

AIED, Personalized Persuasive Technology, Ethics

Julita Vassileva,

University of Saskatchewan, Canada

The best teachers are great persuaders

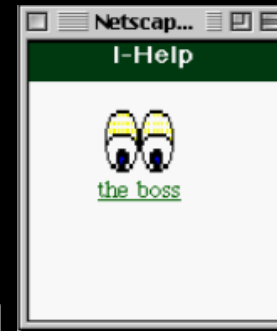
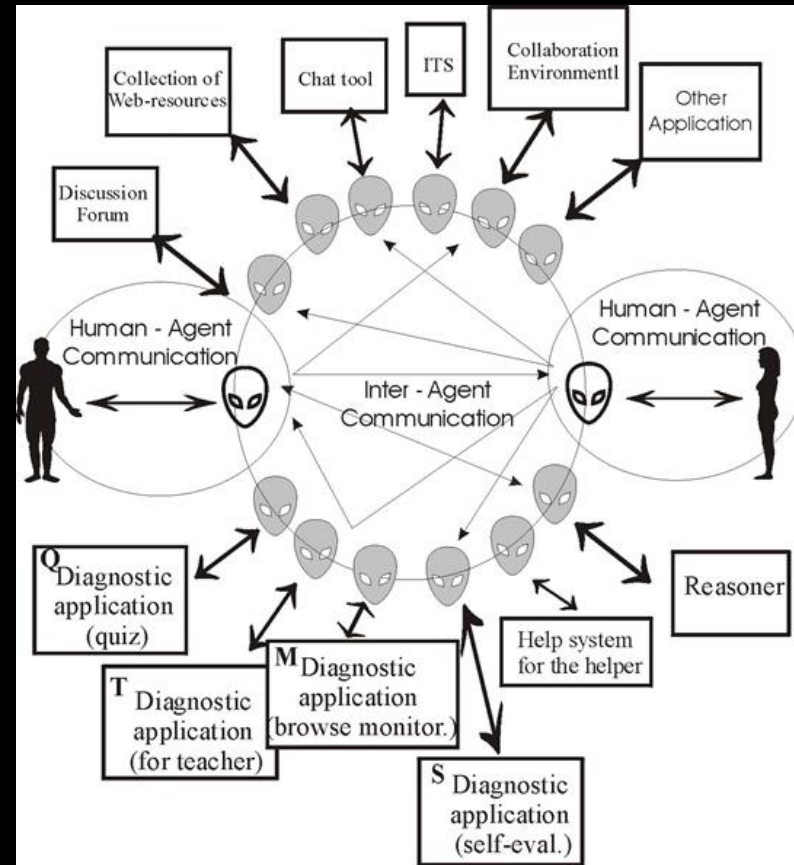
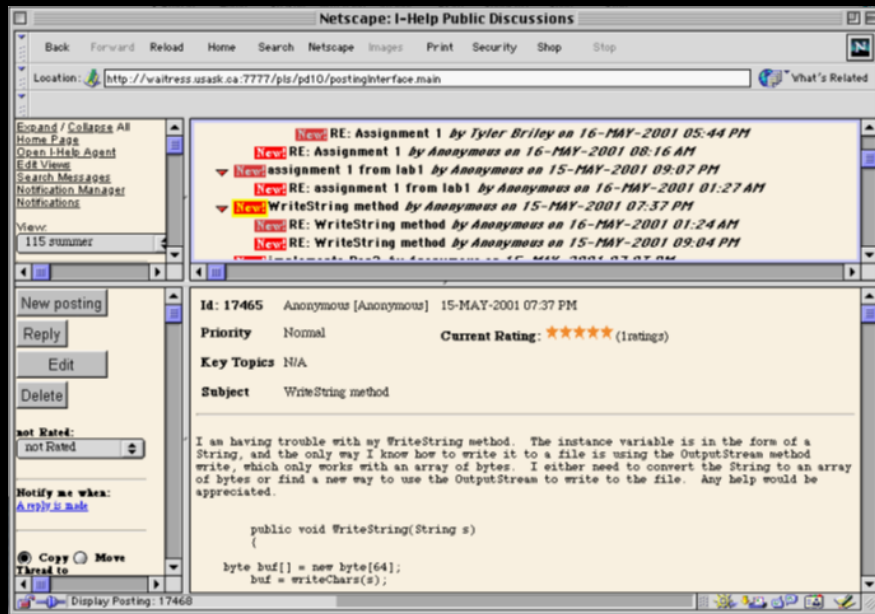
- **Logos** – competent in the subject area and in pedagogy
- **Pathos** – caring, empathetic, engaging, interesting
- **Ethos** – character, integrity, trustworthy, ethical

Plan

- Motivation
- AIED
- Persuasive Technology
- Personalizing Persuasion
- Ethics

Motivation for Participation?

