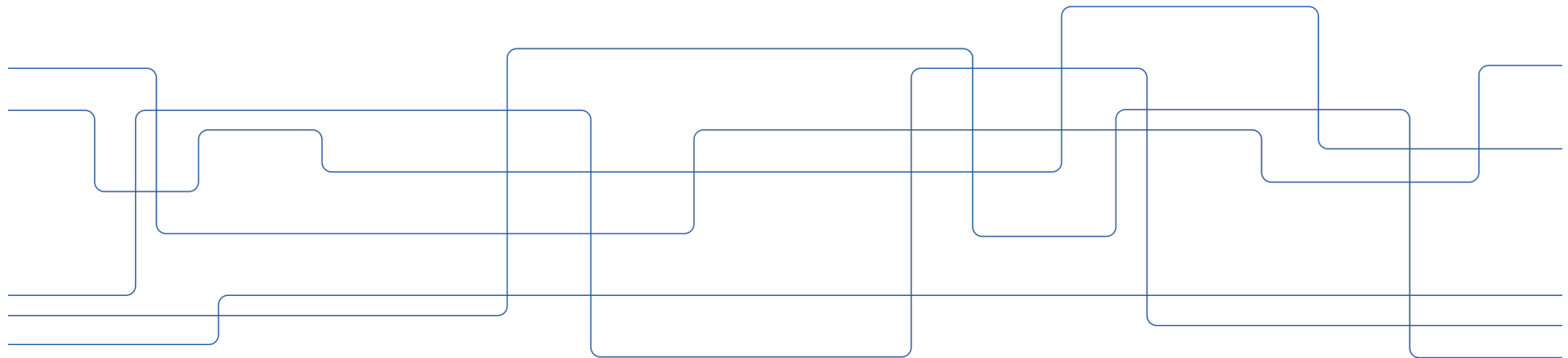




”Spotlight seminar”

Björn Hedin bjornh@kth.se





This presentation

- Who am I, what is my background
- Which research projects am I involved in now
- Paper presentation – “The energy piggy bank – a serious game for energy conservation”
- Discussion
- Presentation of the paper
“The behaviour change wheel: A new method for characterising and designing behaviour change interventions”





About me

- Product of KTH
- Civilingenjör in computer science at KTH
- Started as doctoral student in “graphic arts technology” but found the subject rather boring
- Switched to mobile learning and got a Ph.D. in media technology 2014 and have since (and before) worked at the department of media technology and interaction design at EECS, as program director, director of studies and other things
- “Faculty pedagogical developer” 2014-2017(?)
- Have in recent years worked in designing digital behaviour change solutions for sustainability





Current activities

- Will be course responsible for course LH215V Learning for Sustainable Development
- De facto supervisor for one doctoral student at MID/EECS (still not docent so I can't be main supervisor)
- Currently working in five different research projects
- ... And this keeps me quite busy





Project 1: Designing digital technologies for supporting energy-related behavior change in the kitchen.

- Aims to design, develop and evaluate digital behaviour change tools to help households change energy and resource-intensive behaviours related to kitchen practices.
- I am project leader
- Funded by Energimyndigheten





Project 2: Smart storage solutions in the fridge of the future to reduce food waste.

- develop and evaluate cheap, smart storage containers for food to be used in existing refrigerators, combining non-technical solutions such as color coding, with cheap technical solutions such as RFID tags and QR codes, aimed at increasing "food supply awareness".
- I am project leader
- Funded by Vinnova





Project 3: A systematic review of scientific literature on digital behaviour change interventions for more sustainable energy behaviour

- Literature review investigating the current state of research regarding digital behaviour change interventions aiming to affect households' direct energy use in a more sustainable direction.
- I am project leader
- Funded by Formas

