Rethinking social psychology and intervention design: A model of energy savings and human behavior

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Prof.(FH) Dr. Timo Ohnmacht, Dr. Christian Weibel
Prof.(FH) Dr. Dorothea Schaffner, Matthias Mahrer

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Project Goals and Objectives

2000 Watt-City of Lucerne (Voters 11/2011; 68%)

- to identify energy consumption lifestyle groups in the city of Lucernes population
- to involve models from sociology, psychology and marketing in an transdisciplinary approach
- to develop communication strategies and interventions to stimulate more climate-conscious consumption, sustainable mobility and energy efficiency
- the city of Lucerne uses the interventions developed in the project to support the aim of a 2000 Watt-City

A heuristic model as the groundwork to explain behavioral change:

Review

Rethinking social psychology and intervention design: A model of energy savings and human behavior

Timo Ohnmacht[a,*], Dorothea Schaffner[b], Christian Weibel[a], Helmut Schad[a]

[a] University of Applied Sciences and Arts—Lucerne, Lucerne School of Business, Center for Mobility, Switzerland
[b] University of Applied Sciences and Arts—Lucerne, Lucerne School of Business, Department of Marketing and Communication, Switzerland

a b s t r a c t

This theoretical-review article contributes to the discussion on individual energy savings by developing a hypothetical classification of interventions and linking them to socio-psychological factors affecting the transition points of four phases of behavior change (predecision, preaction, action, and postaction). It helps to segment a population into subgroups, clarifies the dynamic process for individuals, and groups examples of interventions to achieve substantial behavioral change. The generic integrative model presents academic study designers and practitioners with a theoretical viewpoint and an orientation framework for their intervention designs. A systematic literature review of the empirical evidence for the model and interventions is presented. This blueprint of a model can be adapted, specified, further developed and implemented as a backbone for empirically-grounded intervention design.

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Phase models of behavioral change: PMA
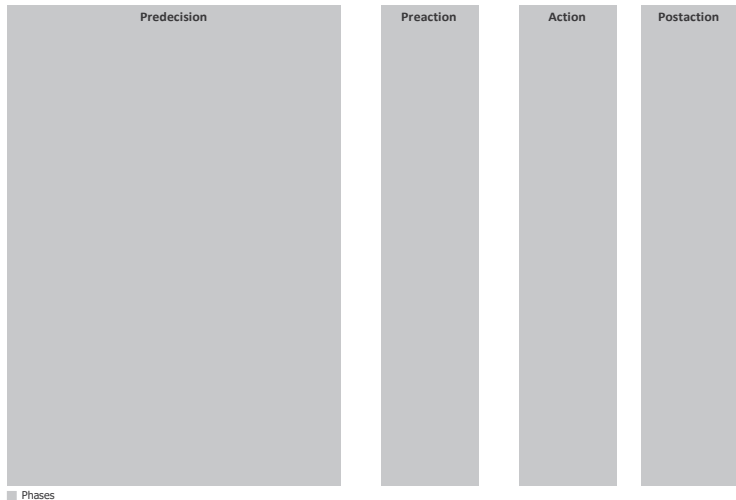
Predecision | Preaction | Action | Postaction

Phases

Source: Ohnmacht et al. (2017), adapted from the self-regulation model based on Bamberg (2012, 2013a,b)

Examples for the Phases

Based on the psychological model for the description of the behaviour change processes, the following Phases were discerned (cycling for example):

Phase 1 I've never considered going around Lucerne by bicycle.

Phase 2 I've already considered using a bike in Lucerne and I intend to do it. I've haven't put this plan into practice yet.

Phase 3 In the last six months, I've biked around Lucerne every now and again. In the future it is my firm intention to do this on a regular basis.

Phase 4 I take cycling around Lucerne as a matter of course.
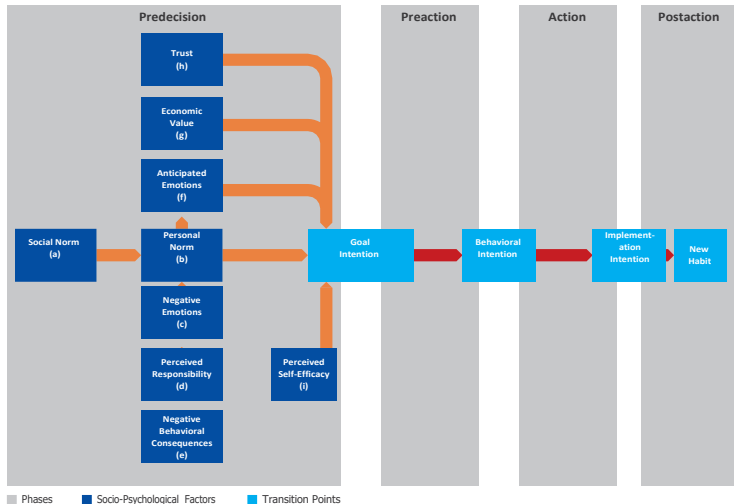
Source: Ohnmacht et al. (2017), adapted from the self-regulation model based on Bamberg (2012, 2013a,b)

