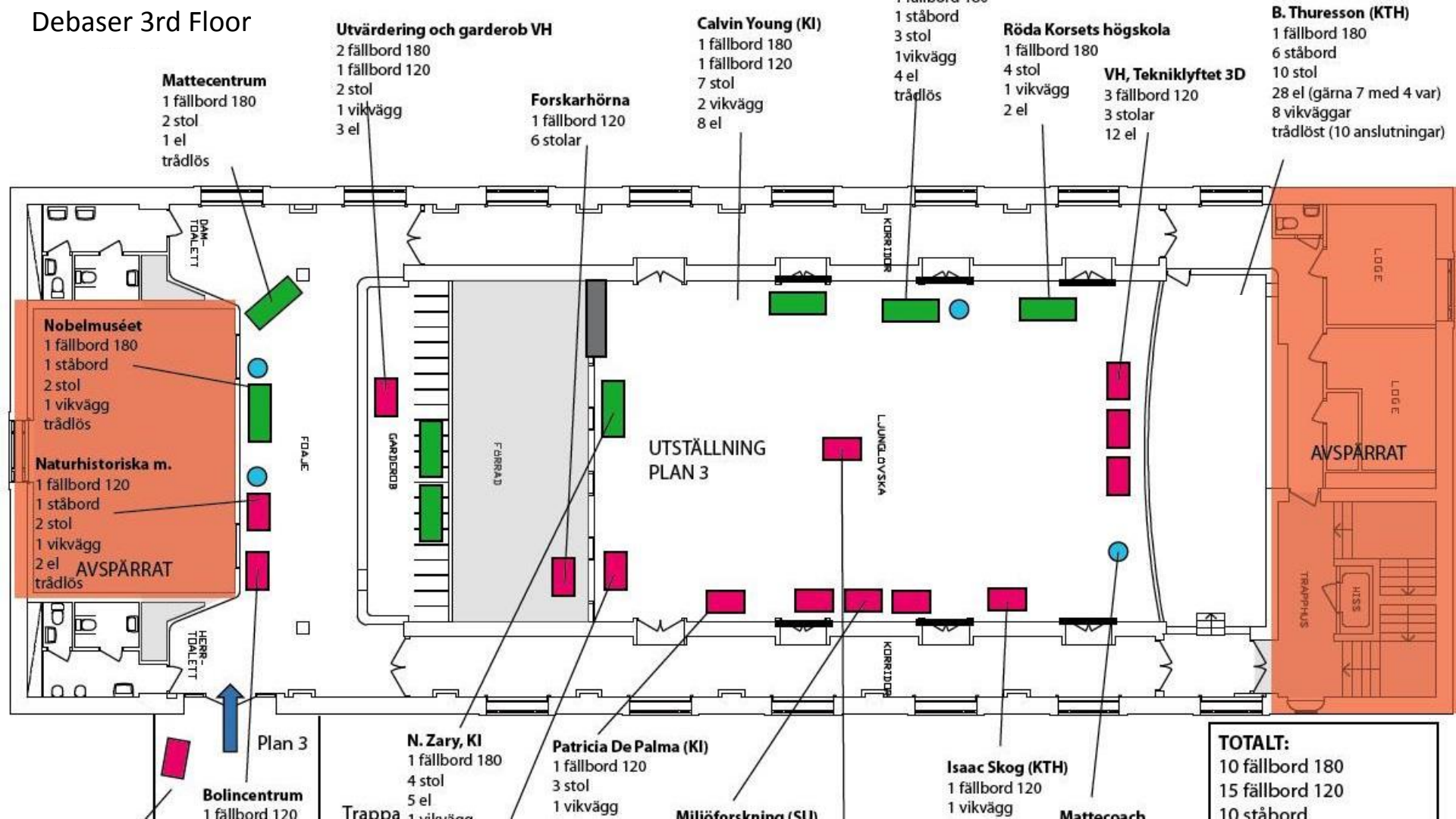
ForskarFredag 2013

ForskarFredag 2014

ForskarFredag 2014

ForskarFredag 2014

Debaser 3rd Floor

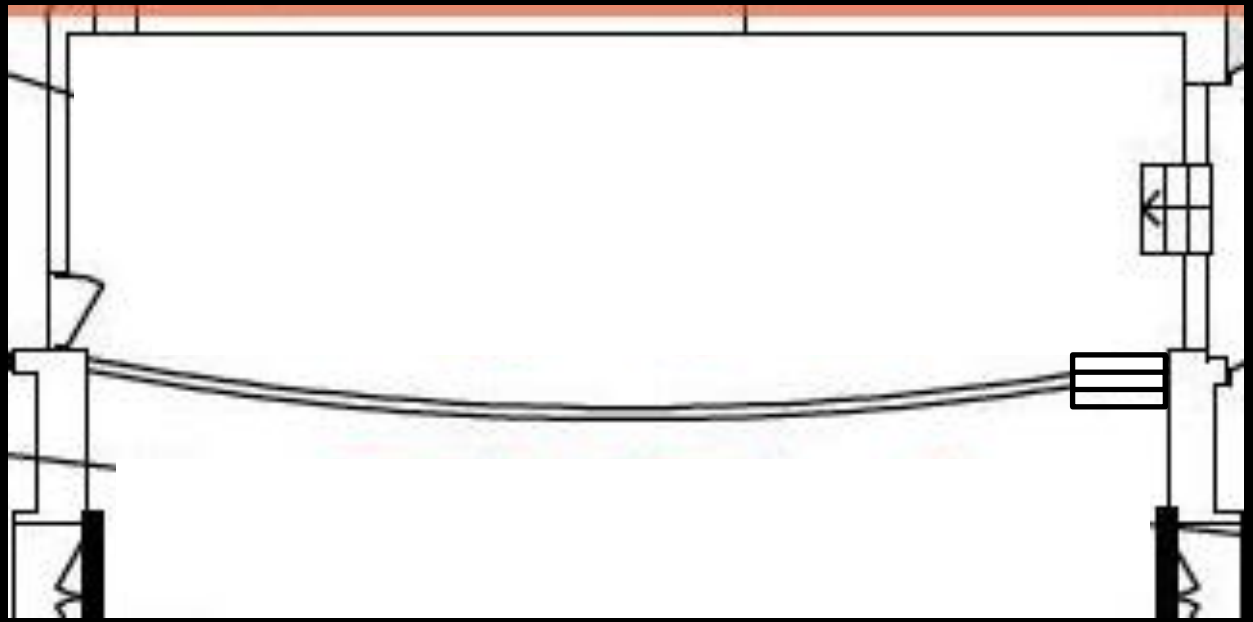


Teamtris

Shmooning

Blooper

Debaser 3rd floor stage

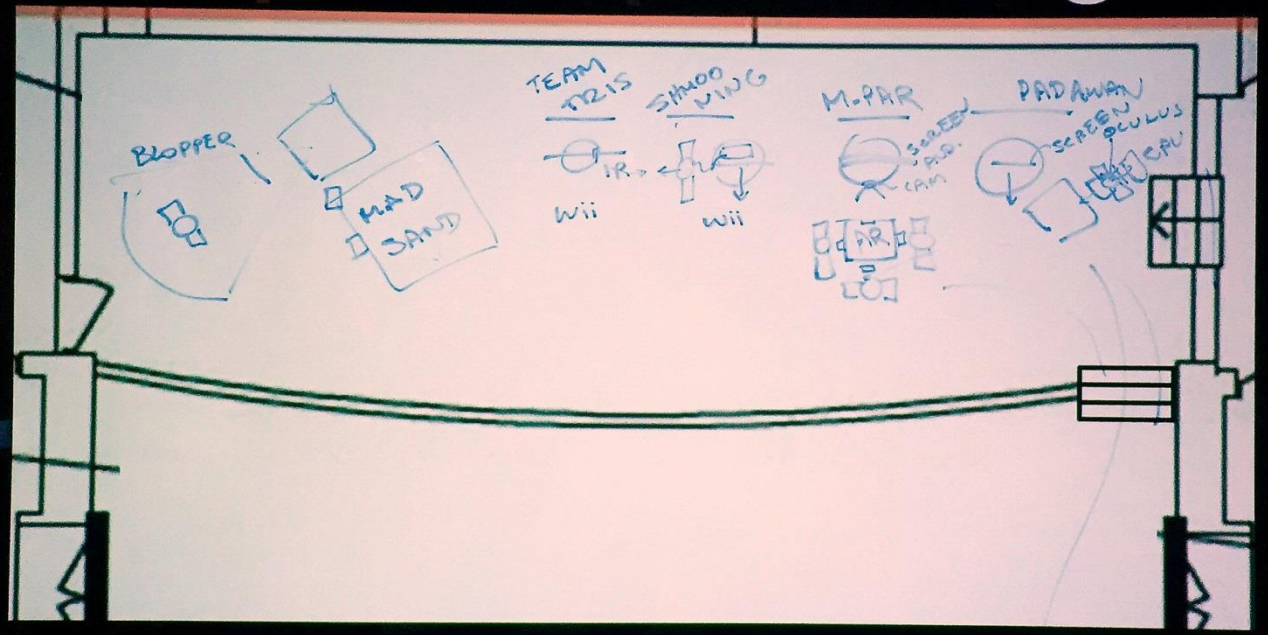


MadSand

M-PAR

Padawan

Debaser 3rd floor stage



Teamtris
1 STANDING TABLE
1 BIG! SCREEN
1 POSTER BOARD
2 Wii

Shmooning
1. STANDING TABLES
1 DESKTOP
1 SCREEN
OCULUS + Wii

Blooper
2 POSTER BOARDS
SHARE TABLE
SPACE
KINECT

MadSand
2 TABLES (SIT STAND)
BOARD
(DARKNESS)
PROJECTOR
KINECT

M-PAR
1 STANDING
1 SIT
} TABLE
WEB CAM
BIG SCREEN

Padawan
OCULUS Wii
1 STAND
1 SIT
} TABLE
CHAIR
BIG SCREEN
MAT CUSHIONS

Teamtris

Teamtris

- Done
  - Tetris
  - Trees
- Going to do
  - Sound
  - Explore
    - Removing trees
    - Make it unlike tetris
    - 3D building
    - Multiview 3D puzzle
    - Limited rotations and translations to view plane
- Not doing
  - Constructive Geometry

Teamtris Updates 18/9

- Done
  - Now in 3D
  - Orthogonal rotations and translations
- Doing
  - 3D puzzle
  - Template to copy
  - Tetris tangram team
  - Connect second wii
- Not Doing
  - Good old fashion tetris
  - tree

Shmooning

Shmooning

- Done
  - Explored
    - Leap Motion
  - Wii mote control
  - Interactive (rough) graphics
- Going to do
  - Game play
  - Models for aliens
  - FX
  - Explore
    - Kalman Filtering
    - Octree Rending
    - Moiré Patterns
    - Anti-Aliasing
