

# SPLENDID

Personalised Guide for Eating and Activity Behaviour  
for the Prevention of Obesity and Eating Disorders

## Welcome to our 3<sup>rd</sup> Newsletter

This is the last newsletter of SPLENDID! In this issue we look back on an exciting and very productive **final year**...

**Last spring**, we launched the final integrated version of our system that was used by 50 young people to monitor how they eat and move in their daily lives and advise them towards healthy habits.

Earlier, SPLENDID was used to assess the eating patterns of more than 100 students during school lunch, proving that for the first time it is possible to objectively measure eating behaviour in real life. Our innovative achievements have been disseminated via conferences, workshops and even **TV broadcasting**.

SPLENDID has brought together researchers from different European institutions. In this issue they are sharing their experiences after working together in SPLENDID for the past 3 years.

SPLENDID is not really ending here... On the research side, our project is **scaling up to BigO, a new project starting in December 2016** exploiting Big behavioural Data in the battle against childhood obesity. On the commercial side, discussions are on their way to move from prototypes to products.

We hope that you will enjoy our press!

Eirini Lekka, Technical Manager



Contract number: 610746

Newsletter 3, October 2016



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*"I think it is a really good experiment and I am excited to see how far it goes in the future"*

-Student who used the SPLENDID system.

## Using SPLENDID in Real Life

In July and August, version 2 of the SPLENDID-system was tested at Wageningen University in Netherlands. Twenty young adults (18-30 years old) with a BMI above 25 participated. It was the first study to be executed at the new home base (Helix building, see image to the left) of the Division of Human Nutrition.



Helix building of Wageningen University. The site for the last experiment on young adults.

Participants visited the university where they received instructions on how to use the system. After this introduction, they started using it in real-life to assess their usual eating behaviour and physical activity.

After one week, the participants returned to the university to discuss the recorded behaviour with a research dietician. Together with the participants, goals were set to improve their behaviour by targeting healthier habits.

Goals were only set for: (a) number of snacks, (b) size of the main meal and (c) physical activity level, although the system allows for wider range of goals.

In the following three weeks the participants continued to use the system while receiving feedback on their progress— i.e. messages were provided through the mobile app. Participants could also monitor the recorded behaviour and goal proximity on the app and on the web tool.

At the end of the three weeks, participants returned to the university to review their progress together with a research dietician.



Participant receives instructions on how to use the SPLENDID system.

In average, participants judged the overall SPLENDID system as 5 on a scale from 1 (very negative) to 7 (very positive). Participants commented that SPLENDID provides insights into ones behaviour and that it makes you behave more consciously. Some suggestions for improvement were also given.

In summary, based on the reactions of the participants, the system seem to have a lot of potential!



The complete SPLENDID system: Mandometer, Data logger, Chewing sensor, Mobile phone and app.



## The final School Experiment

The 8th of June marked the end of the final SPLendid school experiment. Students from Internationella Engelska Gymnasiet Södermalm (IEGS) in Stockholm, Sweden had the opportunity to use the entire integrated SPLendid system.

As SPLendid was envisioned in the beginning of project, the experiment was divided into two distinct phases to enable prevention of obesity and eating disorders.



Some of the many documented and consumed meals during the final school experiment, indicating that the students really enjoyed taking pictures of their food.



Mandometers, mobile phones, data loggers and chewing sensors “ready for use” the day before the final school experiment of SPLendid.

The first phase was the Behavioral Assessment Stage (BAS), with the aim to get the students to use the system as much as possible for 14 days with feedback given on how often they used it. Data collected during this period was used to create a baseline for each student from which the goals in the feedback phase could be derived.

BAS started week 1 with the mobile app and the Mandometer only, and continued during week 2 by adding the data logger and the chewing sensor (see images under

Week 1 and 2+3 to the right). Students used the system the whole day—both at school and at home. On average, students took 48 pictures on meals and used the data logger for 23 hours throughout the three week period.

The second phase was the Personalised Guidance Stage (PGS) with the aim to facilitate the students to follow goals that were set up after the BAS stage (see third picture to the right). Students received feedback on how they ate and how they moved, and how far their current behaviour was from the set up goals.

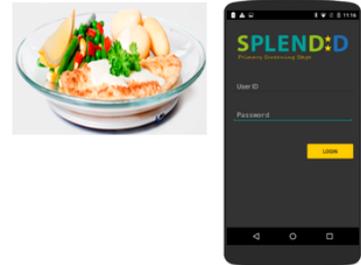
On average, students reported 4.8 meals, used the Mandometer 5 times and the data loggers for 10 hours throughout the PGS week.

