A little less stress...

Designing a stress monitor for employees with autism

Appendices

Graduation thesis by Joost van Hoevelaak

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Graduation thesis
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I Initiation session users

September 15th 2009

As an initiation of the project, a session was planned with seven clients of the Leo Kannerhuis, representing the target group. The goal of this meeting was to gain insight in the daily working lives of people with an autism spectrum disorder (ASD) and the problems that they experience, especially at work. The session was focused on getting insight in the daily lives of employees with autism. What kind of jobs do they have? How do they feel at work? What problems do they experience? In order to facilitate the discussion some illustrations of humans in job environments were created, which could be used to visualize situations or to create a storyboard.

The session was attended by seven clients of the Dr. Leo Kannerhuis diagnosed with ASD: Rini, Bas, Hans, Roderick, Joop, Jorem and Machiel. They could be described as having a form of High-Functioning Autism. Most of them have a job and are quite capable in communication and social interaction.

On behalf of the Leo Kannerhuis project manager Michel Vervaet and Lotte from the R&D department were present. Bas van Abel, Dick van Dijk and Sabine Wildevuur represented Waag Society.

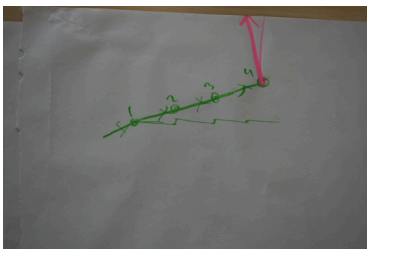
Storyboarding

The participants were divided in three groups which were guided by Bas, Dick and myself. The format for the session was semi-structured, the participants were asked to map activities out of their working lives and value them. Originally the idea was to work in the direction of a storyboard, but due to time limitation and insufficient preparation this was not reached. Instead the sessions unfolded more like group discussions.

Group 1 Bas

Situations where or when stress occurs were listed at first.

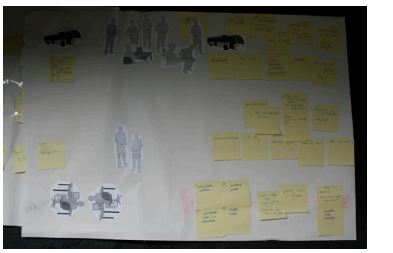
- Perfectionism, trying to do things perfect.
- To check and double-check every piece of work
- Unexpected situations, unpredictability
- Situations or tasks without structure
- Head full of things
- Starting the day tired
- Not knowing who is who
- Not having an overview



Then it was analyzed how these causes lead to an escalation. Many small things add to the level of stress a person with autism is experiencing. It is hard for these people to notice this right away, but in retro perspective the situation can be analyzed to a certain extend. Often they realize these things were irrelevant or insignificant.
At first their stress level is only increasing with little steps, but when too much of these situations follow up on each other the situation might escalate. This theory is shown in the picture to the right, drawn at the workshop.

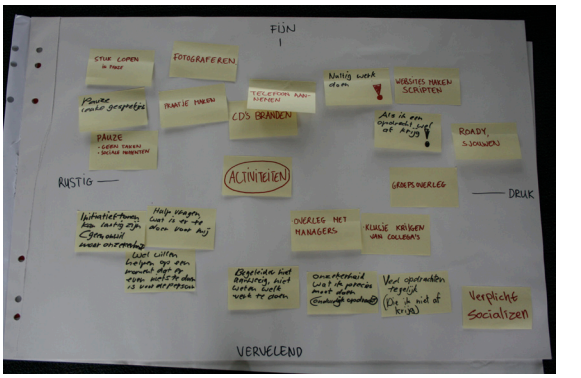
There are some solutions to solve this problem. When this stress points can be made clear, a person might be able to avoid building up too much stress. A technical device might be a good solution for this, because of its objectivity.

Group 2 Dick



The two participants in this group have completely different jobs: one works in a supermarket, the other at an accountant. Both agree that stress is part of life; they do not believe it can be eliminated completely. Working at the checkout is more complex than stock up the shop, but it is also more fun. To relax after work they play computer games. Distractions at work are not always stressful; it might also be a nice variation and a moment to relax. However, sometimes it is too much. Turning off the radio or closing a door might help. Otherwise the team leader might help to solve the problems at work.

Group 3 Joost



After formulating the activities throughout their days, the participants mapped their activities on two axes: quiet - busy and nice - irritating. This arrangement showed the spectrum of situations where stress occurs. One might expect stress in busy situations and when a lot of work should be done and it turns out that this is the case for the participants as well. However, quiet situations might elicit stress just as well. The mapping of the activities along those axes shows the nuances between some everyday situations. Both participants agreed that a situation without tasks is very stressful as long as nobody tells them that there is no work to be done. They are very concerned with the idea people might get when they are not working. On the other hand, busy situations might be very relaxing on the conditions that they feel like they are doing useful work and they can complete their tasks in time.

More obvious are the conclusions that a walk outside during lunch break can be very relaxing and that duties that cannot be fulfilled lead to stress. Social situations can be both relaxing and stressful. One of the participants states explicitly that he is not able to create a comfortable atmosphere himself. When the atmosphere is good, people are talking to each other, he can enjoy his breaks in the company of others very much. Especially because he is working on his own most of the time. The other participant, who is working amongst others, likes to spend his breaks at taking a walk.

II Initiation session experts

September 15th 2009

After the initiation session with target user, a session with experts was planned. This session was attended by six experts on the topic of autism related to work. Four of them are employed at the Leo Kannerhuis, two work as job coaches at Jobstap, a foundation supporting people with limited capabilities in finding and keeping a job. Below the experts are listed along with their functions.

Alida Stukker,	community worker (arbeidshulpverlener), Leo Kannerhuis
Marianne Veltman,	community worker (arbeidshulpverlener), Leo Kannerhuis
Dianne Nijenhuis,	coordinator trajectbegeleiders, Leo Kannerhuis
Annebeth Leijzer	behavioral scientist 'De Wissel', Leo Kannerhuis
Rick Teunissen,	job coach, Jobstap Lent
Pennie Lincewicz,	job coach, Jobstap Arnhem

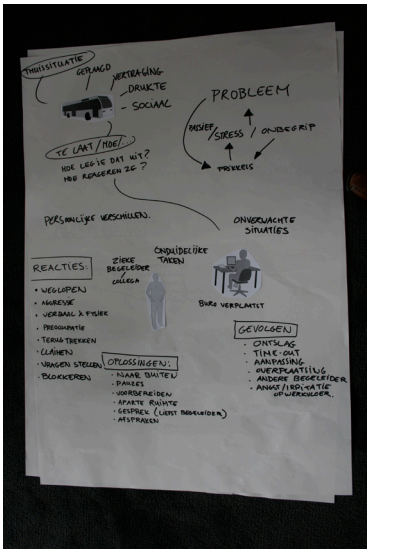
First the goals of the 'Wajong' project were explained briefly as well as the digital coach. The idea of a bio-guide was presented on an abstract level. It was defined as a application that would help to create awareness about stress in a job situation and help to find solutions for it, probably using the digital coach.

The participants were divided into three groups as in the morning session. In these groups the daily activities were discussed and related to the stress one might encounter.

Group 1 Joost

The causes for problems at work are explored by going through a day in chronological order. The experts indicate that problems might originate from experiences and feelings before a person arrives at his job. Getting up, eating breakfast, leaving home and traveling might all lead to stress stimuli, especially when unexpected situations occur.

During a work day many situations might lead to problems, the direct causes could be divided into two categories: under and over activation. The first is the case when a person is tired or sleepy, the latter when he is stressed or tensed. Both states allow for a quick change of temper and might lead to escalation.



The reactions problems might differ from person to person, but could also be divided in two categories: aggression or flight. Some might become verbally or even physically aggressive, while others walk away or get blocked. Since both situations are undesirable it should be tried to avoid these. This can be done by taking the person out of the situation before it escalates. Taking a walk or having a conversation with a mentor might be enough to cool down and continue working.

Group 2 Bas

This group confirms some of the conclusions described above: everything that happens before one gets to his work influences the progression of the day. These situations cause the person to experience a certain amount of stress. In order to reduce or eliminate this tension, one should take a moment of rest to relax. However, often they might not find the time or motivation to do so. This way the tension persists, creating a situation where stimuli might easily lead to escalation.
A little conversation with a job coach or company mentor, even by phone or SMS, could help as a moment of distraction to get back on track. This reduces the tension and makes them more resistant to following stimuli. Other ways to reduce tension are stepping out of a situation, not joining in activities that elicit stress, structure the day, tone down stimuli and respiration exercises.