    - Bump Mapping
    - Register and coordinate hands and eyes
    - Scott Saponas' air guitar hero (?)
- Not doing
  - Leap Motion
  - ?

Shmooning Updates 18/9

- Done
  - Alien model
  - Wii sensor bar
  - Small IR LED sensor
  - Working at a short distance
- Doing
  - Visual animation of alien
  - AI – state machine automaton
  - Space station
  - Enemy space ship
  - Filtering tremors out
  - Leap motion?
- Not Doing
  - Leap motion?

Blooper

You • Are • a • Tree
TRUST YOURSELF
PODRACER
AN IMMERSIVE
RACING
EXPERIENCE
OCULUS RIFT
NOVINT FALCON
ILLINOIS

Blooper

- Done
  - Kinect
  - sockets
- Going to do
  - Explore computing centroid of a blob
- Not doing
  - No multi cam

Blooper Updates 18/9

- Done
  - 3D models of weapon
  - Stage 3D model
- Doing
  - Enhancing tracking
  - Filtering
  - Sending data to player
  - 2D navigation
  - Server robustness
- Not Doing
  - mallot

MadSand

MadSand

- Done
  - Wooden Structure prototype
  - Kinect tracking
  - Simple graphics
  - Simple interaction
- Going to do
  - *Simple* game mechanics
  - Sand
  - Hidden objects
  - Explore
    - Haptics for hidden objects
    - Projecting on non-flat surfaces (image warping)
    - Phong illumination
    - Bump mapping
    - Octree rendering
    - Anti-aliasing
  - Projection
- Not doing
  - ?

MadSand Updates 18/9

- Done
  - Character and camera controller
- Doing
  - Smoothing and filtering depth data from kinect
  - Models
  - How to connect projector