At the end of PGS, data on how well students had been able to follow the set up goals was collected and are now being analysed by researchers at Karolinska Institute, Stockholm, Sweden.

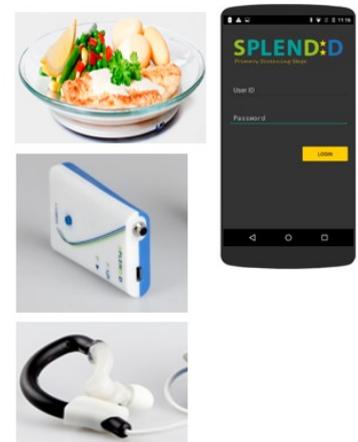


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### Week 1



### Week 2+3



### Week 4



The evolution of BAS (week 1: preparation, week 2-3 full system usage) into PGS.

## SPLendid in Media



SPLendid in Euronews. Double-click the picture to see the video.



Two of the participants in the School study. Double-click the picture to watch the video.

The final school experiment brought a lot of media attention to the SPLendid project.

Starting with a video on Futuris, the science programme of the pan-European television channel Euronews, featuring interviews with researchers and students about the usability and the aim of SPLendid.

Information on the project was later put up on the European Commissions website, where they pointed to the coming project, BigO, which will use the know-how of SPLendid to not only target individuals, but also public health authorities, providing evidence on the impact of specific interventions that aim to prevent eating disorders and obesity.

**More links media coverage of SPLendid:**

[European Commission – Learning to eat right with weighing scales under your dinner plate](#)

[Karolinska Institutet – On Facebook June 22](#)

[Greek media \(text in Greek\)](#)

[Greek media \(text in Greek\)](#)

## The final SPLendid workshop

Tuesday 20th of September 2016, the final SPLendid workshop were held at the Makedonia Palace Hotel in Thessaloniki, Greece.

In the workshop, project outcomes were presented to the consortium and the participating stakeholders. Feedback and exchange of ideas were received related to how the system can be used to prevent obesity and eating disorders.



Feedback and exchange of ideas during the last SPLendid workshop.



Workshop participants eating lunch on the SPLendid system.

The attendees were invited to eat their lunch on the SPLendid portable system – including the Mandometer, the mobile and its application. Their eating profiles were later reviewed to showcase the use of the SPLendid system to illustrate eating behaviour.

Politicians, school personnel, health experts and other researchers were all very excited to participate in this event.

## The Second Project Review

The progress of SPLENDID was reviewed by the European Commission during the second project review in Brussels, January 12<sup>th</sup> 2016.

The project officer, the reviewers as well as representatives from all partners were present. The consortium presented the work accomplished and how the goals of the second year had been achieved.



Partners of team SPLENDID during the second project review.



The reviewers were enthusiastic and happy about the achieved results and the progress of the SPLENDID project.

Furthermore, demonstration of a primary screening meal in a real-life setting using the chewing sensor and the mobile app were conducted. The web application was demonstrated as well. The reviewers were very enthusiastic about the project progress and were fully satisfied with the achieved results.

## Wageningen students visit Mandometer clinic in Stockholm

February 2<sup>nd</sup> 2016, 30 nutrition students from Wageningen University, the Netherlands, visited Mandometer clinic and Karolinska Institutet in Stockholm, Sweden.

During their visit, students learned about the research- and background theory behind the Mandometer treatment and how it is applied in the clinical work at Mando.

Their interest for eating disorders and obesity was great and they had many questions.



Students from Wageningen university attending a lecture at Mando clinic in Stockholm, Sweden.

## Interviews with partners of SPLENDID

**Q: What are you most proud of related to the SPLENDID project?**

**Andrew:** *IEGS's participation in the SPLENDID project was a great opportunity for our students to see how behavioural research is done, and just how challenging it can be. I am proud that a relatively high percentage of the students who were asked to participate chose to do so, and were such willing participants in the longer term, phase two trial last Spring. We were very clear with them that their participation was voluntary and that it would require more of a time commitment than the previous trials, and we still had no trouble getting participants.*