Group 3 Dick

Monitoring stress might have the undesired effect that the output causes stress for the user, creating a downwards spiral. Therefore the output should be adaptable for different types of users. Also the placebo-effect should be considered. From experiences with the iPhone application for public transportation it was clear that the mere fact that they have a digital coach at their demand made them feel more relaxed.

People with an Autistic Spectrum Disorder have difficulties with understanding their feelings. They will have to learn how to deal with negative as well as positive stress.

These results from the group discussions were shared and discussed. Although the three groups discussed some different topics, much consensus was found in the problems and solutions they suggested.

One last remark from the experts was to
take the kind of work in consideration. It might make a difference whether someone is getting paid or is working voluntary. This topic was briefly discussed after the experts had left and it was decided to focus on paid jobs for the moment. Mostly because of the fact that the project in financed under the ‘Wajong’ project, which is focused on (re)integration into the common economic system.

Conclusions

From both sessions it can be concluded that the basic functional idea of a bio-guide is promising. Some clients would like to use such a device right away, especially the idea of an objective, technical buddy is welcome. Personalization was mentioned a few times to adapt the product to the divers target users with Autism Spectrum Disorders.

Both clients and experts were very interested in this project and indicated that they would like to be involved in following phases. This might be of great value to the design process; experts might be able to contribute by transferring knowledge while the clients might help with inspiration and by testing (preliminary) models.

III Consultation Dr. Lisette Verhoeven

October 22nd 2009

- Department Research & Development, Dr. Leo Kannerhuis

Lisette Verhoeven did her master and doctoral title in psychology at the University of Nijmegen. Her doctoral thesis was about skin diseases. One aspect she researched was the influence of stress on skin diseases. Therefore she is experienced in inducing and measuring stress. The possibilities of measuring stress and the relation to people with autism is discussed in an interview. Some excerpts from this conversation are presented over here.

In most research stress is induced to see bodily reactions to the stressors. Often a so called 'public speaking task' is used to do so. This task however, is not so suitable for a target group with autism, because they are not as familiar with the tension of speaking for an audience as most other people are. Since social situations are often described as stressful by people with autism, such a situation could be imitated to try to evoke a stress reaction.

Reactions to stress occur on two different axes; the endocrine system and the autonomic nervous system. Verhoevens research focused on the endocrine system, especially cortisol levels, but she knows about the autonomic response as well. The autonomic nervous system responds very quickly to a stressor, the hormones produced by the endocrine system are used to bring the body back in balance. Although the reactions are separate, they are not completely independent; people that show no reaction to stressors in their cortisol levels show no reactions in the autonomic nervous system either.

Little is known about reactions to stressors by people with autism. Verhoeven knows one research focused in this area (Jansen et al, Autonomic and Neuroendocrine Responses to a Psychosocial Stressor in Adults with Autistic Spectrum Disorder). The question is whether the reaction of people with autism is the same as others', because much is known about reactions to stress of general individuals. It could help to look for stress reaction of people with fear and panic disorders. In this group experimentation with biofeedback on the autonomic nervous system led to positive results.

Using a calibration phase, before actually starting to use a device as intended in this project might give great insight in stress reactions and individual differences. Individual differences are expected as well as individual preferences, because this target group is very diverse. Personal settings should be possible to make such a device suitable for a broader target group. Besides, different types of stressors can have a different effect. A difference could for example be made between short, explicit stressors and concealed, long term stressors. Individuals could also respond in a different way to all these different stressors.

Verhoeven says that Julian F Thayer, Ohio State University, states that Heart Rate Variability (HRV) is the only reliable indication for stress. Verhoeven herself does not have much experience with measuring stress using autonomic variables, but confirms the difficulties with functions such as heart rate or galvanic skin response, that react to positive arousal just as much as too negative stress.

Finally Verhoeven speaks about a project around March 2010, in which she wants to do research in the field of autism and stress reactions. This data might lead to new insights that may be used in the development and fine tuning of the product. It might even be an option to use prototypes of the product in these tests.

IV Consultation
Prof. dr. ir. H.J. Hermens

October 29nd 2009

- Clustermanager Non-invasive Assessment at Roessingh Research and Development
- Professor at University of Twente, Faculty EWI

Hermens is doing research on the topic of non-invasive monitoring of physiological functions. One of his projects was using myofeedback to relieve pain for patients with neck and shoulder injury, mainly due to Repetitive Strain Injuries (RSI). Myofeedback is a form of biofeedback where muscle tension is monitored. In this case the trapezius muscle between neck and shoulders is monitored and a signal is given at a PDA when this muscle is too tensed. Rest moments and muscle activities are used to deduce a tension score. Typically this muscle is not very active, but it reacts to stress, especially when working on a computer.

According to Hermens, the definition of stress is a difficult one. He does not believe in a strict differentiation between physical and mental stress, because they are intertwined. Mental stress at work makes people experience physical stress, because of their posture for example.

A current project targets a broader audience: general people experiencing stress. Multiple variables will be used in determining stress, which is not yet defined, probably a combination of muscle tension, GSR, heart rate and heart rate variability. The data will again be sent to a PDA that gives feedback on the information. In this project the data will also be recorded to view back in graphs.

In this project the GSR is measured in between two fingers. This will give a more accurate measurement than measuring with two electrodes next to each other. Still the interpretation of GSR values requires intelligent processing. It is not an absolute value, so only changes have a significant meaning. The baseline value also drifts; it changes over time due to changes in temperature, movement, etcetera.

Pulse will probably be measured by means of an ECG, because it is more reliable than a pulse oximeter. Two leads on the chest are accurate enough to deduce heart rate and heart rhythm variability.

Finally Hermens emphasizes the need to build some kind of calibration into the algorithms used. The algorithms are the core of stress measuring. The method of sampling, averaging, and interpreting data is the key to the use of the data.

V Consultation of Lilian Jansen

November 1st 2009

- MSc. Social and Organizational Psychology, spec. Environmental Psychology.
- MSc. Education and Child Studies, spec. Developmental Disorders (Autism)

Lilian Jansen has gained experience with autistic people, both in her studies and in her profession. She wrote her MSc thesis about experience of competences and problematic behavior of people with an ASD. In this interview theories on autism are discussed and implications for this project are identified.

There are three main theories explain the impairments of people with ASD: Theory of Mind, Central Coherence Theory and Executive Functions Theory. The Theory of Mind was already known and described in an earlier stage, the other theories were discussed briefly to gain more insight in the characteristics of people with ASD.

The executive functions are controlling many of the brains processes, like planning, abstract thinking, initiation and inhibition of action and selecting relevant information. People with ASD often have difficulties with these functions. For example inhibition of actions: they tend to behave in a restricted way and once an action is initiated it cannot easily be stopped.

The central coherence theory is about perception. People with a weak central coherence are not able to see ‘the big picture’. Sensory information is perceived in a fragmented way. Usually humans combine sensory information before assigning a meaning to it. People with ASD assign meaning to every fragment itself. This results in a view where the perception is very detailed, with an overview of the context. This sensory stimulation can be very disturbing, especially in busy environments.

The problems encountered by people with ASD, related to their ability to find and keep a job are for the greater part categorized under the adaptive functions:

Communication
- **Expressive**
- **Receptive**

Daily skills
- Practical (self-care)
- Domestic
- **Society**

Socialisation
- Play & Leisure
- **Interaction with others**
- **Social skills**

Motor skills
- Gross
- Fine

The bold functions are often impaired for people with ASD and are expected to influence job capabilities. Therefore these should be kept in mind throughout the current project.

A very important remark was made by Jansen: Even high functioning people with ASD will function significantly worse when experiencing stress. In the user-product interaction this should be anticipated. Signaling the stress in an early stage could be very valuable. A person might still be able to do something about it, while in later stages this is doubtable.

Regarding the output of such a device Jansen emphasizes the need for subtle feedback. Probably multiple signs (like light and sound) will be experienced as confusing. Subtle and concrete could be the way to go. On the other hand are some extraordinary stimuli experienced as calming. Some people with autism like to push their head firmly into a pillow.

VI Context mapping session

The techniques of context mapping help designers gain empathy for the user [1]. The goal is not only to gather information on the context, but also inspiration for the design process.

Setup

A workshop session is planned at the Leo Kannerhuis with seven of their clients, in which generative techniques will be used to elicit contextual information. The goal of this session is to gain insight in the target group's working experiences and stress related problems. The research questions could be formulated as follows:

- How do they experience their daily work?
- What causes the problems they encounter?
- What could be done about this?