  - Treasures
  - Score board counter
  - Terrain topology
  - Considering type of sand
    - Regular landscaping
    - Moon sand baking
    - Ti sensor tag for treasure hunt
- Not Doing
  - …

Multiplayer AR game

. Multiplayer AR game

- Done
  - Wireless Client/Server
  - Simple graphics
  - Simple image registration
  - Multi-perspective AR
  - Vuforia
  - Simple physics
- Going to do
  - Audience view
  - Game play
  - Registration consistency
  - Filtering and smoothing
  - Explore social dimensions of AR in context (bar, etc).
- Not doing
  - Table top interaction

Multiplayer AR Updates 18/9

- Done
  - Multiplayer network alive
  - Model texture animation of character
  - Small test of google cardboard with AR
  - AR
- Doing
  - Print better images for stability
  - Run around and brawl
  - Game play
  - Models for small cards
  - Models for world
  - sound
- Not Doing
  - No rolling balls

Padawan 101

Padawan 101

- Done
  - Models
    - Light saber
    - Sphere
  - Wii signal
  - Volumetric shaders
- Going to do
  - Interaction wall
  - Audience visual
  - FX
- Not doing
  - Blind fold

Padawan 101 Updates 18/9

- Done
  - Figured out laser shooting
  - Volumetric shading
  - Lightsaber is a volumetric line with self illumination
- Doing
  - Reflections and refractions from objects in your world
  - Bump mapping
  - Wii mess!!
    - Windows vs mac drivers
    - ☹
  - Score board
- Not Doing
  - Feedback haptic perhaps latter

