Hacking your food?
smart food devices for behavioral
nutrition & sensory science research

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Abstract:
Diet-related non-communicable chronic diseases such as NCDs, e.g., obesity, cardiovascular diseases, etc., as well as unsustainable food practices, is a societal challenge. This requires new cross-disciplinary solutions. The spreading of digital devices, new smart sensors, artificial intelligence, and the internet of things is offering new functionalities and opportunities in the interface between 'digital' and 'food'. This opens new avenues for both sensory scientists and behavioral nutritionists. In this lecture, I build on the insights from the Vices4food project, the Big Food Data, and the Richfields design study that is carried out at FoodScapeLab studies at AAU CPH. It will address the following topics:

1. Realtime dietary assessment technologies and ICT-assisted food choice data acquisition.
2. New sensations and experiences of virtual & augmented food-reality technologies.
3. Smart Exposure Response Technologies.
4. Internet of food Things.
5. Smart foodscape mapping technologies.

Agenda
1. Realtime dietary assessment technologies and ICT-assisted food choice data acquisition.
2. New sensations and experiences of virtual & augmented food-reality technologies.
3. Smart Exposure Response Technologies.
4. Internet of food Things.
5. Smart foodscape mapping technologies.

Other approaches
- ASA24 – Automated Self Administered 24hr
- TADA: Technical Assisted Dietary Assessment
- Diet Data Recorder System (DDRS)
- Smart Plate
- Smart Fork
- TelSpec

FoodScape lab floorplan

From DIMS 1.0 to 1.5
**Is the DIMS saving time?**

The Aalborg feasibility study

- Reduces the time spent on NM from 15 to 4 minutes
- Patients at nutritional risk produced increased amounts of plate waste, with less energy & protein intake when compared to patients not at nutritional risk.
- It can be used in co-creation mode improving accuracy

**Is the DIMS robust in practice?**

The Herlev stress test

**Is the DIMS accurate?**

**Validation Study 1: Herlev Hospital**

- Front End Nutrition & Meal support
- Meal hosting

**Results:**

- No significance pre- og post test
- DIMS functions well with a trained operator
- Meal hosting requires training

**Validation 2: Odense University Hospital**

**Hypothesis**

- High correlation between DIMS data and standard weighed method

**Results:**

- Correlation: DIMS total energy/standard total energy (r = 0.990 and p-value = 0.01)
- Correlation: DIMS total protein/standard total protein (r = 0.79 and p-value=0.05)

**Acknowledgements:**

Dr. Rudolf Albert Scheller, Geriatric DeptG, Odense

**Validation of a novel image-weighed technique for monitoring food intake and estimation of portion size in hospital settings.** Submission Public Health Nutrition. Sept 2017

**Evaluation of NutriDIa: Shared decision making on nutrition among cancer patients:** Finn Andersen og Kian Loftager Haynes, Public Health Programme AAU, 2017

**Medical Research Council Model MRC for intervention development**

**Shared nutrition decision making**

**NSR 2002 risk screening**

**Dankost**

**Menuplanning**

**Dankost**

**Menuplanning**

**MasterCater**

**Menuplanning**

**Food’n Go Meal Booking**

**TradeSync – Food Composition Generic**

**Brand level**

**FoodCost – Price calculation**

**LCA food – Carbon Food Prints**

**FoodComp – Food Composition Generic**

**The Digital Nutrition Journey**

**Creating Seamless interfaces between Software**

**Menu simulation**

**What if scenario planning**

**DankostWeb Ordering**

**NutriQualityAssurance Report (NQAR)**
Internet of food Things

Internet of food Things

Eating, ageing, digitalisation. Place
A smart home to elderly

• Goal: to reduce the cost of moving elderly to elderly homes.
• Ageing in place is the mantra.
• Elderly installed it sensors in their home.
• Wear band & sensors
• Individual going out of bed, to the toilet

• An app rings if there is something strange.
• Big data done predictions:
  increased toilet visits can flag up a urinary tract infection,
  changes in gait can predict an impending fall, the leading cause of death or injury among older adults.
• Only things missing: food consumption recording


The eating robot

• The case of Bestic

Smart Exposure Response Technologies (SERT)

Applying digital response measurement to food exposure (Smart Exposure Response Technologies – SERT) is of great interest to a wide range of disciplines from product developers, to sensory scientists, expert of consumer panels or eating behavior and even market research bureaus.

Traditional measurements have been resting on the use of manually recorded and self-reported types of data collection.

New types of ICT technologies are offering interesting new functionalities of interest to the whole health-oriented scientific community.

Some of the technologies that has been reported being able to measure sensoric/human response as a function of food exposure include the FaceReader 6.0, Emotiv Insight, Finger Heart Rate Sensor, Google Forms, Garmin Vivosmart HR Bracelet, L18 Smart HR Bracelet and Ear clipper HR pulse.

The technologies and matching software have been tested to examine the following characteristics: reliability, user-friendliness, data readability, data export options, possible measurement types, battery life and the participant comfort.

The action in the SERT work group will carry out work on how to take advantage of new “response” technologies and to coordinate studies on strengths and limitations of these and to validate them against traditional methods within food and sensory studies.