As a preparation for the workshop, sensitizing booklets are sent to the participants. These booklets contain some general exercises about daily work. In the workshop the topic is more focused to stress. In small steps the participants work towards the last exercise, where they have to make a mockup of their dream product for stress relief. After creating these mockups they are asked to explain what they have made, because these stories usually contain rich information for the design process. [2]

Sensitizing booklets

The sensitizing booklets contain five small exercises that are meant to make the participants think about the topic of the workshop beforehand. It is handwritten in order to create a loose, informal atmosphere where the participants feel free to write and draw everything they think of. Some doodles are added to increase this feeling.

The exercises are simple and open ended. They give an insight in the lives of target users and make them think about the topic of the workshop. The five exercises have the following themes:

1 Introduction
What is your name? What are your hobbies? Show a picture of yourself!
2 Your job
What do you do? What are you best at? What do you like about it? What not?
3 Your workspace
Show a picture/drawing of your workspace. What is the best/worst about it?
4 Your experience
What do you see/hear/think/feel during your work? And your colleagues?
5 Your work day
Can you draw a timeline of your day, with most and least tensed moments marked?

Workshop

A workshop will be held at the Leo Kannerhuis in Doorwerth at November 2nd. The same seven clients that attended the session September 15th will participate in this workshop. The participants will be divided into two subgroups, each working at its own table. Both tables have a individual facilitator. All activities will be introduced plenary by the one facilitator. Outcomes will be presented and discussed plenary as well.

Introduction

In a short introduction the participants are welcomed and informed on the goals and activities of the session. A time planning is shown in order to prepare them for the coming activities. A timer is introduced in order to keep up with the schedule.

Sensitizing booklets

The participants have filled in a sensitizing booklet in advance. Their input is discussed briefly as a start of the workshop. The participants are also asked to hand in their booklet.

Collage

The participants are asked to create a collage on experiences during their daily work. They are asked to focus especially on the difference between activities that they like and dislike. Sheets of pictures and words are provided to speed up the process. Afterwards the collages are presented on a wall and briefly discussed in a plenary session. The collages themselves are not as important as the stories evoked by the process. Facilitators walk around motivating participants and asking them to tell about their work.

Stress experience

The participants are asked to write down a personal experience regarding stress. They are provided with a worksheet, containing some terms to motivate elaboration. This personal experience is meant to improve the following group discussions, by allowing referral to this personal experience.

Group discussions

In the two groups some dilemmas are discussed with the participants. Every group has its own facilitator. This facilitator is provided with worksheets with the questions to summarize the outcomes of the discussions.

- Cognitive map on the process of stress.
  Every participant has written down a personal experience of stress. These stories are generalized in a cognitive map. How to influence this process?
- Are they able to notice tension or stress, their state of mind?
  (How) do they notice when others (coworkers) feel stressed?
- What do the participants do to ease themselves when they get tensed?
  How can they help others (coworkers) when they feel stressed?

The results are briefly presented and discussed in a plenary moment, using the worksheets as a guide.

Dream product

The last assignment of this workshop is to create and present a mock up of a dream product for stress relief. How would they want such a product to behave? Where should it be? How do they want to interact with it? How should it look?

Basic materials are provided in such a way that these mock ups can be created in short time. Materials include foam shapes, stickers, wire, markers, cardboard and such.

The session ends with presenting these ideas and discussing them briefly. The presenter is asked to put his product on a showcase stand and present it in two minutes. Two other participants are pointed out to give feedback, by handing out two ‘balls’. The green ball to name one of the best features of the product, the blue ball to indicate some feature that could be added to make the product better.

Schedule

The workshop is planned from 13:00 to 17:00. The schedule below is 3 hours 45 minutes, so an extra 15 minutes are available in case of delay.

Introduction		10 min
Discussing booklets		15 min
Collage making	30 min	
Collage presentations		20 min
Break, drinks & sweets		10 min
Stress experience		10 min
Group discussion		30 min
Plenary conclusions		15 min
Break, drinks & sweets		10 min
Perfect product building	30 min	
Perfect product presentations		30 min
Discussion/ wrap up		15 min

Documentation

Not only the materials created in the session will be gathered, also the stories behind them have to be captured as pointed out before. Therefore the entire session will be recorded with a video camera on a tripod and an extra hand camera is available to record short clips. Facilitators will go around during the creation processes to motivate and help people, but also to ask about the reasoning behind their creations. They will take notes to speed up processing the information afterwards, especially quotes are registered.

The information gained in the session will not only be used to answer the research question and formulate conclusions. A poster will be created for each individual participant with pictures, quotes and excerpts from the booklet. These posters cover the inspiration part of the session goals and can later on be used to inspire idea generation and development.

Results

In a generative session preceded by some sensitizing assignments the context of use and users is explored in depth. The research questions formulated beforehand are as follows:

- How do they experience their daily work?
- What causes the problems they encounter?
- What could be done about this?

In this document the insights gained and some answers to these questions are discussed.

Experiencing work

The professions of the participants are quite diverse, while some have regular paid jobs in a supermarket, as a programmer or assistant accountant, another spends his days in a activity center without a salary. It turns out that all participants in this session enjoy their work quite a lot. They give different reasons: one tells that he does not like to be home, another seems to enjoy having a normal job to be taken seriously. Some point out aspects that they do not like about their job, but working itself is enjoyed surprisingly good.

Some prefer to work alone, while others enjoy working together or in a team, which is a bit surprising, because such situations come with higher demands on social skills.

Causes of problems

The problems encountered at work are most of the time not related to primary tasks, but to side issues like social pressure, lack of overview or bad planning. This issues cause stress for the participants, which makes them more vulnerable for even more stimuli.

The situations that cause stress differ from person to person. Most of the participants agree that stress is often causes by small irritations.

This way the little irritations add up to a high level of stress.

Solutions

As expected from theory and earlier sessions, the participants have difficulties with detecting stress. They do not know how to recognize stress symptoms in other people, neither do they feel it for themselves. Only one participant states that he knows when he gets stressed, but the question remains whether this is always the case.

Furthermore it became clear that not many participants have explicit methods to relax. Finally they came up with some activities that make them feel at ease, but these are not consciously used to relax when they feel tensed. Many indicate that they relax behind the computer, playing games or browsing the internet.

“Behind the computer I can shut down part of my brain.” -Mathieu

In the created dream products it becomes clear once more that the personal preferences are very diverse. One of the participants would like to have a robot to assist him in live, while other would like to have a product that is invisible or unrecognizable as such. In functionality demands are different as well. All agree on the importance of stress monitoring, but the desired output of the product differs. One indicates that he would like a product that he can easily turn off and on himself, while others would like constant monitoring. Most of the participants would like to get a signal themselves, but some indicate the possibility to notify others like family or job coaches.

When you attach external sensors it can measure stress and send a signal to your mobile phone, or to an online database. A job coach could get an email, a warning to help out.
Jaap

“It has to be as normal as possible; it should not attract any attention.” -Rienk

“It is a kind of housekeeping robot that knows 101 situations. It knows how you feel and influences the situations.” -Jeroen

Sources

[1] Sleeswijk Visser et al, Context Mapping; Experiences from Practice. CoDesign Vol. 1, No. 2, June 2005.
[2] Stappers, P.J. and Sanders, E.B.N., Generative tools for context mapping: tuning the tools. Design and Emotion: The Experience of Everyday Things. 2003, Taylor and Francis, London

VII Consultation of Dr. J.M. Karemaker

November 3rd 2009

- Integrative Physiology, AMC Amsterdam

The department of Physiology of the Academic Medical Center (AMC) Amsterdam was contacted to discuss issues like physiological stress reactions and sensors to measure this. Dr. Karemaker was so kind to answer some questions on these topics. Some insights gained in this conversation are presented below.

GSR is a direct reaction to stressor. A sudden situation leads to a change in the GSR value. Over time the GSR value will change anyway due to factors like temperature and movement, which makes monitoring slow stress progression very difficult.

Respiration can be measured accurately by measuring the airflow in and out of the body, but this method would force the user to wear a mask of some kind. A less invasive method is to use a chest band which measures expansion of the chest as an indication of respiration. The breathing pattern can be found quite easily, the volume of breathing can however only be estimated this way.

A pulse oximeter can be used to measure pulse, working with transmission or reflection. This device measures blood saturation, pulse is only something extra that can be deduced from the data. The blood saturation itself is not useful for detecting stress. This value is very stable and will only decrease when something very serious is going on. ECG is a more accurate method to measure pulse. A two electrode band should be accurate enough to measure changes in potential. This technique is used for example in fitness and sport devices. Karemaker does not know which technology or sensor is used in wristwatches measuring pulse. It could be a sensor measuring pressure changes, caused by the blood flowing through the radialis vain.