Transition Points
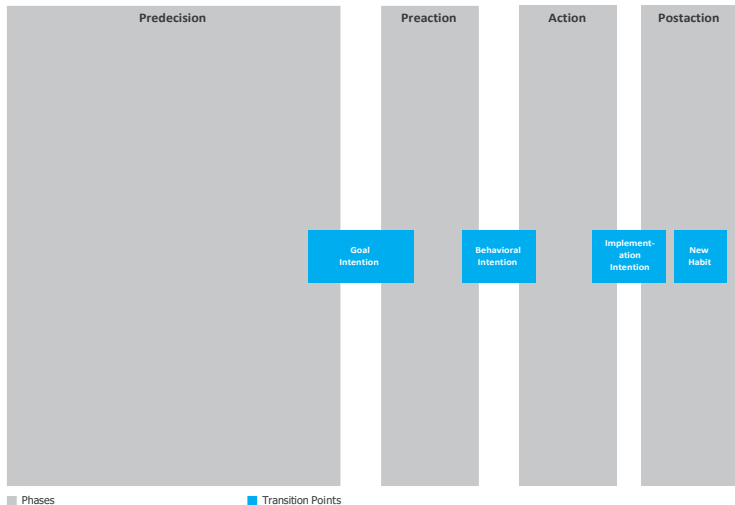
Source: Ohnmacht et al. (2017), adapted from the self-regulation model based on Bamberg (2012, 2013a,b)

Source: Ohnmacht et al. (2017), adapted from the self-regulation model based on Bamberg (2012, 2013a,b)

Socio-Psychological Factors: Preaction

Source: Ohnmacht et al. (2017), adapted from the self-regulation model based on Bamberg (2012, 2013a,b)
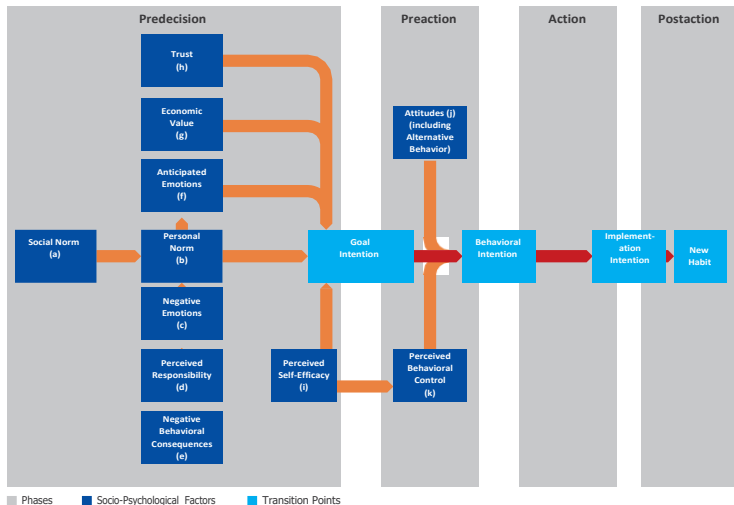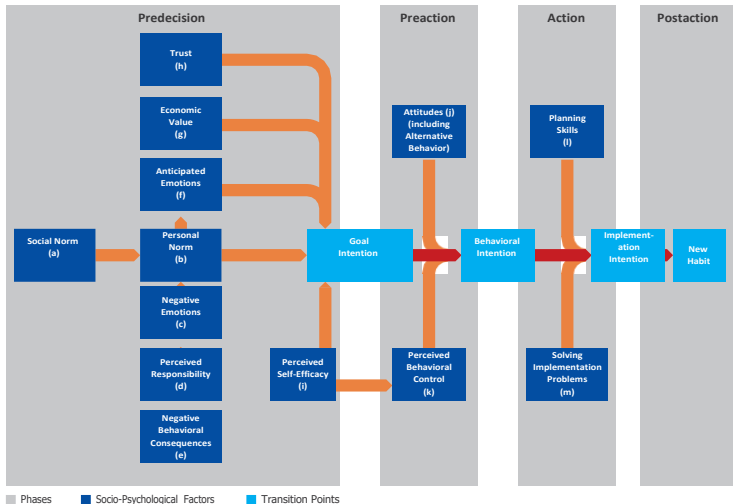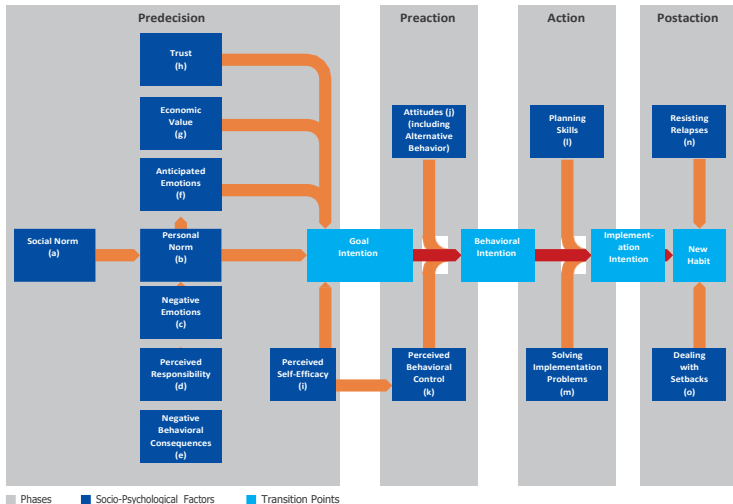
Source: Ohnmacht et al. (2017), adapted from the self-regulation model based on Bamberg (2012, 2013a,b)

Socio-Psychological Factors: Postaction

Source: Ohnmacht et al. (2017), adapted from the self-regulation model based on Bamberg (2012, 2013a,b)