Chair: Mari Sandell, Turku University

Measuring sensory response to food the smart way – an inventory of low cost easy to use wearable devices and an assessment of their feasibility

Ellen Landman 1, Milou van Empel1, Bent Egberg Mikkelsen2, Dafne Di Sciorio1, Kristin Tammvee1, Kristina Bilinskaité1

Eating insects – does informed choice makes a difference on acceptance of consuming edible insects?

Proceedings from ICCAS 2017 AAU CPH

Plate counting to measure food flow in canteen

Smart Exposure Response Technologies (SERT)

Exposure Response Model
Not "liking"

Preference

Motivation

Enjoyment

Happiness

Milestones

WG Objectives

Tasks/Activities

Milestones/ Major Deliverables

3) Smart Exposure Response Technologies (SERT's).

1) Develop inventory of technologies to create overview of existing SERT's.

Investigate the technological solutions available for Smart Exposure Response. This task will aim at summarising existing approaches and workflows, consolidate outputs from individual projects and identify common technical challenges.

1) Testing/feasibility studies of new SERT's against conventional methods. This task will aim piloting SERT's methods in real-time consumer-based innovation platforms e.g. food court in Finland and Denmark together with selected self-reported food choice questionnaires.

1) Investigate and document approaches to evaluate SERT testing studies accuracy, possibilities and limitations. This task will carry out critical evaluation of feasibility of SERT testing. Develop suggestions for future usage of SERT testing.

EEG Electro Encephalo Graphy

http://www.dr.dk/nyheder/viden/so‐ein‐ding‐tester‐kan‐maale‐koereglaede
EKG
ElectroKardio(Cardio) Graphy

- Fast and Scalable EEG Solutions
- Neuroelectrics’ high-end wireless EEG devices have paved the way for a large quantity of innovative research conducted over the last couple of years.
- FDA & CE Medical approved EEG headsets with 8, 20, and 32 channels and wet or dry electrodes options - all integrated into iMotions’ multimodal research platform.
- See how the Neuroelectrics integration can help answer your questions.

PPG
Photo Plethysmo Gram
- See also Electro Galvanic Skin response or Skin conductivity measurement and EDA/GSIR (Electrodermal activity)

Customizable Multi-Camera Eye Tracking
- Smart Eye has 360° eye tracking
- extended freedom of movement
- flexible lighting conditions

A snapshot of the virtual supermarket

New sensations and experiences of virtual & augmented food-reality technologies.

Example: the foodscape lab
Three iterations on smart devices

- Augmented reality technologies for plant food literacy training - The Vegetable & Food Education App. Ada Zawadzka
- Sensorial shopping in the virtual vegetable market. Shova Acharya
- The Eye4Food plant food literacy trainer for kids in kindergarten. Shova Acharya
Seven items for Universitarium

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<thead>
<tr>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>The Virtual Shopper</td>
<td>Den virtuelle shopper er et læringsspil programeret I Unity og beregnet til</td>
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<td>at lære om det sunde valg i supermarkedet: Det bruger Samsung VR og</td>
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<td>computerteknologi</td>
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<td>Eye4food</td>
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<td>skabe maddannelse ved at udfordre børn til at kombinere billeder med ord</td>
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<td>når det gælder frugt og grønt</td>
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<td>Growing Blue &amp; Green</td>
<td>Dette set-up er et simpelt aquaponics anlæg beregnet til at lære børn I</td>
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<td>mellemskolen om urban bæredygtig og cirkulær fødevareproduktion</td>
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<td>The DIMS calorie identifier</td>
<td>Med DIMS'en får du adgang til at billedgenkendelse af tallerken anrettede</td>
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<td>måltider</td>
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<td>Veggie Matchi</td>
<td>Veggie Matchi er et augmenteret smartphone spil der lærer børn om frugt</td>
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<td>og grønt i en augmenteret virkelighed omkring et fødevaremarked</td>
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<td>The Social Vegetable Nudge</td>
<td>SocioNux er en Persuasive teknologi der har til formål at nudge kunder</td>
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<td>til at træffe det sunde valg baseret på real-time info om hvad andre</td>
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<td>kunder tidligere har gjort</td>
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<td>Cooking Down Memory Lana</td>
<td>Et 3D kulinarisk oplevelses univers der skal stimulere appetit for</td>
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<td>demente (work in progress)</td>
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From FSL to Street Science & Food'n Science

- Foodscape Lab. Teaching of graduate students
- Refined at annual Researchers festivals
- Refined at Annual culture nights
- Conceptualized in the Food'n Science Program

Food'n science - overall aim & target

- To co-develop food & nutrition AND science & digital literacy for the benefit of young people in elementary school
- For children aged 8-12 years
- Elementary school
- Mediators: teachers of natural sciences and home-economices

Thanks for your attention

http://www.capfoods.aau.dk/newslist/news/vous‐connaissiez‐le‐model‐aalborg‐.cid331849
bemi@dcm.aau.dk, 25 38 43 66
Personal web site: http://personprofil.aau.dk/119690?lang=en
Linked in: http://dk.linkedin.com/pub/bent‐egberg‐mikkelsen/7/713/13b
ResearchGate: http://www.researchgate.net/profile/Bent_Mikkelsen
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