Instead of an ECG with passive electrodes the heart rate as well as respiration could be measured with active electrodes with AC at around 75 kHz. The frequency in the measurements indicates whether it is the sympathetic or parasympathetic nervous system influencing heart rate. The parasympathetic system controls the rest and recovery of the body, while sympathetic controls the more active functions ‘fight or flight’. Amplitude of change in heart rate can only be interpreted in combination with frequency.

Blood pressure can be measured in two different ways: by means of a band around the upper arm, or on ones finger. The band around the arm needs to be inflated to measure blood pressure. This cannot be done over a longer period of time, because it disturbs the blood flow. The other method can be used over longer periods of time, but has to be done at a finger. Furthermore this is a very expensive technology. (Karemaker shows a machine of 20.000 euro's.)

Muscle tension could also be used as a measurement for stress. When experiencing stress many muscles get tensed. A problem with monitoring these muscles is that movement influences the measurements significantly.

Finally Karemaker remarks that it is often very important for the users of such products to know that the product is functioning. A reassuring signal might give the user feedback, even when no stress is encountered.

VIII Brainstorm session

Date: January 8th 2010
Location: Fablab, Pakhuis de Zwijger, Amsterdam

A brainstorm session was organized to generate some new design directions as input for this project. These could be used in combination with the ideas that were developed already. A mixture of people both known and unknown to the project allows for a creative but realistic session. Nine participants were present: three designers within the project, three designers at Waag Society and three design students.

The session consisted of two parts. In the first part some of the information collected in the analysis phase was presented to the participants alternated with quick brainstorms on some key aspects of the design problem. The second part was a tinkering session where the participants were asked to create a product model in groups of three persons. Tinkering is an experimental process of thinking and creating physical objects synchronously. Therefore the session was held at the Fablab, at Pakhuis de Zwijger in Amsterdam, where machines and materials for prototyping are available.

Each group contained someone from the project team, a Waag designer and a student. They were asked to explain their concept during lunch. These were discussed briefly and after lunch a presenting model was fabricated. The results of the session are presented below.

setup

This brainstorm session is organized in order to generate some different ideas for design solutions. These can be used in combination with the ideas generated beforehand.

Participants

From the current project team Bas and Dick will participate in the brainstorm session. The future team members that will be involved in prototyping are also invited. Furthermore some external

Introduction

The participants introduce themselves and present some work or thought in relation to the subject of this workshop. In the invitation for the session this is already mentioned

HKJ's

Hoe kan je (subtiel) iemands aandacht trekken?
Hoe kan je iemand tot rust manen?
Hoe kan je een product bij je dragen?

Briefing

The design problem is explained in a brief presentation. Furthermore some of the information gathered during the exploration phase is presented to the participants to

.

Also the persona posters created based on the participants in the generative session are available for inspiration.

Brainstorming
In small groups (2-3 persons) ideas are generated to solve the design problem.

Modeling

Prototyping machines available in the Fablab can be used to create physical models of the ideas generated.

Presentations

The ideas are presented to the other participants and are discussed briefly.

Schedule

Welcome
Introduction
Brainstorm rules

Getting acquainted

Briefing:

- Leo Kannerhuis
- Assignment
- Autism
- Theory of mind

Brainstorm:

How can you... attract someone's attention?

Briefing:

- Stress
- Stress building up
- Relaxation

Brainstorm:

How can you… make someone relax?

Briefing:

- Measuring stress
- Sensors

Brainstorm:

How can you... wear a product on your body?

Ideation

Work on concepts

Lunch

Discuss ideas

Modeling

Create presentation models

Presentations

Present the results to each other

Session results

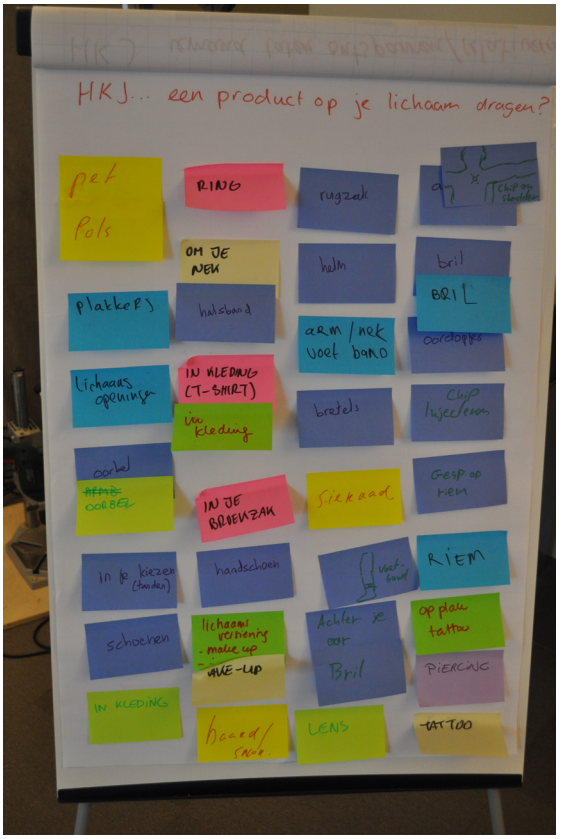
Brainstorms

The brainstorms in the first part of the session were meant as a brain exercise as wells as to make the participants think about some key aspects of the design problem. The results of these brainstorms are presented in the pictures below. No conclusions are drawn of this part; it is merely a warming up for the latter part.

How can you attract someone's attention?

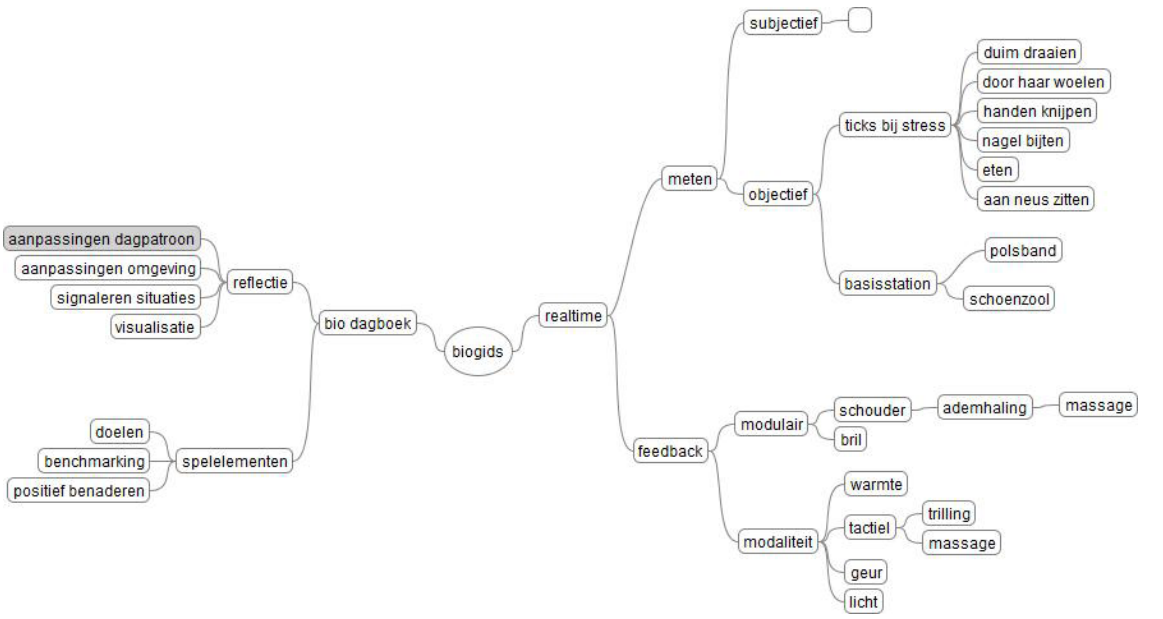
How can you make someone relax?

How can you… wear a product on your body?



Concept group 1 (Bas, Pieter, Raoul)

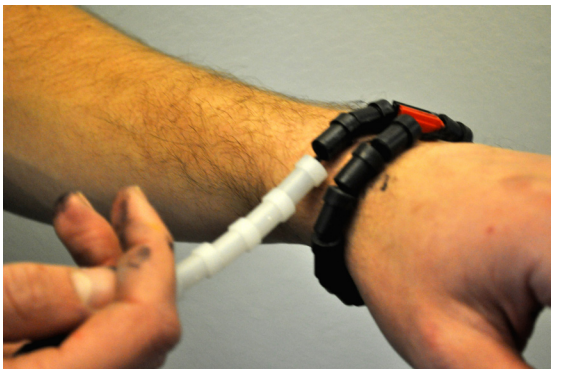
This group visualized the reasoning behind their concept in the mind map shown below. They made a clear distinction between real-time measurement and feedback and the possibilities of reflection afterwards. The concept created by this group is a modular system of sensors, connected wireless to an iPhone. According to user preferences and habits a combination of sensors is chosen to measure stress.