I-Help (Vassileva, Greer, McCalla, Bull, Kettel, Brooks) IJAIED 1998, ITS'2008, AIED' 2001



Kostuik K. and J.Vassileva (1999) Free Market Control for a Multi-Agent Based Peer Help Environment. Autonomous Agents'99, Seattle.

Greer J., McCalla G., Vassileva J., Deters R., Bull S., Kettel L. (2001) Lessons Learned in Deploying a Multi-Agent Learning Support System: The I-Help Experience, Proc. AIED'2001, San Antonio.

Lessons from I-Help Deployment

(2 years, 3 countries, over 2000 students):

Huge variance in participation and in motivations:

- kindness
- help their friends
- self-efficacy (feel empowered)
- seek reputation
- seek recognition from the teacher
- seek higher marks
- earn money

Need for Personalized Incentives!

Vassileva J (2001) Distributed and United, Keynote ICCE'2001, Seoul.

Gamification: Reputation System



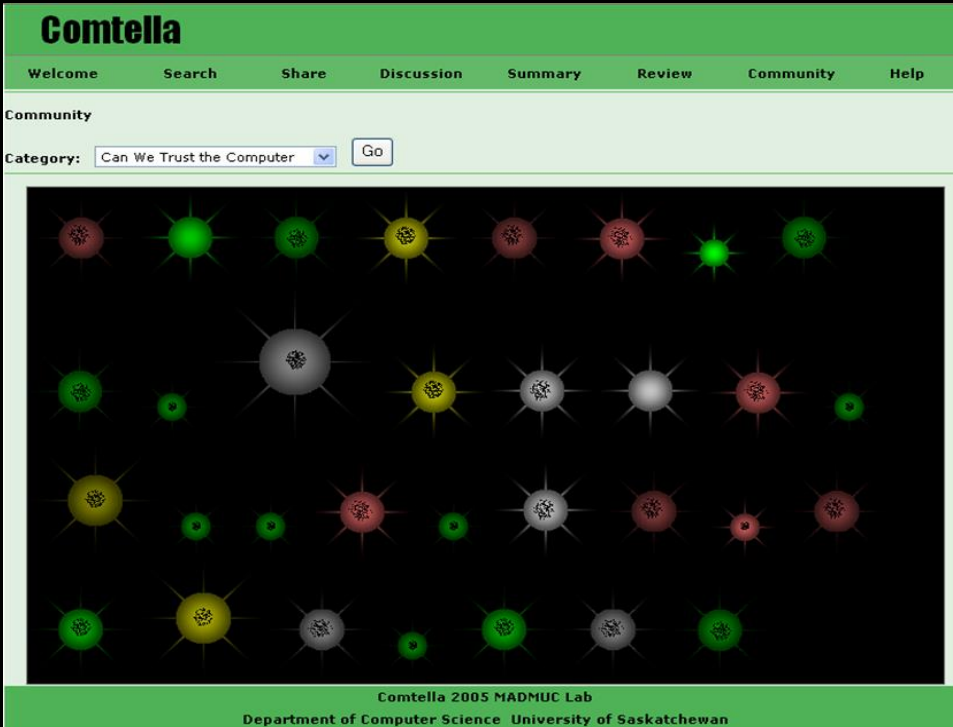
Comtella 2002-2008 Online Learning Community

User Participation rewarded with points, status



Visualized (Social Influence, Social Comparison)

Adaptive Incentive mechanism



Cheng R, Vassileva J (2006) Design and evaluation of an adaptive incentive mechanism for sustained educational online communities. *ser Modeling and User-Adapted Interaction* 16 (3-4), 321-348

More recent work on Gamification

- Does Gamification work equally well for Boys and Girls ?



Pedro L, Lopes A, Prates B, Vassileva J, Isotani S. (2015). Does Gamification Work for Boys and Girls? An Exploratory Study with a Virtual Learning Environment. Proc. ACM SAC'2015, Salamanca, Spain.

- Introducing Game Mechanics in MeuTutor



Dermeval D., Albuquerque J., Bittencourt I., Vassileva J, I Lemos W, da Silva A, Paiva R (2018). Amplifying Teachers Intelligence in the Design of Gamified Intelligent Tutoring Systems. Proc. AIED'2018

Gamifying the grading process for TAs in University

HH Selassie, J Vassileva (2017) Susceptibility of Graduate Assistants to Social Influence Persuasive Strategies. CYTED-RYTOS International Workshop on Groupware, 118-131.