Environmental Context
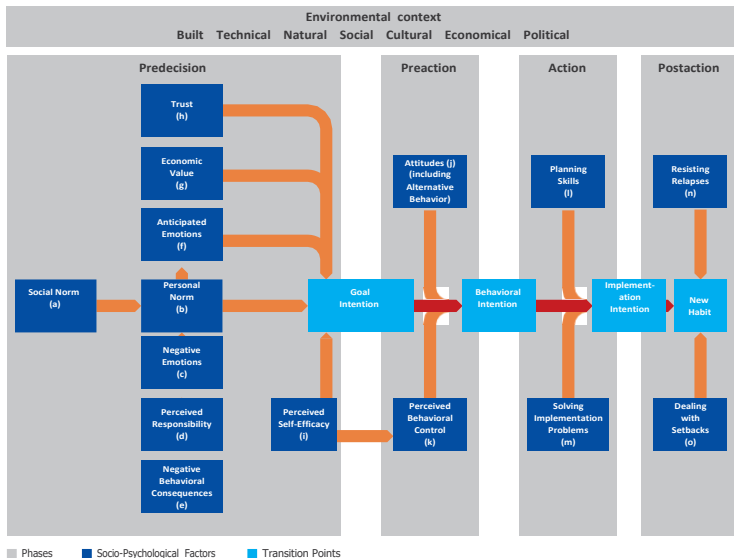
Source: Ohnmacht et al. (2017), adapted from the self-regulation model based on Bamberg (2012, 2013a,b)

Class of Intervention
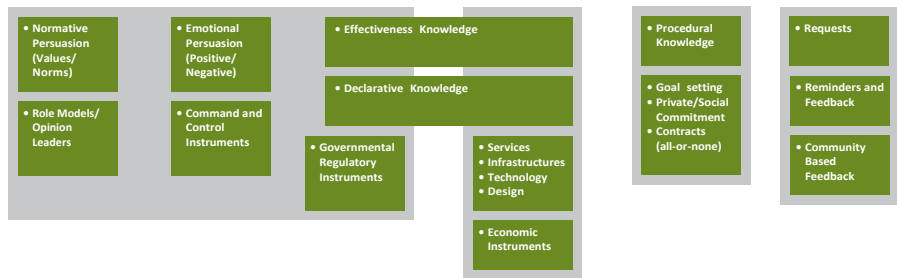
- Normative Persuasion (Values/Norms)
- Role Models/Opinion Leaders

- Emotional Persuasion (Positive/Negative)
- Command and Control Instruments

- Effectiveness Knowledge
- Declarative Knowledge
- Governmental Regulatory Instruments

- Services
- Infrastructures
- Technology
- Design
- Economic Instruments

- Procedural Knowledge
- Goal setting
- Private/Social Commitment
- Contracts (all-or-none)

- Requests
- Reminders and Feedback
- Community Based Feedback

Source: Ohnmacht et al. (2017), adapted from the self-regulation model based on Bamberg (2012, 2013a,b)

Example
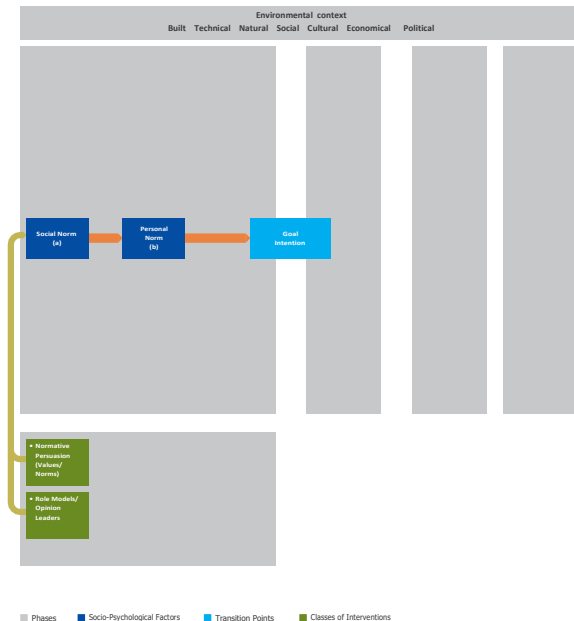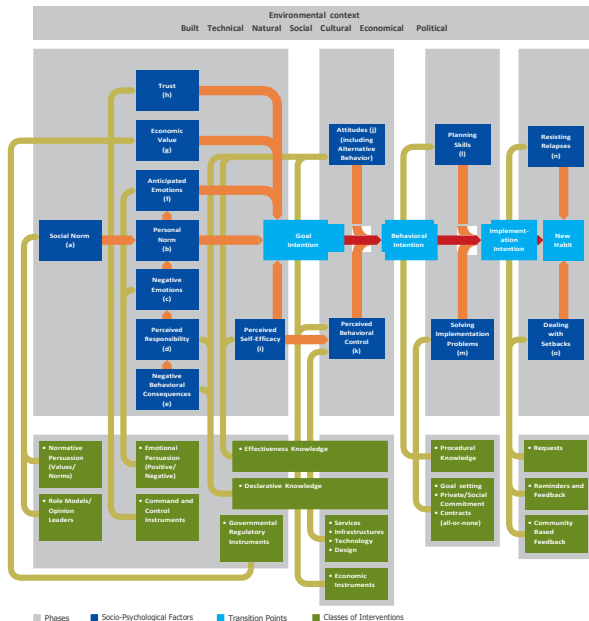
Based on this integrative model, we suggest the following proceeding in order to encouraging pro-environmental behavior

Detect empirically in which phase an individual or group of people can be found.

Define which socio-psychological factors should be adressed to promote pro-environmental behaviour.

Choose the class of intervention that is connected to socio-psychological intervention.

Develop or apply an intervention that suits to the socio-psychological factor and respective phase.