The pictures below show a sensor watch, a shoe inlay and the iPhone. The iPhone shows a possibility to ask the user to reflect on the measurement to calibrate the system. The output is not yet defined, but could be in the form of an iPhone application.

Concept group 2 (Dick, Mark, Nina): Bead-your-stress

This bracelet makes you count to ten. It exists of two loops of beads. One is fixed and measures stress, while the beads on the other can be moved around. When the bracelet detects stress in the wearer, one side of the second loop is detached. Now the wearer can play around with the beads and calm down. This action is inspired by the Greek men that play with their ‘komboloi’, a string of beads.



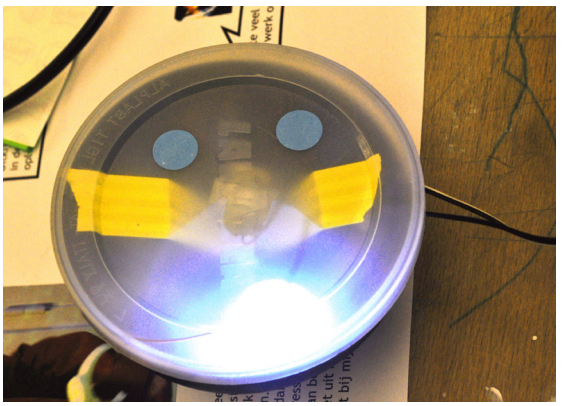
The number of beads that you have to move while playing depends on the stress level measured. By letting the user shift his attention to the beads, he will get out of his (negative) thought loop.

Concept group 3 (Edwin, Thatcher, Joost): Wobbl.e

Before creating a concept the three important aspect of the design problem are discussed and desired properties are defined:

- A wearable sensor that can be worn invisibly or disguised
- A subtle, personal signal for feedback
- An associated action that relativizes the stress

This concept is based on the idea of externalizing one's problem with stress by assigning them to an object. This means that besides a wearable including sensors, also an external object will be designed.



Wristband

The sensors are integrated in a simple, neutral wristband (like the "live strong" etc. wristbands). This wristband contains an actuator as well, probably a vibration or contraction, as a subtle signal to the wearer. Furthermore the data is transmitted to the iPhone using Bluetooth or something alike. The iPhone logs the data and controls the wobbl.e

Wobbl.e

This is the external unit, resting on the user's desk for example. The wobbl.e start wobbling when the user gets tensed. The more stress the user experiences, the more it moves. It will however not start shaking heavily, it stays a calm movement, inviting the user to pick it up and hold it for a moment. It will look like the wobbl.e is restless and needs attention, in stead of the user. This way the user is distracted from his work or situation and focuses on the object.

IX Consultation of Mariëlle Post

March 2nd 2010

- Job consultant / supervisor Werkpad

Setup

The setup of this interview and the interview with Peter Vos later on, is a presentation of all concepts in the same order as described in the report. It is proposed as a scenario: “Image that a person with autism is at work and that the pebble vibrates.” The scenario and the question asked are noted below, but they are in Dutch, because the interviews were conducted in Dutch.

Testen mogelijke richtingen biogids. Allereerst een wearable, op het lichaam om stress te meten. In dit geval een horloge. Stel je voor, stress stituatie, horloge meet stress. Verschillende manieren om hier feedback op te geven. Bijvoorbeeld integraal. Het horloge geeft een tril signaal af.

- *Wat vind je van het tril signaal? Subtiel? Opvallend?*
- *Zou je schrikken als je ineens zo’n signaal krijgt?*
- *Zou je zelf weten wat te doen in zo’n geval?*

Het signaal zou ook anders gegeven kunnen worden. Bijvoorbeeld op je telefoon. Door middel van een smsje, of een speciaal programma. Misschien een programma om je takenlijst bij te houden. Wanneer je gestresst raakt moet je deze misschien wel aanpassen.

- *Wat is je eerste indruk van de applicatie?*
- *Hoe zou je je voelen bij het gebruik hiervan?*
- *Zou je zoiets elke werkdag willen gebruiken?*
- *Zou je het vaak gebruiken op een werkdag?*
- *Als je gestresst bent, zou je dan je planning aan passen?*
- *Wat is de toegevoegde waarde van een waarschuwingssignaal?*
- *Zou je dit graag op je telefoon doen, of op je computer bijvoorbeeld?*
- *Zou je dit delen met je collega’s?*

Ik zou me kunnen voorstellen dat je in geval van hoge stress soms geen zin hebt om aan je planning te werken. Je wilt vooral rustig worden. Veel mensen gebruiken ademhaling om te kalmeren. Dit dingetje zou je hierbij misschien kunnen helpen.

Als je gespannen bent zal het een trilsignaal geven. Je kunt dan zelf aangeven hoe je je voelt door eraan te draaien. Als je dit hebt gedaan zal het dingetje in een heel rustig ademhalingsritme gaan gloeien.

- *Wat is je indruk van dit steentje?*
- *Begrijp je het gebruik?*
- *Hoe voel je je bij het gebruik hiervan?*
- *Hoe is het om je eigen spanning te moeten beoordelen?*
- *Zou je dit willen gebruiken? Hoe vaak?*
- *Zou je dit aan je collega's laten zien?*
- *Zou je hem in je zak houden? Of in je tas, bureaulade, etc?*

We hebben nu nog een alternatief, waarbij je niet bewust aan de slag gaat met je planning of ademhaling, maar hopelijk wat ontspant door een spelletje te spelen. Het is een eenvoudig klein dingetje, waar je af en toe tussendoor mee kunt spelen als je te gespannen raakt.

- *Wat denk je van dit spelletje?*
- *Zou je hiervan ontspannen?*
- *Zou je dit op je werk kunnen spelen?*
- *In welke situaties zou je dit gaan spelen?*
- *Speel je wel eens (computer)spelletjes op je werk?*
- *Zou je zo'n simpel spelletje gauw zat worden?*

Tot slot:

- *Wat is je favoriete oplossing?*
- *Waarin verschillen deze richtingen van jouw droomproduct?*
- *Wat zou je hier nog aan willen aanpassen?*
- *Denk je dat dit je zal helpen om minder gestresst te raken?*
- *Wat vind je ervan om tussen je werk door dit soort dingen te gebruiken?*
- *Wat zouden je collega's of baas hiervan vinden?*

Results

Job coaching

In her profession Post supports clients as a job coach. Her clients apply for the support of a job coach at UWV (Uitvoeringsinstituut Werknemersverzekeringen, Institute for Employee Insurances) and get an allowance for a number of hours a month. When a client is about to start at a new job, Post informs both the managers and coworkers

in the company. In most cases she meets the clients at their work on a regular basis. The client comes up with subjects to talk about himself.

People with autism can get an acute blockade when they experience stress. They start reasoning in circles and cannot get out. Some of them have to call their parents to get out, because they are often the most important people in their lives.

Uncertainty or Insecurity is often at the basis of stress. When they loose overview, don't know what to do, or are not able to complete a task they get tensed and their functioning decreases rapidly.

There are many different ways these employees with autism try to deal with their stress. The possible solutions are mostly discussed and agreed on with a job coach and sometimes the managers. Some go to the toilet when they are tensed, some go for a walk or read for a while.

Some are very good at hiding their stress and frustration at work. Their tension only surfaces when they arrive at home. These escalations can give their parents or care takers a hard time, not knowing what it is all about, but also the person himself, who is often feeling ashamed for such escalations.

Often they can analyze and explain such a situation in hindsight, but not at the very moment. However, it often happens that at the time of a job coach meeting the situation is already too long ago to get to know the real causes.

General feedback

The concept of measuring stress and presenting the user with feedback on this stress is received very positively by Post. She thinks a timely warning might indeed help avoid escalation when the signal is appropriate.

For some people the measurement could lead to fixation on the stress values. She does not expect this to be a big problem, but for some individuals it might be better not to see the value all the time.

Planning application

A planning can help people with autism a lot. Post knows some clients of her are using the pomodoro technique (http://www.pomodorotechnique.com), which combines a simple to-do-list with a 25 minute timer. The user pick one task to do, sets the timer and concentrates on this one task only for 25 minutes. After every task a break of 5 minutes is allowed, after every fourth a longer break. This method helps with focus and concentration, which create a peace of mind that helps avoiding stress.