Next Tuesday

- Demo warm up for ForskarFredag

Demo: Purpose

- Practice for ForskarFredag
- Demonstrate state of projects
- Interact with each other's projects
- Discuss
- Improve
- BUT…
  - Train to:
    - Present in 60 seconds to six-year-olds
    - Observe and gather formative evaluation quantitative and qualitative data in the field
    - Ellicit constructive criticism

Demo: Structure

- Technical Presentation 05:00
- Interactive Demo 08:00
  - Hands-on
  - Non team members
  - As many as possible
  - Discussion going on
- Context Switch 02:00

Demo: Roles

- At least:
  - One presenter
    - Present script only
    - Answer questions
  - One observer
    - Take notes
    - DO NOT TALK
  - One inquirer
    - Ask clarifying questions
    - Do not ask leading questions

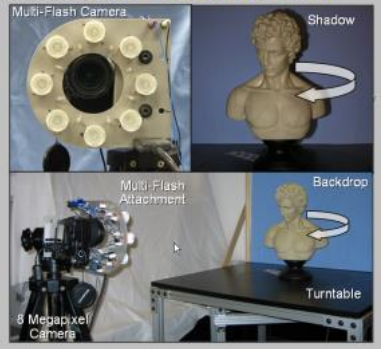
Demo: Presentation on Poster

- One slide
- 2, 3 or 4 columns
  - Motivation and Goals
  - Methods
  - Results
- Few words many images
- Link to how to do and present posters

Multi-Flash 3D Photography: Capturing the Shape and Appearance of 3D Objects

A new approach for reconstructing 3D objects using shadows cast by depth discontinuities, as detected by a multi-flash camera. Unlike existing stereo vision algorithms, this method works *even with plain surfaces*, including unpainted ceramics and architecture.

Data Capture: A turntable and a digital camera are used to acquire data from 670 viewpoints. For each viewpoint, we capture a set of images using illumination from four different flashes. Future embodiments will include a small, inexpensive handheld multi-flash camera.



Multi-Flash Turntable Sequence: Input Image	Estimated Shape: 3D Point Cloud	Recovered Appearance: Phong BRDF Model

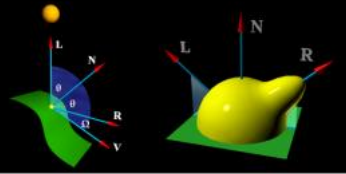
Recovering a Smooth Surface

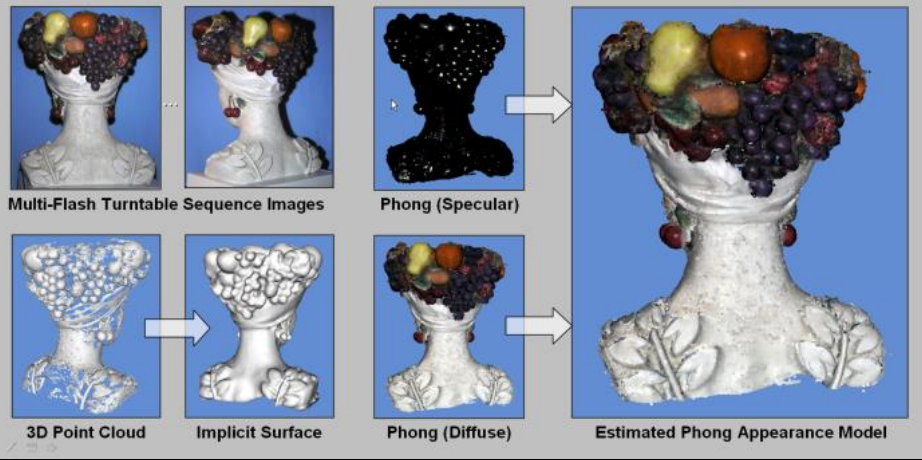
The reconstructed point cloud can possess errors, including gaps and noise. To minimize these effects, we find an implicit surface which interpolates the 3D points. This method can be applied to any 3D point cloud, including those generated by laser scanners.

Photometric Reconstruction

Using the implicit surface, we can determine which points are visible from each viewpoint. To model the material properties of the surface, we fit a per-point Phong BRDF model to the set of visible reflectance observations (using a total of 67 viewpoints).

$$I_\lambda = \underbrace{k_{a\lambda}}_{\text{Ambient}} + \underbrace{k_{d\lambda}\mathbf{n}\cdot\mathbf{l}}_{\text{Diffuse}} + \underbrace{k_{s\lambda}(\mathbf{r}\cdot\mathbf{v})^n}_{\text{Specular}}$$