Source: Ohnmacht et al. (2017))

Empirical field instrument based on values, attitudes, orientations, opinions and behaviour

The questionnaire contained questions regarding the energy-consuming and saving behaviours of Lucerne residents in the following four areas:

- Cycling in the City of Lucerne
- Moving into energy-saving housing
- Reducing the consumption of meat
- Postponing the purchase of a new mobile phone until the old one no longer works

The City of Lucerne drew a representative sample of 3,500 people from the city register
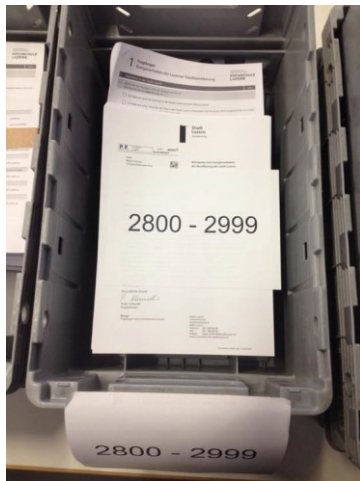
Data was collected about respondents' current phase in the change process as well as their attitudes, norms, behaviour checks, emotions, intentions, and their previous patterns of   behaviour.

1 | Fragebogen
Energieverhalten der Luzerner Stadtbevölkerung

Hochschule Luzern
Lucerne University of Applied Sciences and Arts

1.1. Welche der vier Aussagen trifft am ehesten auf Sie zu?

1. Velofahren in der Stadt Luzern
Bitte kreuzen Sie nur eine Aussage an.

☐ Ich habe mir noch nie überlegt, in der Stadt Luzern mit dem Velo zu fahren.

☐ Ich habe mir schon überlegt, das Velo in der Stadt Luzern zu benutzen und mir auch schon vorgenommen, es zu tun. Ich habe diesen Plan aber noch nicht umgesetzt.

☐ Im letzten halben Jahr war ich ab und zu mit dem Velo in der Stadt Luzern unterwegs. Es ist mein festes Ziel, dies in Zukunft regelmässig zu tun.

☐ Das Velofahren in der Stadt Luzern ist für mich eine Selbstverständlichkeit.

1.2. Mit dem Velo in der Stadt unterwegs zu sein, ist für mich...

leicht	☐	☐	☐	☐	☐	schwierig
umsetzbar	☐	☐	☐	☐	☐	nicht umsetzbar
angenehm	☐	☐	☐	☐	☐	unangenehm
gut	☐	☐	☐	☐	☐	schlecht

1.3. Die meisten Menschen, die mir wichtig sind, würden es unterstützen, wenn ich in der Stadt mit dem Velo fahre.

sehr wahrscheinlich ☐ ☐ ☐ ☐ ☐ sehr unwahrscheinlich

1.4. Ich beabsichtige, das Velo in Zukunft für viele meiner Alltagswege in der Stadt Luzern zu benutzen.

trifft zu ☐ ☐ ☐ ☐ ☐ trifft nicht zu

1.5. Ich habe es mir zu einem Grundsatz gemacht, meine Wege in der Stadt Luzern möglichst oft mit dem Velo zurückzulegen.

trifft zu ☐ ☐ ☐ ☐ ☐ trifft nicht zu

1.6. Wenn ich Velo fahre, fühle ich mich zufrieden.

trifft zu ☐ ☐ ☐ ☐ ☐ trifft nicht zu

1.7. Wenn ich in der Stadt mit dem Velo fahre, habe ich ein gutes Gewissen.

trifft zu ☐ ☐ ☐ ☐ ☐ trifft nicht zu

Empirical field work with representative sampling of inhabitants of Lucerne

Sample and response rate

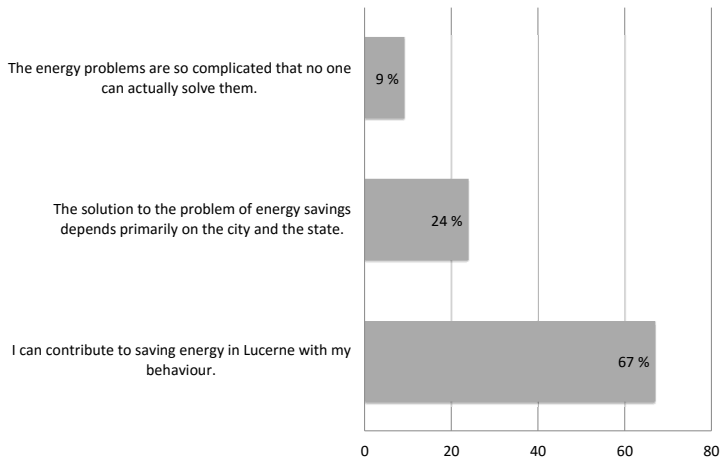| Aspect	Quantity
Participants (random selection from the register of the City of Lucerne)	3500
Exceptions (death, old-age, etc.)	105
Adjusted sample size (Brutto)	3395
Response before data cleansing	1818
in %	54%
Response after data cleansing* (Netto)	1798
in %	53%

Mixed-Method-Approach: Paper-based questionnaire [n: 1565] and CAWI-Version [n: 233]

Field: 08/15-10/15

* excluded were any responses where more than 20% of the items were not answered

Outline

Who, in your opinion, can most likely set about the reduction of energy consumption in Lucerne?