**Billy:** *Being able to perform the studies within the time constraints posed by a regular school schedule.*

**Christos:** *The indicator extraction algorithms and the decision support system of SPLENDID. While it may appear that measurement of user behaviour and its interpretation is something that you 'just get from the sensors', this is hardly the case. There are complex algorithms executed behind the scenes that provide us with all this useful information.*

**Isabel:** *I'm very proud of having being able to work with these diverse team, were not only technical people, but also clinicians were able to work together to create a tool to help young people avoid series nutritional problems.*

**Vasileios:** *As part of my work, I was involved in developing the algorithms that process the sensor signals and implementing them on the mobile phone. Seeing their results in the final product (the PWT website) has been an important milestone in this work that I am really proud of.*

**Janet:** *SPLENDID brought people from different areas of expertise together. This way we managed to accomplish more than we ever would have as individuals.*

### Interviewed partners

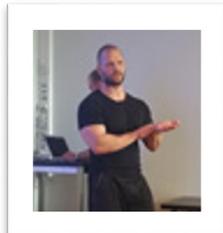
**Dr. Andrew Glossner**

Internationella Engelska Gymnasiet Södermalm (IEGS), Stockholm, Sweden.



**Billy Langlet**

PhD candidate at Division of Applied neuroendocrinology, Karolinska Institute, Stockholm, Sweden.



**Isabel Martí**

R&D Project Manager at TSB Technologies for Health and Wellbeing, Valencia, Spain.



**Dr. Christos Diou**

PhD at Multimedia Understanding Group, Aristotle University of Thessaloniki, Greece.



**Vasileios Papapanagiotou**

PhD candidate at the Multimedia Understanding Group, Aristotle University of Thessaloniki, Greece.



**Janet van den Boer**

PhD candidate at Wageningen university, Netherlands.



## Interviews with partners of SPLendid

**Q: Anything unexpected that happened during the process?** *people find SPLendid useful.*

**Andrew:** *I was surprised to learn that the type of data generated in the phase 1 and 2 trials did not exist in the literature.*

**Isabel:** *The greatest reward has been getting to know my colleagues, as well as being able to work with all of them and finish the applications to execute a successful pilot.*

**Billy:** *I did not expect the students and school personnel to be so helpful and enthusiastic during the studies.*

**Vasileios:** *Meeting and collaborating with a big group of people into building a complete and functional system had been the greatest reward for me.*

**Christos:** *Development of sensors, algorithms and the system integration was never short of surprises. But in the end we managed to build a robust product.*

**Janet:** *At the beginning we envisioned how the SPLendid-system would ideally function. It is great to see it come to life.*

**Isabel:** *During the last year of the project I got pregnant and I've missed the latest pilots which is a shame for me, although having a baby was the most beautiful thing ever happened.*

**Q: What was the biggest challenge during SPLendid?**

**Vasileios:** *Various changes had to be incorporated in the algorithms based on user feedback during the early data collection studies of the project. Also, the transition from the early versions of the chewing sensor to the final one introduced the need for additional changes. However, the initial planning of the project made sure that these problems were tackled immediately and properly.*

**Andrew:** *The main challenge for me, coordinating logistics at the school, was to make sure that the rooms and food were organized properly. Despite my best efforts there were mistakes with respect to double booking of the dining hall and food catering. The SPLendid team were always well prepared and able to deal with any setbacks, so things worked out, but these issues made for some nervous days.*

**Janet:** *In the beginning I was not sure what to expect, as I had never been involved in an EU-project before. Despite the large distances the communication went remarkably well.*

**Billy:** *The scale of the behavioural assessment and personal guidance phase proved quite the challenge.*

**Q: What was the greatest reward being part of team SPLendid?**

**Christos:** *Coming up with measurements that matter for obesity and eating disorders (which can be computed from the available portable/wearable sensors).*

**Andrew:** *I was very gratified to hear students describe how much they had learned about their own behaviour during the Euronews interviews, and proud of how well spoken and confident they were.*

**Isabel:** *The biggest challenge was to be able to communicate with the clinicians to understand their needs.*

**Billy:** *The benefit of working with people from many different fields.*

**Vasileios:** *Researching new algorithms and solutions is always a challenge, and it involves a great risk as well. Fortunately, all objectives were met successfully, within the time schedule.*

**Christos:** *The involved participation of users during the trials was the most rewarding part; to see that*

**Janet:** *Finally people tested the SPLendid-system in real-life, while previous tests were performed at the university (or at school). At first it was a bit difficult to hand the system over to the participants, but then I noticed that the participants were quite good with these new technologies.*

## Primary Screening Trial

During three days in December 2015 (14-16<sup>th</sup>), a pilot study was performed at Internationella Engelska Gymnasiet Södermalm (IEGS).