Using Flow-Visualization for Studying Sub-Molecular Motions

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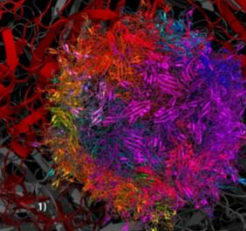
Abhilash Mohan mohan.25@osu.edu The Ohio State University Bioinformatics Program
Jeffrey Bartlett bartlett-jeffrey@columbus.rr.com Columbus Children's Research Institute



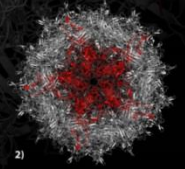
1)

Introduction:

Visualization of molecular structures is important for understanding basic molecular conformations and because structure is intimately tied to function. Molecular function however is also associated with molecular flexibility. The Adenylate Kinase lid hinges to trap its phosphorylation target in the active site. Different environmental conditions cause the Cyclic-AMP Response Protein to open like a clothes-pin, and to clamp different DNA sequences, thereby activating or repressing the expression of different genes. The Adeno-Associated Virus (AAV) capsid protein appears to unfold to expose a catalytic domain that allows the virus to escape, when presented with the low pH of the normally entrapping endosome.

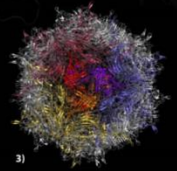
Visualization methods used for examining structural change however, are typically derived from methods for static structures. Typically these representations are overlays, or animations of multiple traces of the molecular backbone, with each trace representing a different point in time [Krebs and Gerstein 2000]. Such representations are effectively flow representations using timelines (the linked location of the atoms at each discrete point in time) to depict motion. While timelines are ideal for visualizing certain complex flow features, being orthogonal to the flow motion, they are not an intuitive method for visualizing the motion itself. We propose the use of atomic pathlines (the path of each atom over time) as an alternative for representing molecular change. This orthogonal transposition of the visualization allows the 3-dimensional motion of individual atoms to be examined in detail, as well as the overall motion of domains to be understood in concert.

The molecular motion we are studying is a potential conformational change undergone by the AAV2 capsid (external shell, or packaging) protein, on experiencing a pH shift after endocytosis and acidification of the endosome vesicle. The AAV2 capsid is composed of 60 identical protein subunits (Figure 1) arranged in 20 symmetric trimeric groups of 3, aligned to the faces of an icosahedron. The 5-fold axes of symmetry (Figure 1) posess an apparent pore, while the 3-fold axes of symmetry (Figure 3) are comparatively tightly interwoven.



2)

While not yet completely characterized at the molecular level, AAV2 escape and targetting of the nucleus requires passage through an acidified endosome [Bartlett et al. 2000]. We hypothesize therefore that the capsid undergoes a conformational change at low pH, exposing a protected functional domain, and that the conformational change displays hysteresis or anisotropism upon release to normal neutral cytosol pH levels. Analyzing the pathlines followed by atoms during this change, rather than the individual conformations assumed during folding, will allow us to better understand the conformational change, determine the functionally changing regions, and predict candidate domains for further biochemical study.



3)

Background and Rationale:

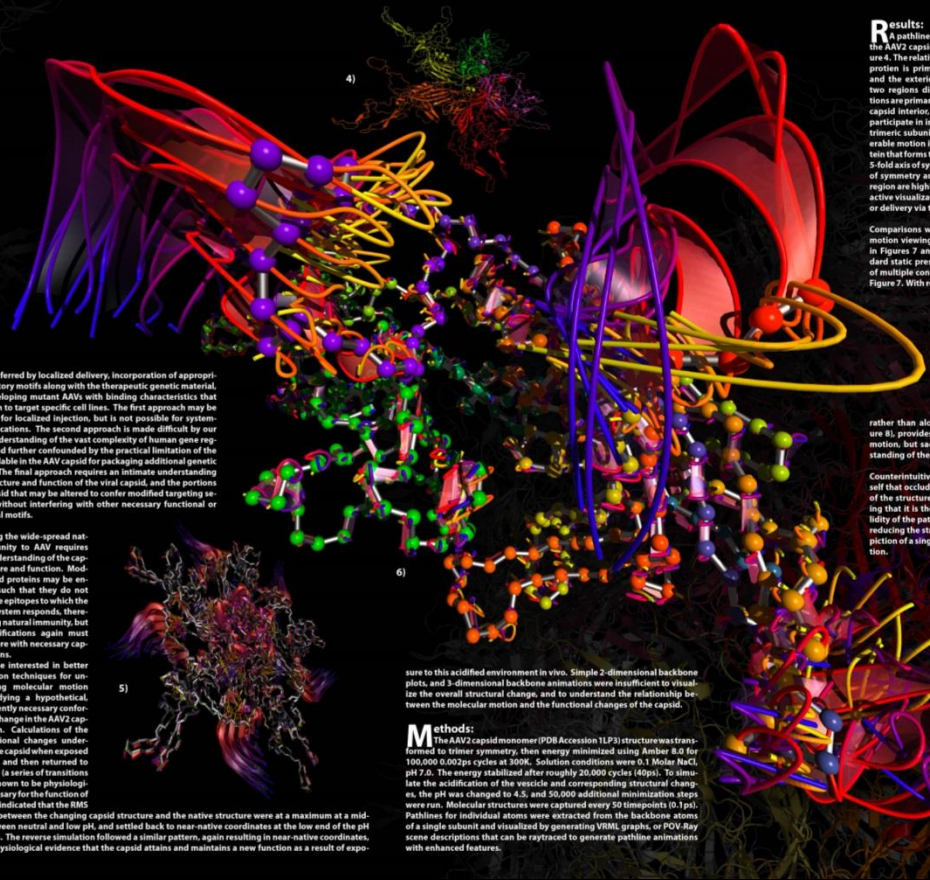
Adeno-Associated Viruses (AAVs) are promising candidates for gene-therapy vectors. While incapable of autonomous replication, they maintain the ability to efficiently infect host cells, and lacking a helper virus to enable replication, establish persistence in the host by integrating into the host genome. By inserting new genes into an AAV genome, and denying the helper virus necessary for replication, AAV may be used to deliver these genes into the genome of a human host, potentially treating a large range of genetic diseases or deficiencies.