Post questions the appropriateness of such an application at times when the user is experiencing stress. The biggest handicap is that stress has such a big impact on their functioning. The overview of tasks might help avoid stress, but reorganizing tasks can be a challenge for a user that is stressed.

Breathing stone

Post knows about breathing exercises used for relaxations, but does not know clients that use this technique in daily live. She thinks it might help avoid escalation of stress, like counting to ten is supposed to do, when it is a very simple task.

When stressed, people with autism fall back onto well known habits. The breathing exercise should become such a habit in order to be effective. It should become a ritual that makes them feel secure again.

Game

Post cannot say much about the expected effectiveness of a game to relieve stress. She thinks it is highly personal whether someone would like to play games when stressed and feel relaxed after playing such a game. This applies to the other concepts as well probably, but to a smaller extend.

Interface

Availability of the recorded data could help job coaches in understanding more of the situations and could lead to interesting conversations, but it depends on both accuracy and readability of the information. Post would have to see the data first in order to have a good impression. This so called bio-profile could possibly be linked to the profile sketches they started using recently. The profile sketch is a new tool for job coaches to record a client's personal traits and preferences. This way the information is easier communicated to employers as well as other job coaches.

X User evaluation

In order to make a good decision between the different concepts, they are evaluated in collaboration with both experts and target users. The session with the target users is described in this appendix.

Method

The interviews were conducted individually, except for Ben and Rick who were interviewed together. Two interviewers were present, Dick van Dijk and myself. The questions were postulated alternated and informally. Both interviewers took notes of the interviews, both concluding answers and quotes were noted. The two interviewers allowed for one accurate notation while the other could continue the interview.

The sessions were structured like a hypothetical scenario. After a short introduction the users were asked to think of a daily work and particularly a situation that could cause them to feel stressed. They were asked to put on the wrist watch and imagine it would measure stress. Then they were presented with a vibration signal through this watch, followed by the question what they would think of such a signal in their daily work. To the right a picture of a participant wearing the watch and trying the breathing stone.

Next the possibility of a signal on a mobile phone and an attached planning application were discussed using the mockup on a computer. Subsequently the model of the breathing stone is introduced as a way to relax by means of a breathing exercise, before solving the problem causing stress. Then the game model is handed to the participants and it is discussed whether this distraction could help them relax. In the previous session the possibility to access the data was discussed, in this session it was only discussed briefly.

Finally the session is concluded by summarizing one's opinion. A preferred concept is selected and possible changes or additions are inquired. The preferences are linked to the 'dream product' created in the preceding generative session in the case of the participants that were present at that time.

Results

The feedback provided by target users in the interview sessions is presented below, organized by concept direction.

Wearable

The wearable is accepted as a necessity to measure stress. Most participants like the fact that this function is integrated in a wrist watch, though only one of the participants was wearing a watch. One of them mentions that he would like to select a watch himself to make sure it is his style. He would appreciate either a fancy watch, or an extension to add to a regular watch.

Some participants indicate that they would accept a chest belt as well to measure heartbeats. Some for the reason that it would be invisible, another participants just wants it to work, no matter in what form.

The vibration signal is found to be accepted by every one of the participants. It is called subtle, personal and still clearly noticeable. One participant states that if one chooses to use such a product one will get used to it and not get startled by it.

Some of the participants indicate they know what to do when a wearable would tell them they are experiencing stress, but others indicate that a signal on itself is not enough. The signal has to come at an early stage of the stress building up, the signal can become more urgently depending on the level of stress. Or different activities can be suggested depending on the stress level.

“In early stages of stress, there is still a way out.” -Henk

“When you get such a signal, the question is: what to do?” -Jeroen

Planning application

Most participants indicate that a planning application will not solve their problems with stress. Some indicate that it might help to avoid stress by organizing tasks in such a way that one only has to deal with one task at a time. However, it is not suitable for usage at the time when one is experiencing stress. This means there is no added value perceived in connecting such an application to a stress monitor.

“Even when I know what to do next, I stay stressed...” -Ben

The option to forward or reject tasks is considered interesting, but only when feedback is received on what happens to the task. Otherwise they still have the feeling of responsibility. Some participants indicate that forwarding a task by means of an application is too impersonal.

“It is not enough when it disappears from my listing, it has to disappear from my mind.” -Henk

Pebble

None of the participants has experience with using breathing exercise. Some indicate that they have heard of it as a way to relax and all of them are open to try it out. Some raise questions on the discipline needed for the exercise, but are prepared to give it a try. Even though it does not directly help with solving the problem causing stress, the participants accept the exercise to help them deal with the situation.

Probably the reflection on one’s stress level is a good possibility. Some participants indicate they can think about their feelings only after being asked. It will not come to mind naturally that they are experiencing stress, but when thinking about it they might recognize symptoms and evaluate their feeling.

The idea of an external object is received with mixed opinions. Some like the physical object to show others when they are stressed (as one participant does with printed card already), one is afraid to get asked about the object by coworkers, others indicate they would isolate themselves for a moment to use the product, in the same way they do when they receive a txt message on their mobile phone.

“Physical disabilities are visible to others, not my mental (in)capacities. I would like to show this to others: for me it’s a good thing to put the solution outside of myself.” -Henk

“It has to look like something normal.” -Mathieu

Game

Observation indicates the participants like to fiddle around with the game. Most of them fiddle around with different objects large parts of the interview. This seems to connect to the basic idea behind the game.

However, this concept was not very popular among the participants for various reasons. It is not perceived as a constructive way to deal with a stressful situation. Most participants indicate that they do not want to play a game when experiencing stress. They want to get rid of the stress, either by solving the problem causing stress, or by reducing the stress itself. Avoiding the situation is not appreciated by the participants.

Connecting the game more directly to the stress level of the user might improve the concept, but still most participants do not believe in playing a game when stressed.

“I don’t want to avoid the problem, I want to solve it.”” -Ben

“When I am stressed, I cannot concentrate on a game, not even tetris.” -Mathieu

General remarks

Two of the participants emphasize that it is important to have a fixed response to stress, to avoid that the user has to rethink this every time he experiences stress. It can either be an agreement one makes with himself or a job coach, or an activity prescribed by the product.

One participant indicates he does not want random quotes or hints from a product telling him what to do. It should either be a personal advice by a human, or something abstract; nothing in between.

A possibility for the user to check his stress level manually is considered valuable. This way one can for example take his stress level into account when making a planning for the rest of the day.

Furthermore, some participants suggested implementing a way to enter information about the situation or problem causing stress. Preferably this should be entered after the stress experience, when the user is more capable of reflecting on the situation. Afterwards this information can be analyzed, for example with a job coach.

In order to calibrate, the product should ask for feedback on the measured stress level. One participant suggests that the product could also ask for input at random moments, to improve the calibration.

Some participants indicate a desire to let others know how they feel, not only the people around them, but possibly family or job coaches as well. The possibility of sending text messages to these relatives is discussed and turns out to be a controversial subject. Some like the idea, but others are very strong against it.

XI Consultation of Peter Vos

April 6th 2010

- Job coach / job finder at Jobstap

Vos visits clients at their work and works with them to find out what the problems are. He also informs supervisors about the employee and his/her characteristics. One thing that he stresses immediately is the differences of people with an ASD. The ones with most problems to find and keep a job often have an intellectual disability as well. Those people lack an exploration drift that other have, to try new things and learn by experience. Therefore it is hard to learn for them.

General feedback

It is an interesting thought to give them insight in what their body is doing. It might lead to a focus on the device, or even testing the device by evoking stress in oneself. However, when someone is getting used to this product at a young age he can profit later on.

Not everyone with an ASD accepts his diagnosis and those people are often not willing to accept help. On the other hand, it might be introduced as something that is part of the job. When a job coach and a supervisor but advice someone to use such a thing it might work (not enforcing, but insisting). When they notice that the product helps, they will accept it.

In mental-motorical therapy stress is evoked to get the participants to experience stress physically, in order for them to recognize symptoms in daily life.

It is not sure whether insurances will reimburse such a product, but maybe the employer can ask for a government allowance. The training to use the product could be done in regular job coaching hours that are paid for by the government.

Planning application

Organization helps them a lot in avoiding stress. With some of the clients Vos had to make them clean their desk every Friday in order for them to work more relaxed and efficient.

An application to organize tasks might help them in focusing on their work. The application could maybe present only one part of the to-do list at a time, not everything at once. However, this might lead to dependency on the application, while the goal is really independency of the client.

Breathing stone

This might work really well, maybe even with lower functioning. People with an intellectual disability need to be reminded of behavior alternatives all the time. This stone could attract their attention and tell them to breathe easily for a while.