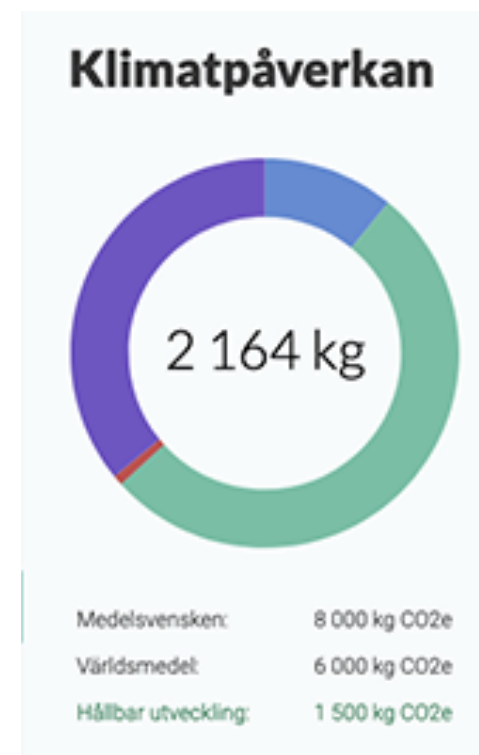


Energy Review



Project 4: HabitWise - Creating Sustainable Everyday Habits

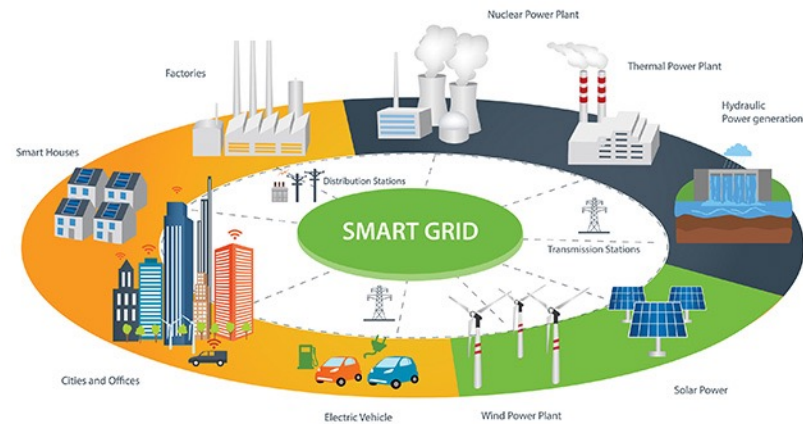
- Explore how organizations as intermediaries can support people to change their habits to become less harmful for the climate, especially regarding energy use and travel.
- Cecilia Katzeff at ABE is project leader
- Funded by Energimyndigheten





Project 5: Smart grid stories from the home and participation in future electricity systems

- Study the introduction of the second generation of smart electricity meters and smart grid technology in housing through behavioral scientific methods, focusing on differences in households.
- Cecilia Katzeff at ABE is project leader
- Funded by Energimyndigheten





Now for paper presentation



- The Energy Piggy Bank
 - A Serious Game for Energy Conservation

 - Why this paper?
 - Not the best paper I have written but...
 - A good example of what I do and have done
 - Uses several frameworks that can be interesting
-



Introduction



- **Problem**

- 78% of Swedes think they can reduce their climate footprint 58% don't know how (Naturvårdsverket, 2018)
- Many people lack knowledge and motivation about how to conserve household energy.

- **Goal**

Help people to conserve household energy

- **How**

Make a “serious game” about energy conservation, addressing knowledge and motivation. The **Energy Piggy Bank**.



Why games?

- **Games can be very engaging. “Engagement Design”**
 - **Gamification** = *“the use of game-elements in non-gaming contexts”*
 - Old-style gamification: Points, badges, leaderboards – can be bad, extrinsic motivation
 - Newer gamification models focus on intrinsic motivation
 - A lot of what we see at universities are in principle old-style gamification
 - > Points: Course credits, test scores, measurability, citations...
 - > Badges: Gather “badges” to get promoted, titles...
 - > Leaderboards: H-index, university rankings...
 - **Serious games** = *“any form of interactive computer-based game software for one or multiple players to be used on any platform and that has been developed with the intention to be more than entertainment”*
-



This Presentation

- Overview of “the game”
 - The theoretically based design of the game (this is what I think is most interesting)
 - Some results
-



The basics

- Web based collaborative game
- A team works together to work with habitual and one-time energy savings
- Both educational (know what to do), persuasive (see the importance of some actions) and habit building



Demonstration The room view

Nu ska vi spara energi! Välj ett rum för att se vad du kan göra där!