The energy problems are so complicated that no one can actually solve them. — 9 %

The solution to the problem of energy savings depends primarily on the city and the state. — 24 %

I can contribute to saving energy in Lucerne with my behaviour. — 67 %

Source: Survey in Lucerne, n = 1798

Opinions regarding energy consumptions

(Shares in Percent)

| | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

5.1. It is important to do something about the high energy consumption in passenger transport (n = 1,751): 6, 6, 22, 24, 43

5.2. The energy required for the production of electrical devices is a problem for the environment. (n = 1,744): 5, 6, 24, 31, 34

5.3. Energy consumption in the production of meat is a problem. (n = 1,714): 8, 10, 27, 25, 30

5.4. Reducing energy consumption in residential buildings belonging to Lucerne's urban area is an urgent problem, that needs to be solved. (n = 1,748): 4, 8, 27, 29, 32

Legend: Strongly disagree | 2 | 3 | 4 | strongly agree

Source: Survey in Lucerne, n = 1798

Outline

Cycling in the City of Lucerne

Source: City of Lucerne

Phases - Cycling in the City of Lucerne

(Shares in Percent)

Source: Survey in Lucerne, n = 1798

Outline

Moving into energy-saving housing

Source: City of Lucerne

Phases - Moving into energy-saving housing

(Shares in Percent)

Phase	Percent
Phase 4: I take living in an energy-saving flat for granted.	15
Phase 3: The last time I moved I made sure I moved into an energy-efficient flat.	11
Phase 2: I've considered moving into energy-efficient flat and I intend to do so. I've haven't put this plan into practice yet.	27
Phase 1: I have never considered moving into to an energy-efficient flat.	47

Source: Survey in Lucerne, n = 1798

Outline

Phases - Reducing the consumption of meat

(Shares in Percent)

Phase 4: I take consuming little or no meat for granted. — 26

Phase 3: I make sure I consume less meat occasionally. In the future it is my firm intention to do this on a regular basis. — 42

Phase 2: I've considered reducing my meat consumption and I have already undertaken to do so. I've haven't put this plan into practice yet. — 9

Phase 1: I have never considered reducing my meat consumption. — 24

Source: Survey in Lucerne, n = 1798

Outline

Postponing the purchase of a new mobile phone until the old one no longer works

Source: City of Lucerne

Postponing the purchase of a new mobile phone until the old one no longer works

(Shares in Percent)

Phase 4: I take buying a new phone only if my current phone no longer works for granted. — 54

Phase 3: I've already held off buying a new mobile phone until my current mobile phone no longer worked. It is my firm intention to do this in the future. — 22

Phase 2: I have considered holding off buying a new mobile phone until my existing mobile phone no longer works. I've haven't put this plan into practice yet. — 13

Phase 1: I have never intended holding off buying a new mobile phone until my existing mobile phone no longer works. — 11

Source: Survey in Lucerne, n = 1798

Outline

Postponed purchases of a new mobile phone for individual energy savings - Independent   Variables

Socio-psychological factors

Attitude	Ratio (mean-index consisting of 2 ordinal five-point Likert scales treated as equidistant), Cronbach's alpha = 0.84, mean = 4.03, SD = 1.11 *Waiting to buy a new mobile phone, until the one I have no longer works, is for me:* **Q1**: *pleasant* (1), *unpleasant* (5) **Q2**: *good* (1), *bad* (5)
Social Norm	Ratio (1 ordinal five-point Likert scale treated as equidistant), mean = 4.10, SD = 1.20 **Q1**: *Most people who are important to me would support me waiting to buy a new mobile phone, until the one I have no longer works.*
Perceived Behaviour Control (PBC)	Ratio (mean-index consisting of 2 ordinal five-point Likert scales treated as equidistant), Cronbach's alpha = 0.81, mean = 3.87, SD = 1.02 *Waiting to buy a new mobile phone, until the one I have no longer works, is for me:* **Q1:** *easy* (1), *difficult* (5) **Q2:** *practical* (1), *impractical* (5)
Personal Norm	Ratio (1 ordinal five-point Likert scale treated as equidistant), mean = 3.76, SD = 1.50 **Q1**: *I have made it one of my personal principals, to only replace my phone if it stops working.*
Emotion	Ratio (mean-index consisting out of 2 ordinal five-point Likert scale treated as equidistant), Cronbach's alpha = 0.70, mean = 3.19, SD = 1.50 **Q1:** *It makes me happy to be able to use my current phone, even if it isn't that modern anymore.* **Q2:** *I feel guilty if I buy a new phone even though my current one still works.*
Problem awareness	Ratio (1 ordinal five-point Likert scale treated as equidistant), mean = 3.82, SD = 1.11 Q1: The energy required for the production of electrical devices is a problem for the environment.

Aim: Pointers for interventions based on socio-psychological factors and a phase model of behavioural change

Source: Ohnmacht et al. (in review, b)

MNL Postponed purchases of a new mobile   phone

Table 3: Multinomial logit results for "Postponed purchases of a new mobile   phone."

Variables	Phase 2				Phase 3				Phase 4			
	β	S.E.	t values	Sig.	β	S.E.	t values	Sig.	β	S.E.	t values	Sig.
Intercept	-3.279	0.709	-4.625	***	-7.046	0.797	-8.844	***	-13.431	0.986	-13.617	***
Socio-psychological Factors												
Attitude	0.438	0.196	2.233	**	0.708	0.203	3.496	***	0.970	0.218	4.453	***
Social Norm	0.135	0.102	1.323		0.098	0.107	0.909		0.025	0.115	0.219	
Perceived Behaviour Control	-0.005	0.162	-0.030		0.561	0.172	3.089	***	1.436	0.211	6.795	***
Personal Norm	0.015	0.129	0.114		0.415	0.126	3.308	***	0.893	0.135	6.598	***
Emotion	0.377	0.113	3.334	***	0.327	0.116	2.830	***	0.475	0.120	3.943	***
Problem Awareness	0.141	0.110	1.282		0.164	0.117	1.402		0.108	0.127	0.852	
Nationality												
Swiss (Ref.)	-	-	-		-	-	-		-	-	-	
Non Swiss	-0.344	0.295	-1.170		-0.820	0.316	-2.595	***	-0.961	0.340	-2.828	***
Education												
Low (Ref.)	-	-	-		-	-	-		-	-	-	
Middle	1.042	0.474	2.199	**	1.252	0.486	2.578	**	1.095	0.503	2.178	**
High	0.666	0.453	1.471		1.218	0.461	2.643	***	1.047	0.477	2.196	**