Some coaches work with the ‘traffic light’ method. When someone is getting angry you ask them: “How angry are you now?” The participant has to reflect on his own feelings and choose one of the colors of the traffic lights: green, I’m okay; orange, I have to stop while I can; red, I lost control.

Game

For people with an ASD it is hard to switch between tasks. With this game you want to get them out of their task to do something else: this will not feel natural for them. On the other hand, maybe some in situations it is a good thing to drag someone out of this situation. When things are about to go wrong it might be the only solution.

Interface

The value of the data and the interface is dependent on the results that show up. It might give insight in the problems one encounters, but the question is whether this is easily deduced by job coaches.

In Vos’ opinion the clients should be in charge of all the data and decide how they want to use this. A division should be made between working hours and leisure, because a job coach only works with job related problems. The user might however decide to use such a product outside of his work as well when it works for him. Time slots for measurements or for logging might be a solution to maintain one’s privacy.

Setting options are important, especially because the people with an ASD differ very much from one another. With setting the preferences a job coach could probably help, with some kind of training to get acquainted with the product.

VIII Excisting products and concepts

In this appendix the products analyzed in the market analysis are presented one by one. In the report only the categories and some examples are discussed.

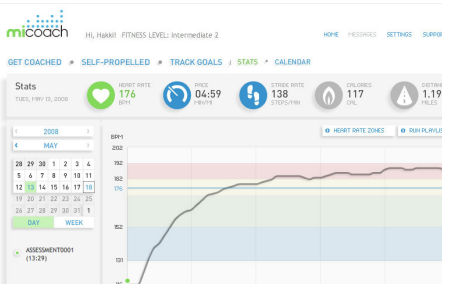
Sport & exercise

Nike+ Sensor and SportBand

The Nike + Sensor measures pace, distance, time and calories burned. This information is wireless transmitted to either a Nike+ SportBand or a iPod/iPhone. This information can be uploaded to a website to track progress and achievements.

Adidas & Samsung: miCoach

Quite similar to Nike's system, the miCoach records pace, distance and time and calories with a shoe sensor. However, this system can be enhanced with a heart rate monitor in a chest band. All data is sent to a special Samsung phone to record and display information.



Polar Training Computers



Polar watches do more than displaying time: they measure heart rate and calories burned and have many settings for time recording and aerobic zone-warnings. The functionalities can be enhanced by connecting extra sensors like ECG, GPS and cycle cadence sensors.

Fitbit

The fitbit measures steps, distance and calories, just like the products mentioned above, but also sleep quality. It only contains a 3D motion sensor, so I doubt the accuracy. The product gives an insight in one's daily movement, rather than being a sport coach.



Stress & relaxation

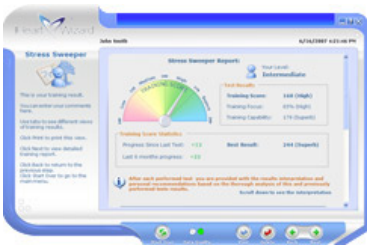
StressEraser Portable Biofeedback device

This product is used to do breathing exercises in order to relax. The infrared sensor measures pulse, to compute the Hearth Rhythm Variability (HRV). From this HRV one's breathing pattern is derived and plotted on the screen. The device suggests moments of exhaling and rates the curves of the user´s breathing. This way the user can score point with breathing regularly and calm.

Emwave biofeedback stress reliever

The Emwave works quite similar to the StressEraser. By means of a infrared sensor the Emwave measures blood saturation in finger tissue. From this data it computes pulse and HRV. When the HRV is irregular, Emwave will indicate this. It also shows a breathing pattern to regulate the HRV, using the blue led bar.

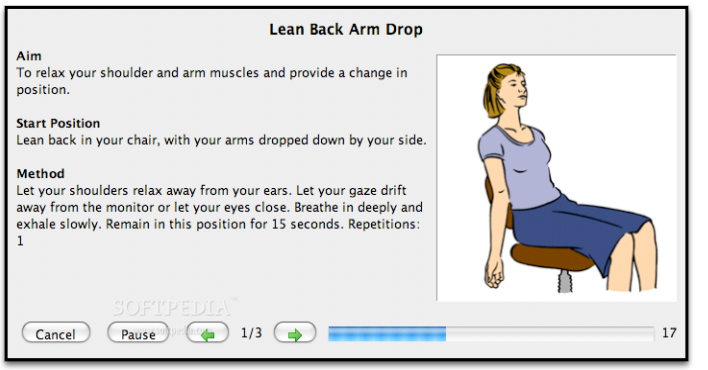
Stress Sweeper



Stress sweeper is meant for 5 to 15 minute sessions to relax. It shows a breathing pace on a computer screen which te user should follow. It makes use of an ear clip or fingertip device connected to an USB port to measure breathing pattern. After a session Stress Sweeper will generate a report with achieved results.

Wellnomics WorkPace

This software monitors computer use (keystrokes and mouse movement) and suggests pause moments to the user in order to prevent Repetitive Strain Injuries. Preferences can be set about break time and frequencies; normally one is suggested to take a micro break of 8 seconds every 6 minutes and a longer break of 8 minutes every hour. This should prevent chronic muscle strain and following injuries.



ThoughtStream personal GSR biofeedback system

This system measures the Galvanic Skin Response (GSR) by means of a hand palm sensor. The feedback is provided by a tone and by LEDs in different colors, but the system can also be connected to a PC. This way the user can train by playing some different games.

Thought Technology GSR Temp 2X Biofeedback Stress Monitoring Device

Just like the ThoughtStream described above, this device is measuring GSR, but also skin temperature. It is providing feedback by means of a tone that is changing pitch according to the GSR values and a visual analog meter. The GSR and temperature are measured either by the finger sensor that can be held in a hand, or by the two

electrodes that can be attached to the hands or feet. The device comes with a CD with a relaxation program.

My Beating Heart

This pillow is not measuring anything at all, it simply provides the user with a heart rhythm. Every time it is turned on it generates a unique rhythm that gradually changes over time. Holding the pillow for some minutes should relax the body and ease the mind.

Stress ball

The stress ball is a famous example of a simple stress relieving product. Its principals can be linked to the relaxation method ‘Progressive Muscle Relaxation’, which is based on alternately tensing and relaxing muscles to reach a deeper relaxation.

Health & Wellbeing

Wrist blood pressure monitor

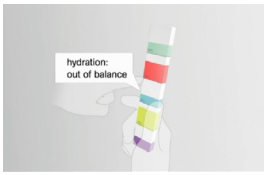
This wrist blood pressure monitor is meant for home use measures systolic and diastolic blood pressure and pulse. It also detects irregularities in heart rhythm. This data can be stored with a date and time stamp.

InterX Neurostimulation Technology

Neurostimulating technology for professionals as well as home use, this device is meant for pain relief. It is used for trigger point treatment to stimulate the nerval system and the body's natural pain relieving systems.

Philips Nutrition Monitor

The Nutrition monitor is just a concept at this moment, part of Philips'research into future possibilities. It consists of three parts: a sensor pill that the user har to swallow, a scanner to measure nutritions in food and a display. This way the user should be provided with real time data what to eat and what not to eat.



Hästens MindSpa

The famous bed manufacturer also created MindSpa, a audio player with attached led light glasses. It plays audio, light and color patterns to move the mind into the desired brain state: either a deep relaxed or a cognitive stimulated state. It is a passive systems, without specific input.

Zeo Personal Sleep Coach

This Sleep Coach monitors one's personal sleeping patterns and log them. It is meant to help the user improve sleeping quality over time by offering insight in these patterns. The headband picks up electrical signals produced by the brain while sleeping and sends them to the de side alarm clock. The data can be uploaded onto a website as well. Furthermore it offers an alarm function that detects the best moment to wake up within half an hour before the alarm time.

InterCure RESPeRATE

The RESPeRATE is used to lower blood pressure and heart rate in four 15 minute sessions a week. With a strap around the chest the RESPeRATE measure breathing pace. Via headphones it offers musical and verbal cues to gradually slow down one's breathing.

Wellness Connected Wireless Health Monitor

Games & gadgets

Wii Vitality Sensor

This concept accessory for the Nintendo Wii contains a pulse oximeter to measure pulse. Nintendo intends to do more than just reading heartbeats: it could use this information to let one achieve greater relaxation. Since it is just a concept it is not announce what games should work with this device.

Neurosky Mindset

This headset reads electric impulses generated by the brain. This data is interpreted and used in gaming environments, for example one's concentration could be used to influence in-game characteristics such as speed or accuracy.

Heart rate mouses

These computer mouses, respectively from Asus an Yanko design, contain infrared sensors to detect pulse. Asus' model transfers this data to the pc and displays it using some software, while Yanko's mouse comes with a USB display unit to read out the data.