KÖKET



SOVRUMMET



BADRUMMET



TVÄTTSTUGEN



VARDAGSRUMMET



Sample Room - Livingroom



Du befinner dig i **Vardagsrummet**

Här nedan har du energi-tips! Se ifall du kan checka av några av dessa idag



STÄNG AV MED
STRÖMBRYTAREN
ISTÄLLET FÖR MED
FJÄRRKONTROLL



VÄLJ ENERGIEFFEKTIV
ELEKTRONIK



SLÄCK LYSET NÄR DU GÅR
UT UR RUMMET



BYT TILL
LÅGENERGILAMPOR ELLER
LED



VÄDRA SNABBT MED
TVÄRDRAG



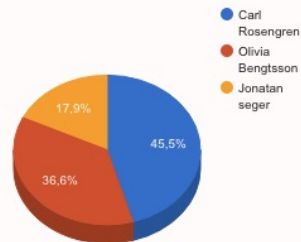
Scoreboard

Print1
Gemensamt har ni tagit

123

initiativ mot en lägre förbrukning!

Nivå 8 : Skogsmullar
123/126 till nästa nivå



Carl Rosengren Totalt: 56 moment



Kök:		17
Sovrum:		16
Badrum:		6
Tvättstuga:		2
Vardagsrum:		15

Olivia Bengtsson Totalt: 45 moment



Kök:		9
Sovrum:		11
Badrum:		6
Tvättstuga:		2
Vardagsrum:		17

Jonatan seger Totalt: 22 moment



Kök:		6
Sovrum:		4
Badrum:		1
Tvättstuga:		0
Vardagsrum:		11



Theories and frameworks used

- **For design**

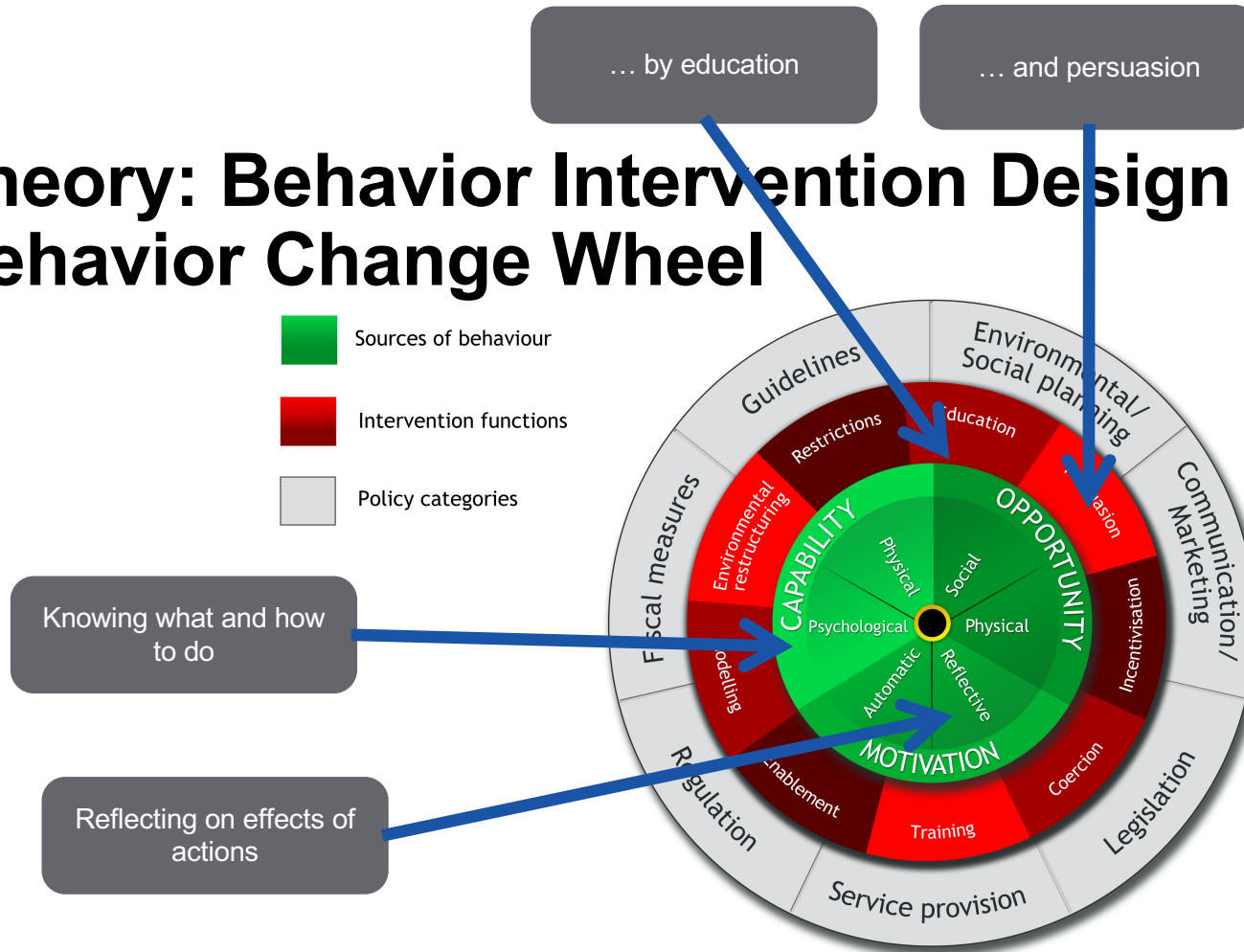
- Behavior Change Wheel (will talk about that in the second paper)
- Behavior Change Technique Taxonomy (BCTTv1)
- Bartle Player Types
- Werbach's gamification framework

- **For evaluation**

- Intrinsic Motivation Inventory
-



Theory: Behavior Intervention Design using the Behavior Change Wheel





Behavior Change Techniques used

Mapped to the “Behavior Change Technique Taxonomy”

- 2. Feedback and monitoring**
 - 2.1 Monitoring of behavior by others without feedback**
 - 2.3 Self-monitoring of behavior**
 - 2.7 Feedback on outcome of behavior**
 - 4. Shaping knowledge**
 - 4.1 Instruction on how to perform a behavior**
 - 5. Natural consequences**
 - 5.1 Information about social and environmental consequences**
 - 6. Comparisons of behavior**
 - 6.2 Social comparison**
 - 7. Associations**
 - 7.1 Prompts/cues**
 - 8. Repetitions and substitutions**
 - 8.3 Habit formation**
 - 10. Rewards and threats**
 - 10.8 Incentive**
 - 10.10 Reward**
-



Bartle Player Types

Achievers

Regard points-gathering and rising in levels as their main goal

Explorers

Prefer to expose the game's internal machinations. The real fun comes only from discovery.

Socializers

Like to connect with other people. The game is merely a backdrop, a common ground where things happen to players.

(Killers)

Like to impose themselves on others. The more massive the distress caused, the greater the killer's joy at having caused it.