Two of the factors that must be overcome in applying AAV as a gene-delivery technology are the non-selectivity of AAV targeting of host cells, and the wide pre-exposure of human populations to AAV from natural infections.

Non-selective delivery of genes by AAV is a problematic due to the possible toxic effects of some genes in non-regulated contexts. Selectivity can be conferred by localized delivery, incorporation of appropriate regulatory motifs along with the therapeutic genetic material, or by developing mutant AAVs with binding characteristics that allow them to target specific cell lines. The first approach may be successful for localized injection, but is not possible for system-wide applications. The second approach is made difficult by our limited understanding of the vast complexity of human gene regulation, and further confounded by the practical limitation of the space available in the AAV capsid for packaging additional genetic material. The final approach requires an intimate understanding of the structure and function of the viral capsid, and the portions of the capsid that may be altered to confer modified targeting selectivity, without interfering with other necessary functional or mechanical motifs.

Addressing the wide-spread natural immunity to AAV requires similar understanding of the capsid structure and function. Modified capsid proteins may be engineered such that they do not present the epitopes to which the immune system responds, thereby evading natural immunity, but such modifications again must not interfere with necessary capsid functions.

We became interested in better visualization techniques for understanding molecular motion while studying a hypothetical, but apparently necessary conformational change in the AAV2 capsid protein. Calculations of the conformational changes undergone by the capsid when exposed to low pH, and then returned to neutral pH (a series of transitions that are known to be physiologically necessary for the function of the virus), indicated that the RMS distances between the changing capsid structure and the native structure were at a maximum at a midpoint between neutral and low pH, and settled back to near-native coordinates at the low end of the pH simulation. The reverse simulation followed a similar pattern, again resulting in near-native coordinates, despite physiological evidence that the capsid attains and maintains a new function as a result of exposure to this acidified environment in vivo. Simple 2-dimensional backbone plots, and 3-dimensional backbone animations were insufficient to visualize the overall structural change, and to understand the relationship between the molecular motion and the functional changes of the capsid.



4)

5)

6)

Methods:

The AAV2 capsid monomer (PDB Accession 1LP3) structure was transformed to trimer symmetry, then energy minimized using Amber 8.0 for 100,000 0.002ps cycles at 300K. Solution conditions were 0.1 Molar NaCl, pH 7.0. The energy stabilized after roughly 20,000 cycles (40ps). To simulate the acidification of the vesicle and corresponding structural changes, the pH was changed to 4.5, and 50,000 additional minimization steps were run. Molecular structures were captured every 50 timepoints (0.1ps). Pathlines for individual atoms were extracted from the backbone atoms of a single subunit and visualized by generating VRML graphs, or POV-Ray scene descriptions that can be raytraced to generate pathline animations with enhanced features.

Results:

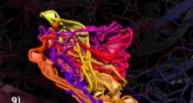
A pathline-rendering (POV-Ray) of the motions undergone by the a monomer of the AAV2 capsid protein, on transition from neutral to acidic pH, is presented in Figure 4. The relatively stable region of the protien is primarily the protein core, and the exterior capsid surface. The two regions displaying dramatic motions are primarily directed towards the capsid interior, though one loop does participate in interactions forming the trimeric subunit. There is also considerable motion in the region of the protein that forms the apparent pore at the 5-fold axis of symmetry (The 5-fold axis of symmetry and motions around this region are highlighted in Figures 5 and 6). Alternatively, less dynamic but more interactive visualizations can be adequately constructed in VRML for convenient browsing or delivery via the WWW.