Note: Sig. = Significance: *** $p < 0.01$; ** $p < 0.05$, β = coefficient, S.E. = Standard   Error
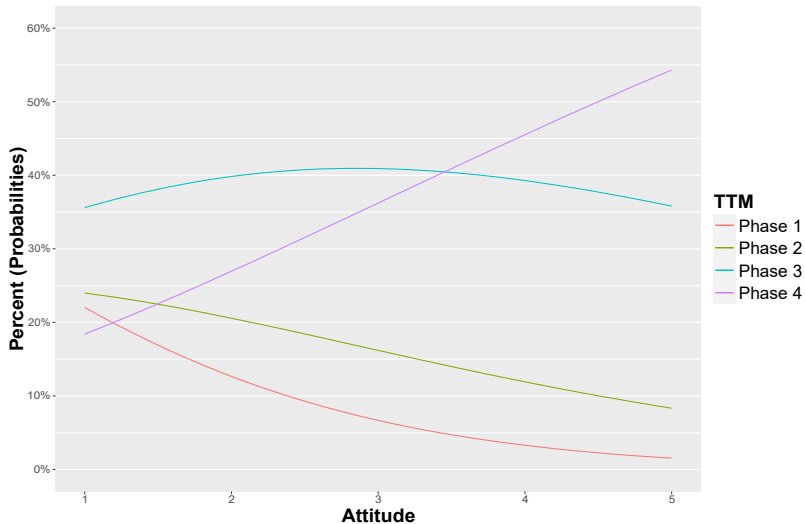
R^2 (McFadden) = 0.509

n = 1,818

Source: Ohnmacht et al. (in review, b)

Attitude

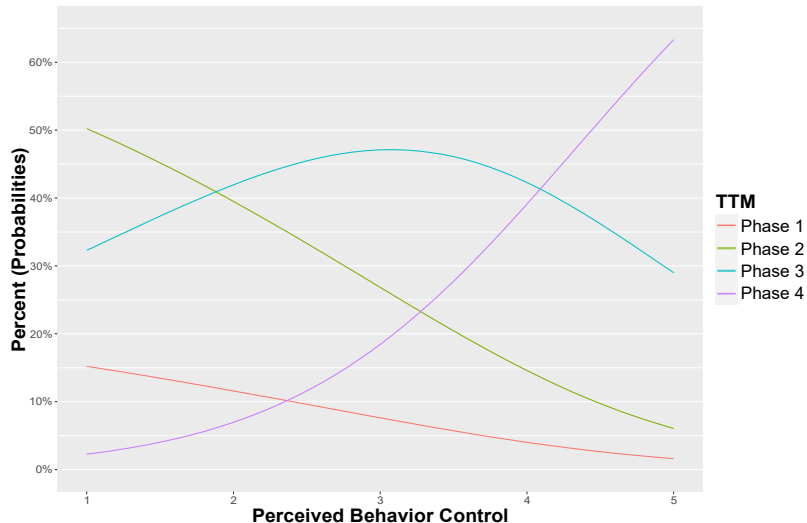Delayed purchase of a new mobile phone: Effects of Attitude on TTM

(All other variables are held constant at their mean when each of these probabilities is calculated.)

TTM
— Phase 1
— Phase 2
— Phase 3
— Phase 4

Source: Survey in Lucerne, n = 1798

Perceived Behavior Control

Delayed purchase of a new mobile phone: Effects of Perceived Behavior Control on TTM

(All other variables are held constant at their mean when each of these probabilities is calculated.)

Source: Survey in Lucerne, n = 1798

Personal Norm

Delayed purchase of a new mobile phone: Effects of Personal Norm on TTM

(All other variables are held constant at their mean when each of these probabilities is calculated.)

Source: Survey in Lucerne, n = 1798
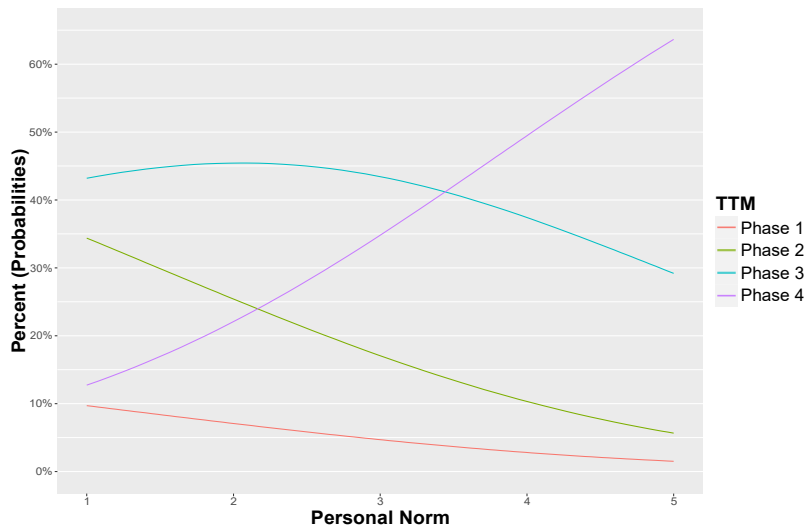
Emotion