Werbach's gamification framework

1. Define [business] objectives
 - facilitate behavior change that enables a reduction in household energy consumption
 2. Delineate target behaviors
 - do as many of the one-time energy saving activities as possible
 - try as many of the energy saving behaviors as possible
 3. Describe your players
 - A group, such as a family, who wants to decrease energy use
 4. Device activity cycles
 - daily reporting of energy saving activities performed during the day
 5. Don't forget the fun!
 - Well, kind of fun?
 6. Deploy the appropriate tools
 - Collaborative points, badges and leaderboards
-



Evaluate using Intrinsic Motivation Inventory

- **Likert scale with question covering (in our case) three areas**
 - **Interest/enjoyment** - Self-report measure of intrinsic motivation. Example question: ***“This activity was fun to do.”***
 - **Value/usefulness** - Self report measure of potential for internalization of behavior. Example question: ***“I think this is important to do because it can help me learn how to save energy.”***
 - **Perceived Choice** - Self report measure on the degree to which an activity is perceived as being subject to choice. Example Question: ***“I believe I had some choice about doing this activity.”***
-



Our study

- 33 engineering students participated (really too few for our method)
 - Use the system for 7 days.
 - Before
 - Questionnaire about current energy saving habits
 - Bartle Player Type test
 - During
 - Log daily activities
 - After
 - Intrinsic Motivation Inventory questionnaire
 - Self Estimated Behavior Change
-



Bartle Types vs IMI results

TABLE.1 IMI-Questionnaire Result

	Killer (N=6)		Achiever (N=7)		Explorer (N=8)		Socializer (N = 4)		Undefined (N = 8)	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Interest/Enjoyment	3,14	1,23	4,02	0,65	3,34	1,44	3,29	1,70	4,21	1,61
Value/Usefulness	4,55	0,71	4,51	0,80	4,98	0,73	3,57	1,87	4,88	1,57
Perceived Choice	2,05	0,97	2,78	0,87	2,38	0,70	2,43	1,06	2,70	1,28



Correlations

TABLE.2 Pearson's Correlation for dependent variables			
	Interest/ Enjoyment	Value/ Usefulness	Perceived Choice
SEBC	0,42*	0,38*	0,42*
Killer	-0,01	-0,04	-0,02
Achiever	0,27	0,11	-0,07
Explorer	-0,02	0,06	-0,07
Socializer	-0,12	-0,10	0,16

* Significant at $p < 0,05$.
SEBC = Self Estimated Behavior Change



What the participants planned to change most

- Turn off lights when leaving room 58%,
 - Disconnect chargers when not using 58%,
 - Use a lid when boiling water 55%
 - Switch to LED lights 48%
 - Shower quickly 48%
-

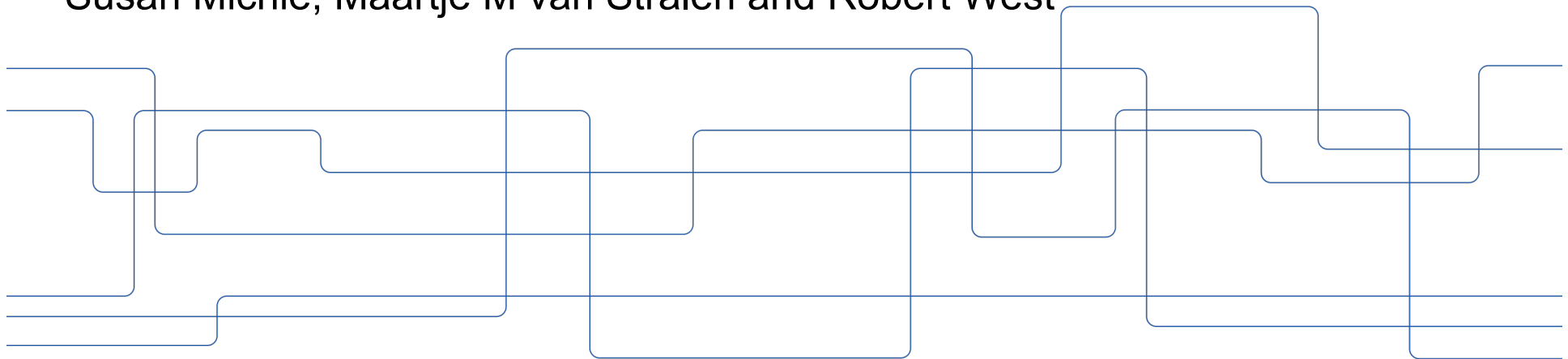


Summary (what you should remember)