7)

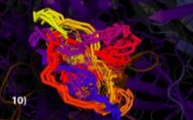
Comparisons with existing molecular-motion viewing techniques are shown in Figures 7 and 8. The defacto standard static presentation is the overlay of multiple conformations as shown in Figure 7. With relatively distant conformations overlayed, each customarily rendered with a color spectrum distributed along the protein backbone, overall locations of motion are readily apparent, but the temporal sequence of motion is lost, and rapidly-moving areas become visually uninterpretable. Plotting more conformations, closer together, and rearranging the spectrum to shade temporally, rather than along the backbone (Figure 8), provides a greater sense of the motion, but sacrifices intuitive understanding of the structure.

8)

Counterintuitively, it is the structure itself that occludes visual interpretation of the structure in Figure 8. Recognizing that it is the near-pathline-like solidity of the paths traced by the atoms, that allows the motion to be understood, and reducing the structural depiction to a single timepoint, we arrive at our proposed depiction of a single structure, its atoms sweeping along the atomic pathlines of the motion.



9)



10)

Figures 9 and 10 focus on the motion of the N-terminal domain across the entire neutral-acidic-neutral simulation. Figure 9 depicts it in the POV-Ray rendered form, and Figure 10 in the VRML form. The expected conformational anisotropism in the return to neutral pH is clear in each, from the distinct paths of the backbone atoms.

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Celestia

A Vocal Interaction Music Game

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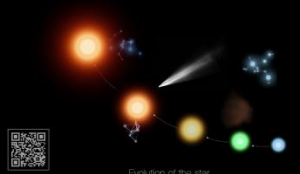
Introduction

Voice is one of the most natural means of expression, we always underestimate our vocal instinct as game interface, what if we use this instinct to power up a beautiful game? Incorporating visualization technique, Celestia uses voice input based on pitch detection as a primary controller, and provides insight into innovation of vocal interaction.

Design

The initial idea came to us as a scenario of someone playing a game using only her voice. She is charmed with this mysterious celestial environment which merges visual and vocal elements seamlessly.

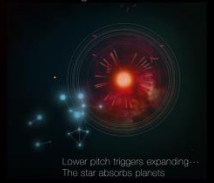
We started with the story, a newborn star wants to grow. However, comets and nebulae might hurt it in its journey. Fortunately, user's voice can help it gain more power by absorbing smaller planets.



Evolution of the star

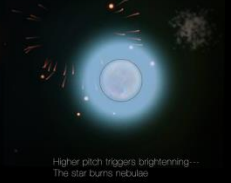
Game Play

The purpose is to guide a newborn star through the universe with melody. The user's voice can enlarge the star to absorb smaller planets and survive encounters with comets, nebulae. Every element of the experiential aesthetic is tied to the background music; the constellation is the music visualization with three different colors reacting to high, mid and bass range of the soundtrack in real-time.



Lower pitch triggers expanding…
The star absorbs planets

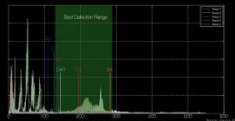
Middle pitch triggers dodging…
The star dodges comets



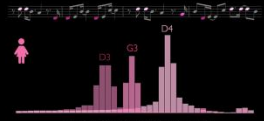
Higher pitch triggers brightenning…
The star burns nebulae

Approach

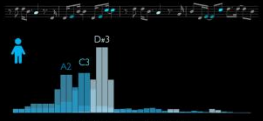
By using Fast Fourier Transformation algorithm and voice spectrum analysis, we precisely selected 3 pitches as controllers, because they are in the best detection range and are in perfect harmony with background music. The whole experience of playing Celstia can be singing a song by connecting those notes in chord as game progresses. We also adopted two different pitch ranges to accommodate both female and male voices.