Delayed purchase of a new mobile phone: Effects of Emotion on TTM
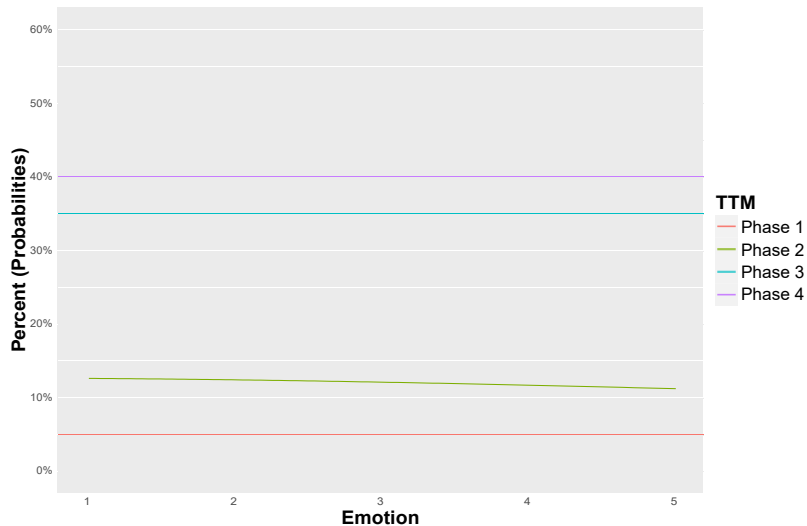*(All other variables are held constant at their mean when each of these probabilities is calculated.)*

Source: Survey in Lucerne, n = 1798

Evidence-based Interventions

Tabelle: Examples of interventions

	Ranking	C. o. l.	Interventions
1	PBC	Technology	Longer battery life span Decreased updates that slow down the system
2	PN	Role Models (via SN)	Celebrities with older phone models
3	Attitude	Knowledge	Awareness-Campaigns rare and precious metals
4	Emo	Emotional Persuasion	Awareness-Campaigns mineral mining for new production of mobile phones further degrades the environment

Outline

Table 2. Measures, reliability, descriptives, factor analysis (n = 1295)

Latent and manifest variables (adapted from Bamberg, 2013)	M	SD	α	Factor Loadings	CR	AVE
Attitude: Moving into an energy-efficient home is ...	3.55	1.28	.93		.93	.87
A1 ... bad (1), good (5)	3.49	1.26		.932		
A2 ... unpleasant (1), pleasant (5)	3.61	1.33		.928		
Social Norm – disagree (1) to agree (5) Most people who are important to me would support me in moving into an energy-efficient home.	3.40	1.47				
Perceived Behavioural Control:	2.60	1.39	.90		.90	.81
PBC 1 ... difficult (1), easy (5)	2.60	1.37		.919		
PBC 2 ... impractical (1), practical (5)	2.81	1.34		.883		
Emotion – disagree (1) to agree (5)	3.86	1.07	.68		.79	.54
E1 I'm happy using less energy because of the choice of an energy-efficient home.	4.11	1.11		.775		
E2 I feel guilty using more energy for living.	3.62	1.32		.715		
Personal Norm – disagree (1) to agree (5) I have made it one of my personal principles to move into an energy-efficient home.	4.12	1.13				
Behavioural Intention – disagree (1) to agree (5) For my next relocation, I intend moving into an energy-efficient home.	3.01	1.45				

Notes: α = Cronbach's alpha; M = Mean; SD = Standard Deviation

Source: Ohnmacht et al. (in review, c)
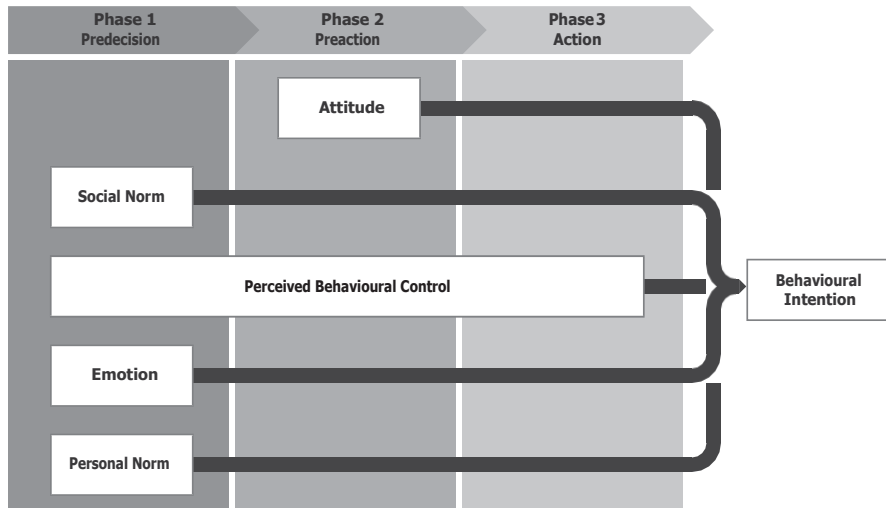
SEM Multigroup: Moving into energy-saving housing

Source: Ohnmacht et al. (in review, c)

SEM Multigroup: Moving into energy-saving housing

Source: Ohnmacht et al. (in review, c)

SEM Multigroup: Moving into energy-saving housing

Source: Ohnmacht et al. (in review, c)

**Phase 3
Action**

A1 .952

| A2 | .957

Attitude -.173

Social Norm .106

| PBC1 | .943

| PBC2 | .861

Perceived Behavioural Control .548***

| E2 | .582

Emotion .327

| Personal Norm | .113

Source: Ohnmacht et al. (in review, c)