- We developed a “serious game” for people to learn energy efficient behaviors using:
 - **The Behavior Change Wheel:** for understanding behavioral contextual factors, identifying barriers and choosing behavior change techniques.
 - **The Behavior Change Technique Taxonomy:** for categorizing the user (player types) and understanding how their different motivation and propensities.
 - **Bartle player types:** People find “games” motivating for different reasons
 - **Werbach’s gamification framework:** for designing a serious game intervention.
-

The behaviour change wheel: A new method for characterising and designing behaviour change interventions

Susan Michie, Maartje M van Stralen and Robert West





What and why?

- A need for better frameworks to design and analyze behaviour change interventions
- Synthesis of 19 different framework from several disciplines to one comprehensive framework
- Has become widely used, and I use it all the time
- Can be useful for “us” for many purposes
 - How to help/support students to study more/better
 - How to get students to fill out course surveys
 - How to get teachers to write course analyses
 - How to get teachers to take our courses
 - How to get teachers to use new teaching methods
 - ...

First: Sources of behaviour: COM-B

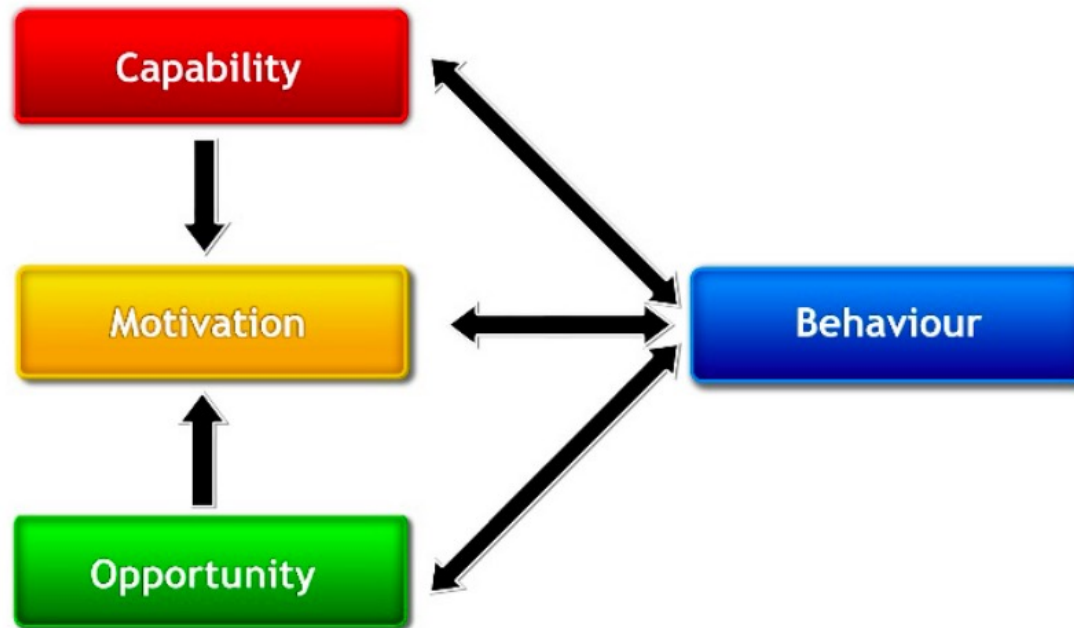


Figure 1 The COM-B system - a framework for understanding behaviour.