Philips & ABN Amro Rationalizer

The Rationalizer is a emotion mirroring system developed by Philips in cooperation with a bank for stock traders at home. It measures GSR with multiple electrodes in a wristband, the emotional status of the wearer is displayed on the outside of the wristband as well as on an external bowl with led lichts that changes color and intensity.

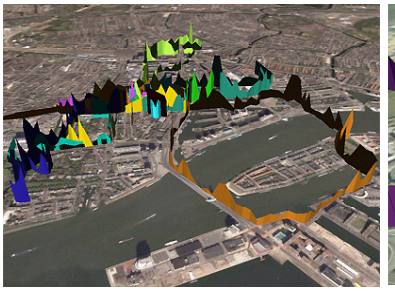
Microsoft Life Recorder

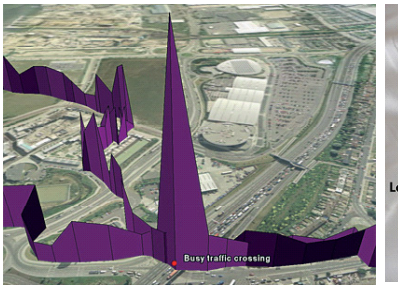
This Life Recorder is just a concept, already ten year old, from Microsoft. It is intended as a wearable that takes a picture every few seconds and records sound all day long. Together with a GPS tag and time stamp all this data will be uploaded and available online. The hardware is not a proble, nowadays such a device could already be much smaller than the one shown in the picture. More of a problem is the data handling; transcribing and storing all the footage would take a lot of space and processing.

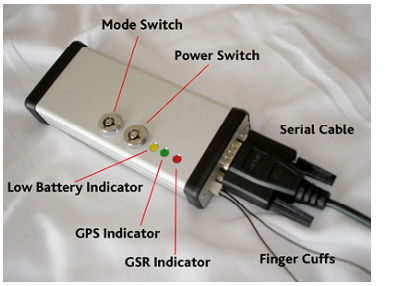
Emotion & Expression

Emotion mapping

In this project participants wear a device measuring their Galvanic Skin Response, which is stored together with GPS tags. Later this can be visualized using Google Earth. As an art project some cities are mapped emotionally this way. The figures below show examples of the outcome.

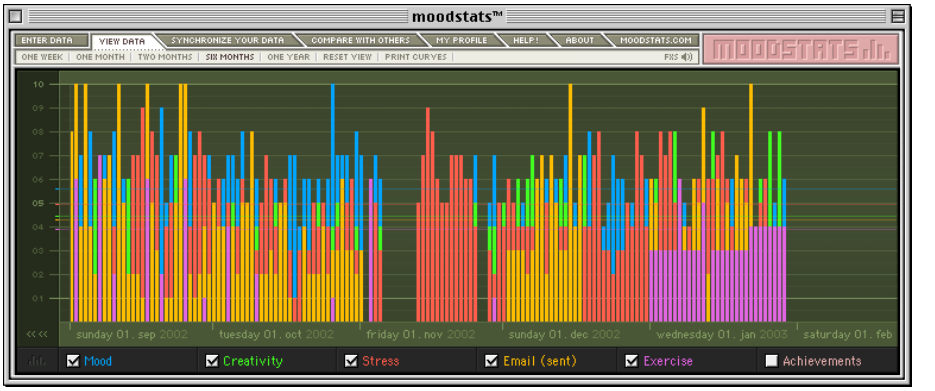






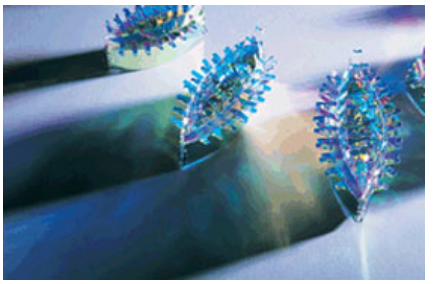
Moodstats

Moodstats is a software tool to visualize one's moods over time. It relies on self-reflection; the user has to assign values to six parameters (mood, creativity, stress and 3custom parameters). The program saves these values and allows the user to view his or her history on these scales.



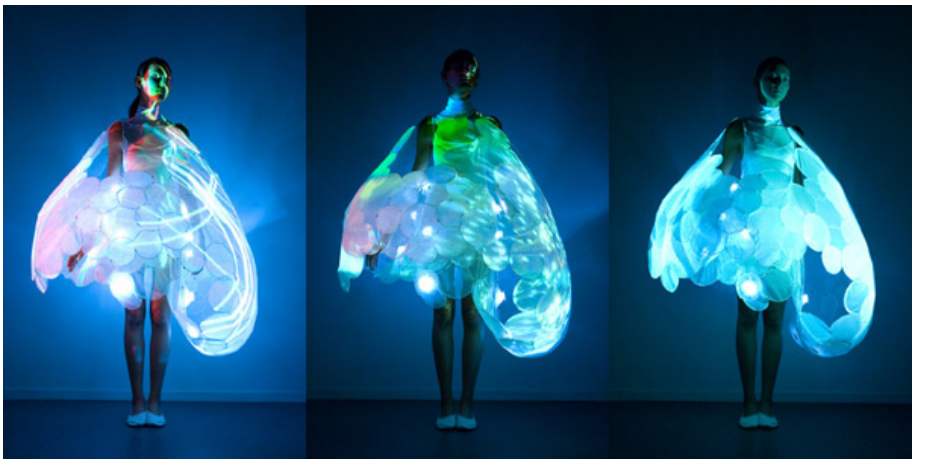
Interactive Ornaments

Sompit Moi Fusakul created accessories that react to emotions, based on heart rate. 'Vein2', shown in the picture below, turns from blue to red with a rising heart rate. Another piece, 'Anemone' lights up with e very heartbeat. The idea behind is that the wearer brings the pieces to live.



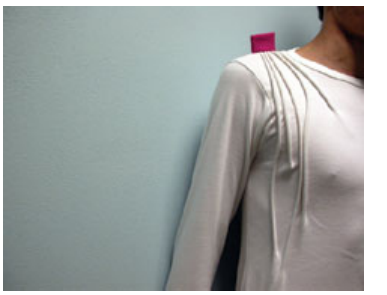
Philips 'Bubelle'

This mood-sensing dress, designed by Lucy McRae uses sensors in the tight fitting inner to detect the mood of the wearer. This information influences the color of the light emitted by the dress. Philips is also working on interactive tattoos that respond to emotions or gestures of the wearer.



Fashion victims bags

The design collective questions social issues with their projects. They are working on a fashion line that reacts to electronic pollution. The print on the bags shown below changes shape and color, according to the intensity and frequency of the perceived electronic pollution.

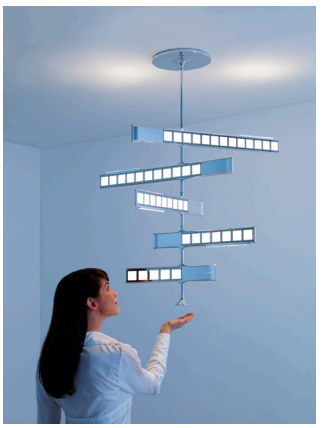


Emotional T-shirt

This T-shirt allows the wearer to display his or her emotional status, using the LED face on the shirt. The user has to select one of the emotions, happy, sad, surprised and winking, himself.

Philips OLED Lightning

Philips introduced some lightning concepts based on Organic LED principles. The lamps react to the presence of people and can be adjusted with hand gestures. A OLED wall was created to invite passer-byes to play with it.



Biometric Bar

This bar is an art project exhibited in Rotterdam. It intends to provide its guest with the most suitable consumption. Therefore the guest has to take place in the chair where some physiological functions are measured. Based on this data the machine can for example prepare a coffee or offer a energy bar.

Security & safety

Febrile Screening System

A non-invasive system for detecting people with fever is developed in the United Kingdom. A high resolution infrared camera can detect the slightest changes in temperature (up to 0,05oC) at as distance, without contact and software can point out feverish individuals. It can be used to scan crowds, for example people on transit on an airport to prevent mass outbreak of flu.

Lie detector

Lie detectors are developed in many different setups, mostly using a variety of sensors like temperature, GSR, Electrocardiograph or Electroencephalograph. This is why the equipment is called a polygraph. The suspect is interrogated and from the readout of the polygraph it is examined whether one is telling the truth. Control questions are asked to verify readings.

Driver Fatigue Bracelet

This bracelet measures whether the wearer is awake when driving, in order to avoid traffic accidents. By means of an RFID chip it only start measuring when inside one's car.

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