Evidence-based Interventions
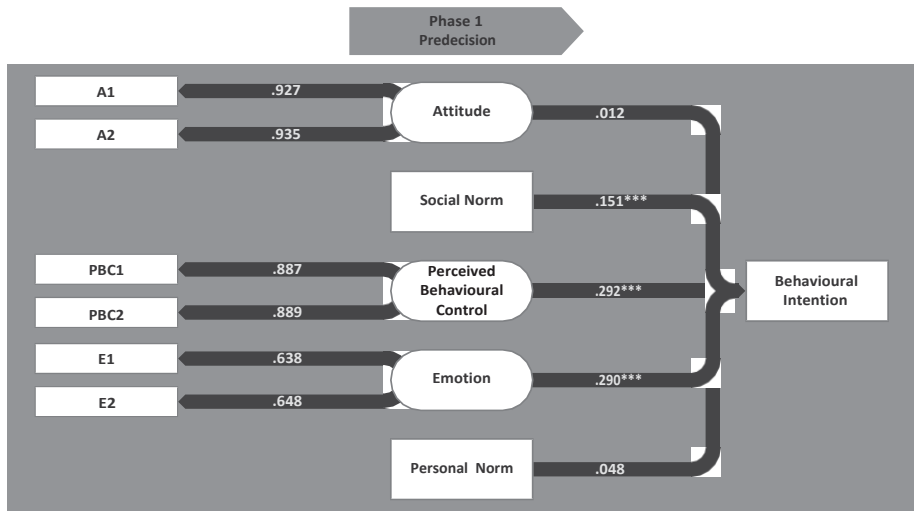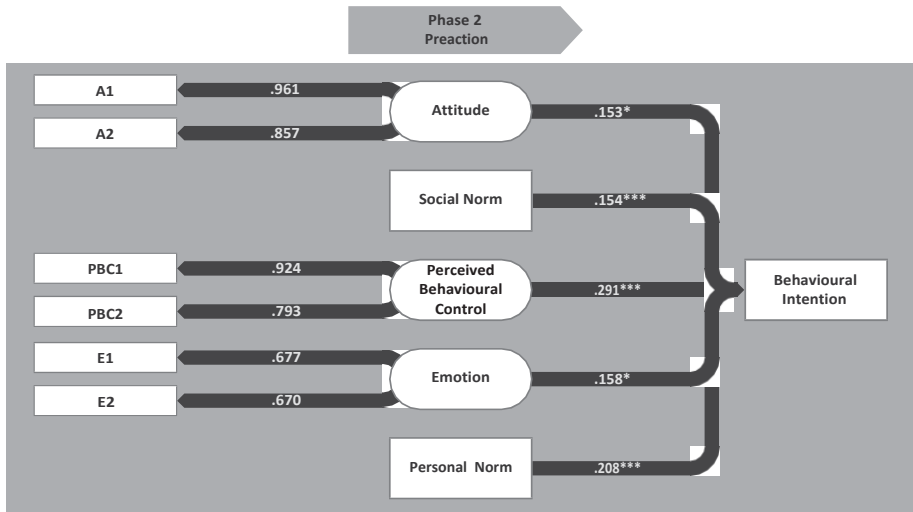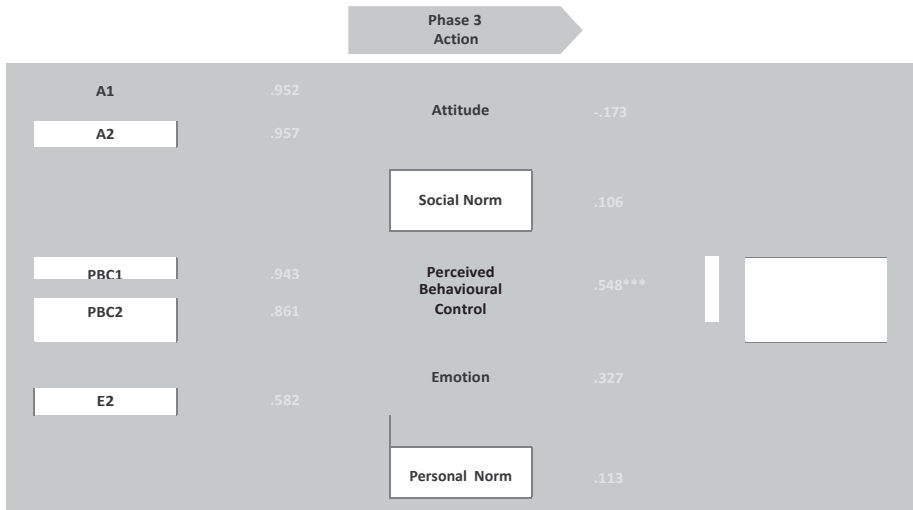
Tabelle: Examples of interventions

	Ranking	C. o. I.	Interventions
1	PBC	Infrastructure, Services and Economic Instruments Economic Instruments	Subsidies for private home-owners and commercial investors to construct energy-efficient buildings or refurbish existing ones to energy-efficient standards
2	SN	Role Models (via SN)	Celebrities demonstrate that they have moved into energy-efficient homes in public or to inform the public about the advantages of living in such homes
3	Attitude	Knowledge	Conventional information campaigns that provide declarative and/or procedural knowledge
4	Emo	Emotional Persuasion	Awareness-Campaigns with emotional persuasion living in low-energy homes might be more effective than simple information that addresses attitudes

Conclusions & Outlook

A phase model is linked to socio-psychological factors and interventions in a hypothetical scenario.

The model provides an orientation framework for academic study designers and practitioners.

The generic model can be adapted, specified, operationalized and further developed.

Quantitative survey data from a study of a medium-sized city in Switzerland (n = 1,800) supports the proposition that behavioural intentions are influenced by different social-psychological factors: perceived behavioural control, social norms, emotions, attitudes as well as personal norms

The influence of the social-psychological factors depends on the phase an individual has reached in the process of behaviour change:

Interventions, marketing strategies and communication campaigns must be tailored according to the phase of behaviour change target groups have reached

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