How to affect the sources of behaviour: Intervention functions

Table 1 Definitions of interventions and policies

Interventions	Definition	Examples
Education	Increasing knowledge or understanding	Providing information to promote healthy eating
Persuasion	Using communication to induce positive or negative feelings or stimulate action	Using imagery to motivate increases in physical activity
Incentivisation	Creating expectation of reward	Using prize draws to induce attempts to stop smoking
Coercion	Creating expectation of punishment or cost	Raising the financial cost to reduce excessive alcohol consumption
Training	Imparting skills	Advanced driver training to increase safe driving
Restriction	Using rules to reduce the opportunity to engage in the target behaviour (or to increase the target behaviour by reducing the opportunity to engage in competing behaviours)	Prohibiting sales of solvents to people under 18 to reduce use for intoxication
Environmental restructuring	Changing the physical or social context	Providing on-screen prompts for GPs to ask about smoking behaviour
Modelling	Providing an example for people to aspire to or imitate	Using TV drama scenes involving safe-sex practices to increase condom use
Enablement	Increasing means/reducing barriers to increase capability or opportunity ¹	Behavioural support for smoking cessation, medication for cognitive deficits, surgery to reduce obesity, prostheses to promote physical activity

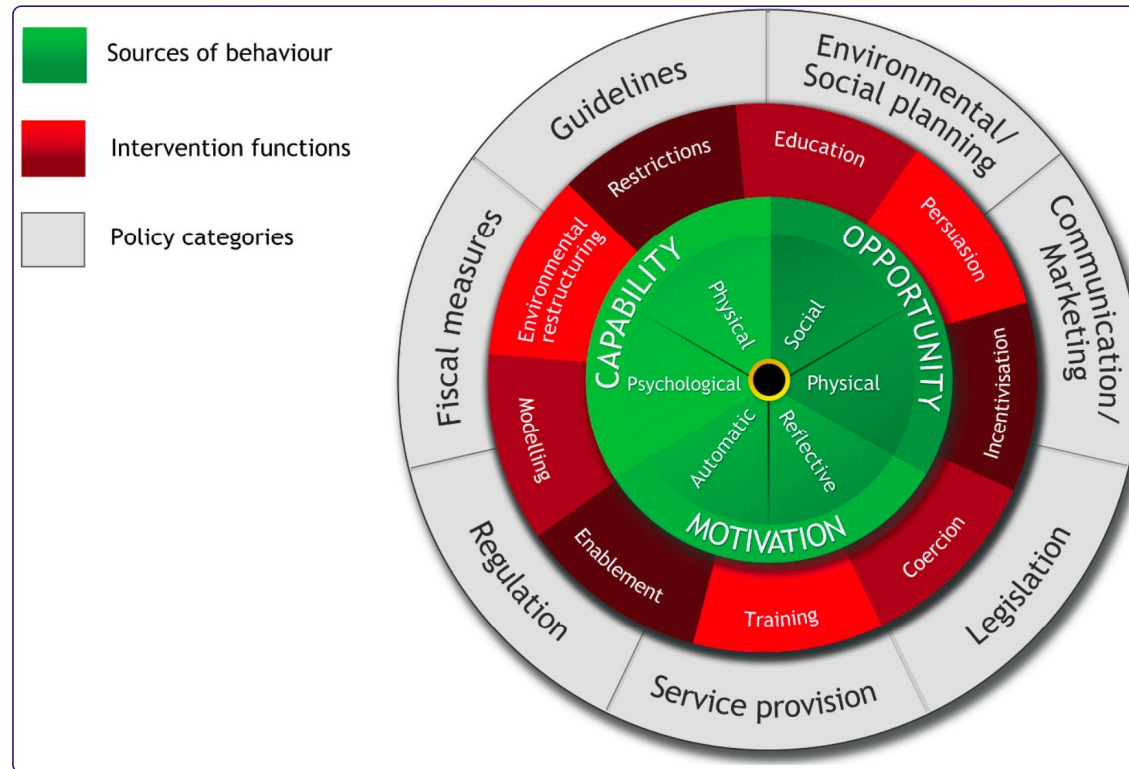


Policies to get intervention functions in place

Process system activity		
Policies		
Communication/ marketing	Using print, electronic, telephonic or broadcast media	Conducting mass media campaigns
Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision	Producing and disseminating treatment protocols
Fiscal	Using the tax system to reduce or increase the financial cost	Increasing duty or increasing anti-smuggling activities
Regulation	Establishing rules or principles of behaviour or practice	Establishing voluntary agreements on advertising
Legislation	Making or changing laws	Prohibiting sale or use
Environmental/ social planning	Designing and/or controlling the physical or social environment	Using town planning
Service provision	Delivering a service	Establishing support services in workplaces, communities etc.