In total, 107 students ate lunch with the Mandometer V5 and used the new SPLENDID App during their meal. Students eating profiles were then automatically extracted and assessed.

Students really enjoyed their experience and they seemed both interested and happy to participate. For example, a student who used SPLENDID said:

*"I could see a lot of things about myself that I didn't know. So I think it is a really good project".*

Another student said:

*"I would love to get more involved with the project or by using the Mandometer daily".*

We were very satisfied and happy that we managed to coordinate the pilot with so many students.



Ioannis Ioakeimidis preparing the participating students how to use the Mandometer and the mobile app.

## Technical Testing of the App

October 23<sup>rd</sup> 2015, the SPLENDID team managed to conduct a complete test of Mandometer version 5 together with the SPLENDID online database and the SPLENDID mobile application - all validated against the older generation of the Mandometer version 4.

Specifically, the test included: (a) creation of groups of data inside the SPLENDID online database before the meal, (b) recording of a meal using the SPLENDID mobile application,

and (c) reviewing the SPLENDID online database after the meal.



Dinner time using the chewing sensor and Mandometer.



Another test using the chewing sensor and Mandometer.

The test was completed with success and the final evaluation of both the SPLENDID online database and the mobile application worked great.

At the end of the testing, supplementary suggestions were made for future improvements.

## SPLendid in Scientific Conferences

During May and June 2016 consortium members were invited to three conferences in which different parts of the SPLendid project were presented.

### 1. ISBNPA Conference in Cape Town, South Africa

The International Society of Behavioral Nutrition and Physical Activity (ISBNPA) promotes and advocates innovative research and policy in the area of behavioral nutrition and physical activity toward the betterment of human health worldwide.



Ioannis Ioakeimidis (KI) presented at ISBNPA in Cape Town, South Africa

During the 15th international conference in Cape Town, South Africa, Ioannis Ioakeimidis (KI) presented "Real time smart monitoring of eating patterns during main meals", where the SPLendid system as a whole was described.

### 2. Measuring Behavior Conference in Dublin, Ireland

Measuring Behavior is an interdisciplinary conference where interventions and methods for

measurement of human and animal behavior is presented.



Billy Langlet (KI) presented at measuring behaviour conference in Dublin, Ireland

During the conference in Dublin, Ireland, Billy Langlet (KI) presented "Measuring eating behaviour in a Swedish high school", where the methods used in the SPLendid project to measure eating behaviour in a school setting was described.

### 3. pHealth Conference in Crete, Greece



Christos Maramis (AUTH) presented at the pHealth conference in Crete, Greece

pHealth 2016 bring together experts on wearable, micro & nano technologies for personalized health.

During the 13th international conference in Crete, Greece, Christos Maramis presented "A

Sensor-enabled Smartphone Application to Collect Eating Behavior Data for Population Screening".

In this presentation, the SPLendid mobile application developed for the project experiments was described.

### 4. EMBS Conference in Orlando, USA

EMBS is the annual gathering of the Engineering in Medicine and Biology Society. It is a four day event, where various topics of bioengineering and bioinformatics are presented.

During the conference, Vasileios Papapanagiotou (AUTH) presented a paper titled "A novel approach for chewing detection based on a wearable PPG sensor" which describes the PPG chewing sensor, three different processing algorithms, and an evaluation dataset for the overall system.



Vasileios Papapanagiotou (AUTH) presented at EMBS conference in Orlando, USA



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## Upcoming events



Team SPLendid will participate in **FOOD 2030: Research & Innovation for Tomorrow's Nutrition & Food Systems**—a high-level event that will take place between 12-13th of October 2016, in Brussels.



Ioannis Ioakeimidis (KI), Irini Lekka (AUTH), Christos Diou (AUTH), Monica Mars (WUR) and Per Södersten (KI) will participate and represent SPLendid in this event.

## The Consortium



Aristotle University of Thessaloniki, Greece



Karolinska Institutet, Sweden



Mando Group AB, Sweden



Swiss Center for Electronics & Microtechnology – CSEM SA, Switzerland



Soluciones Tecnológicas para la Salud y el Bienestar SA – TSB, Spain



Wageningen University, the Netherlands



Internationella Engelska Gymnasiet Södermalm, Sweden