Voice detection analysis



3 triggers match background music



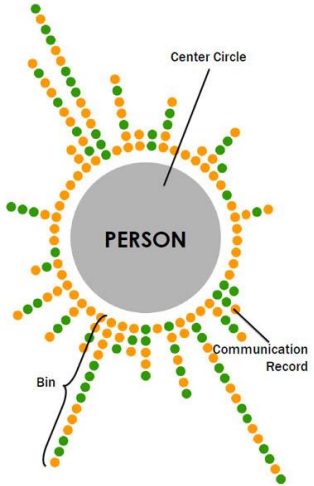
Lower frequency set for male voice

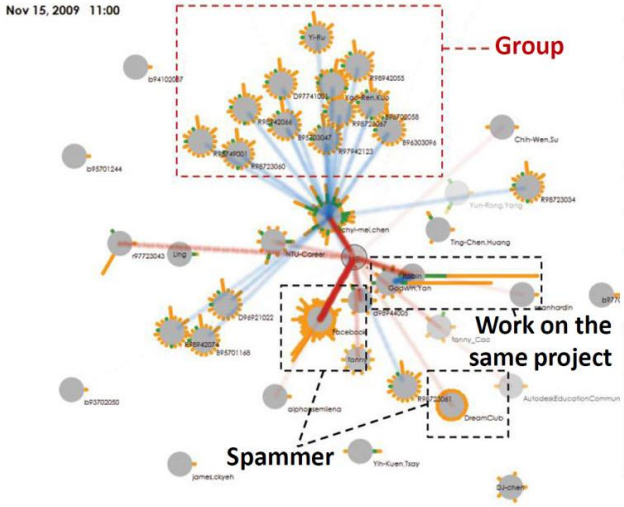
Future Work

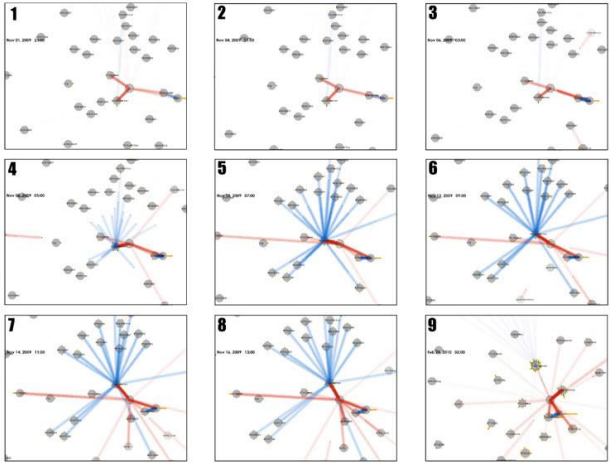
We introduced Celestia to a vocalist to improvise the game for a live audience, it turned out to be a great success, people think "it's visually and aurally appealing". Celestia is not confined to human voice, users can play instruments, such as guitar, harmonica or water bells.

We will keep exploring more possibilities of Celestia, iOS version will follow soon…

Presentation of Time-Evolving Activities Using Communication Archive Data







Planetary Defence

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Introduction

Planetary Defence is an online 3D graphics multiplayer game. You shoot rockets at your opponents and you can shoot your opponents' rockets down.

Motivation

- Build lightweight socializing
- Learn new technologies
- Design Entertainment

Goals

- Multiplayer
- Multiplatform
- High resolution
- 3D game
- On the web

Technology

- WebGL
- Web sockets
- Html5
- Three.js

Interaction

- Swipe / click and drag
- Tap / click

Mobile Game Play

Conclusions

- Real-time 3D graphics
- Multiplayer interaction
- Online
- No downloading!

References

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2. WebGL http://www.chromeexperiments.com/webgl/
3. Parisi, Tony (2012). *WebGL Up and Runing.* USA: O´rilly Media

bit.ly/QwaRhj

AGI12 Advanced Computer Graphics and Interaction 2012

Demo: Questions

- Clarifying questions:
  - What do you mean by “so and so”?
  - I don’t understand, could you explain it differently?
  - Could you talk about that further?
  - Tell more about that...
  - How does that make you feel?
  - ”Following” questions

Demo: Questions

- Leading questions:
  - What do you think?
  - Is it working for you?
  - Do you like it?
  - What would you improve?
  - What would you change?
  - Why don't you like it?
  - Why do you like it?

Observers

- Pen and pad
- Take copious notes
- Count, count, count!
- Take photos
- Record (VERY SHORT) videos – be selective
- Record (VERY SHORT) testimonials

Remember: Deliverable

- Working VIC Demo
- Code with good comments
- Webpage with:
  - Description
    - Goal and motivation of the project
    - Explanation and Justification of the graphics and interaction technologies used and developed
    - Challenges
    - Obstacles
    - Related work
    - Lessons learned
  - Photos
  - "Making of" documentary (2 minutes)
  - Demo Reel (30 seconds)
  - Optional PR material (logo, trailer, flyers, posters, catalog)
  - User testimonials (what did people say)

Demo: Audience

- Take notes
- Comment during demo
- Take notes of comments
- Transfer your notes to the facebook wall
- Help each other

Grading of ForskarFredag

- 10%
- Group
  - 9:00 – 16:00 (- 1% per hour missed)
- Individual component – KTH social
  - Answer the survey which will be posted on Friday, September 26 at 17:00 before Sunday September 28 before 23:55. It is very important that you answer it as soon as possible after ForskarFredag is over.

ForskarFredag Survey

- What did you learn presenting, observing, interacting?
- What were the most common questions?
- What were the challenges?
- What were the rewards?
- A few technical questions.

Communication

- Poster feedback
- Printing (Tuesday morning)
- Other communication materials
  - Web page
  - Flyers
  - Logo
  - Slogan
  - …

Thank you!

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