¹Capability beyond education and training; opportunity beyond environmental restructuring

The behaviour change wheel





More concretely: 93 behaviour change techniques

1. Goals and planning	9. Comparison of outcomes	10. Reward and threat	13. Identity
1.1. Goal setting (behavior)	9.1. Credible source	10.1. Material incentive (behavior)	13.1. Identification of self as role model
1.2. Problem solving	9.2. Pros and cons	10.2. Material reward (behavior)	13.2. Framing/reframing
1.3. Goal setting (outcome)	9.3. Comparative imagining of future outcomes	10.3. Non-specific reward	13.3. Incompatible beliefs
1.4. Action planning		10.4. Social reward	13.4. Valued self-identify
1.5. Review behavior goal(s)	5. Natural consequences	10.5. Social incentive	13.5. Identity associated with changed behavior
1.6. Discrepancy between current behavior and goal	5.1. Information about health consequences	10.6. Non-specific incentive	
1.7. Review outcome goal(s)	5.2. Saliency of consequences	10.7. Self-incentive	14. Scheduled consequences
1.8. Behavioral contract	5.3. Information about social and environmental consequences	10.8. Incentive (outcome)	14.1. Behavior cost
1.9. Commitment	5.4. Monitoring of emotional consequences	10.9. Self-reward	14.2. Punishment
	5.5. Anticipated regret	10.10. Reward (outcome)	14.3. Remove reward
2. Feedback and monitoring	5.6. Information about emotional consequences	10.11. Future punishment	14.4. Reward approximation
2.1. Monitoring of behavior by others without feedback			14.5. Rewarding completion
2.2. Feedback on behaviour	6. Comparison of behaviour	11. Regulation	14.6. Situation-specific reward
2.3. Self-monitoring of behaviour	6.1. Demonstration of the behavior	11.1. Pharmacological support	14.7. Reward incompatible behavior
2.4. Self-monitoring of outcome(s) of behaviour	6.2. Social comparison	11.2. Reduce negative emotions	14.8. Reward alternative behavior
2.5. Monitoring of outcome(s) of behavior without feedback	6.3. Information about others' approval	11.3. Conserving mental resources	14.9. Reduce reward frequency
2.6. Biofeedback		11.4. Paradoxical instructions	14.10. Remove punishment
2.7. Feedback on outcome(s) of behavior	7. Associations		
	7.1. Prompts/cues	12. Antecedents	15. Self-belief
3. Social support	7.2. Cue signalling reward	12.1. Restructuring the physical environment	15.1. Verbal persuasion about capability
3.1. Social support (unspecified)	7.3. Reduce prompts/cues	12.2. Restructuring the social environment	15.2. Mental rehearsal of successful performance
3.2. Social support (practical)	7.4. Remove access to the reward	12.3. Avoidance/reducing exposure to cues for the behavior	15.3. Focus on past success
3.3. Social support (emotional)	7.5. Remove aversive stimulus	12.4. Distraction	15.4. Self-talk
	7.6. Satiation	12.5. Adding objects to the environment	
4. Shaping knowledge	7.7. Exposure	12.6. Body changes	16. Covert learning
4.1. Instruction on how to perform the behavior	7.8. Associative learning		16.1. Imaginary punishment
4.2. Information about Antecedents	8.5. Overcorrection		16.2. Imaginary reward
4.3. Re-attribution	8.6. Generalisation of target behavior		16.3. Vicarious consequences
4.4. Behavioral experiments	8.7. Graded tasks		



Possible weaknesses

- Slightly geared towards personal benefits (better health, exercise, stop smoking...)
- Not so much towards utilitarian benefits (save the environment, help others...)
- Biases to interventions that are ethically possible to study within health/benefits
 - “Flygskam” difficult to categorise

But

- Overall very useful
- Also useful on a personal level