Comtella-D (2006)



Webster A.S., Vassileva J. (2006) Visualizing Personal Relations in Online Communities, (2006) Proc. Adaptive Hypermedia and Adaptive Web-Based Systems, Dublin, Ireland, Springer LNCS 4018, 223-233.

Comtella discussions [Logout](#)
energy
[stored: 1069 @work: 922]

[home](#) | [discuss](#) | [relations](#) | [mailbox](#) | [profile](#) | [help](#)

Main Forums : **Information Technology**

Forums	Description
Privacy	Big Brother, databases, risks, protection, aware
Freedom of Speech	Censorship, anonymity, laws, offensive/dan
Intellectual Property	Fair-use, copying music/movies/software, solu
Wiretapping and Encryption	Role of secrecy, trust in government, cryptogra
Computer Security and Crime	Hacking, hactivism, law, identity theft, privacy
Computers and Work	Changing nature of work, impact on employment
Broader social issues	Computers and community, digital divide, bad tec
Can we trust the computer?	What can go wrong, Therac-25 case study, reliabil
Ethics and Professionalism	Professional codes and guidelines, cases, aspects of

- 0 energy units
- 1 energy unit
- 2 energy units
- 3 energy units - (default level)
- 4 energy units
- 5 energy units
- 6 energy units
- 7 energy units
- 8 energy units
- 9 energy units
- 10 energy units

Immediate visual feedback on user actions of rating posts, simulation, aesthetics

@work Energy

The quick red fox jumped over the lazy brown dog.
By Andrew



upvoted

All generalizations are false, including this one.
By Mark Twain



downvoted

Ikanos – the best Greek restaurant in Montreal.
By Julita



new not voted post

Stored Energy



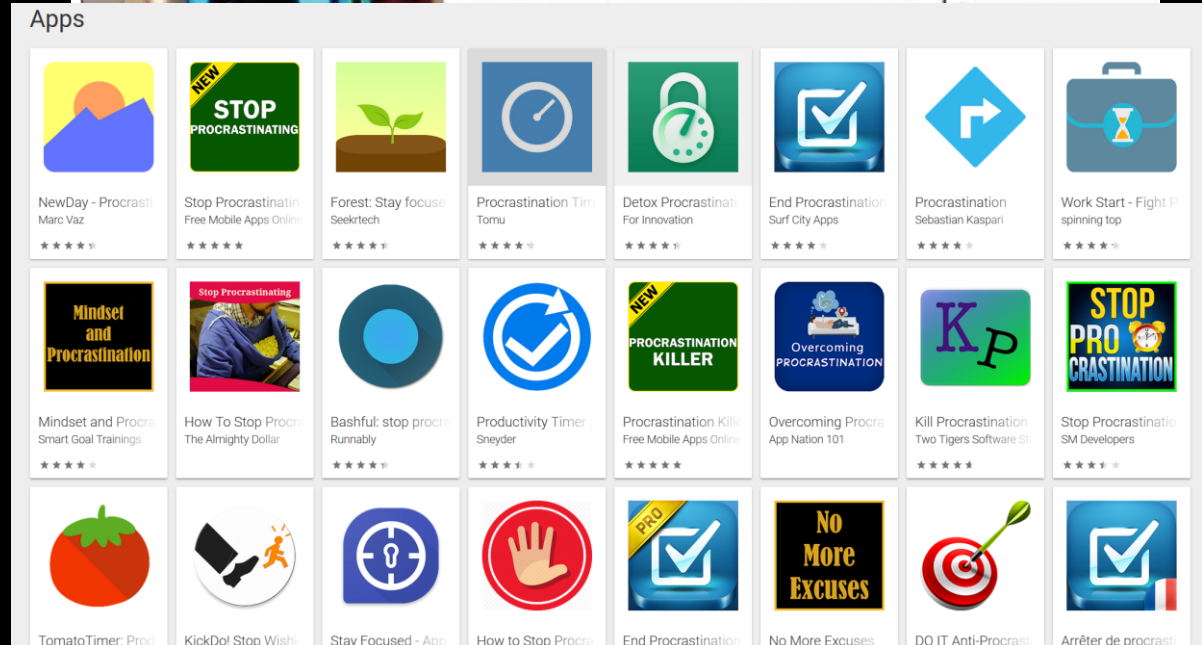
Persuasive Technology and Behaviour Change

- Origins – 1960s: Marketing and health sciences,
- Theoretical background
 - social psychology,
 - behavioural economics,
 - cognitive biases;
- Applications in any area one can imagine

Changing Human Behaviour through Technology



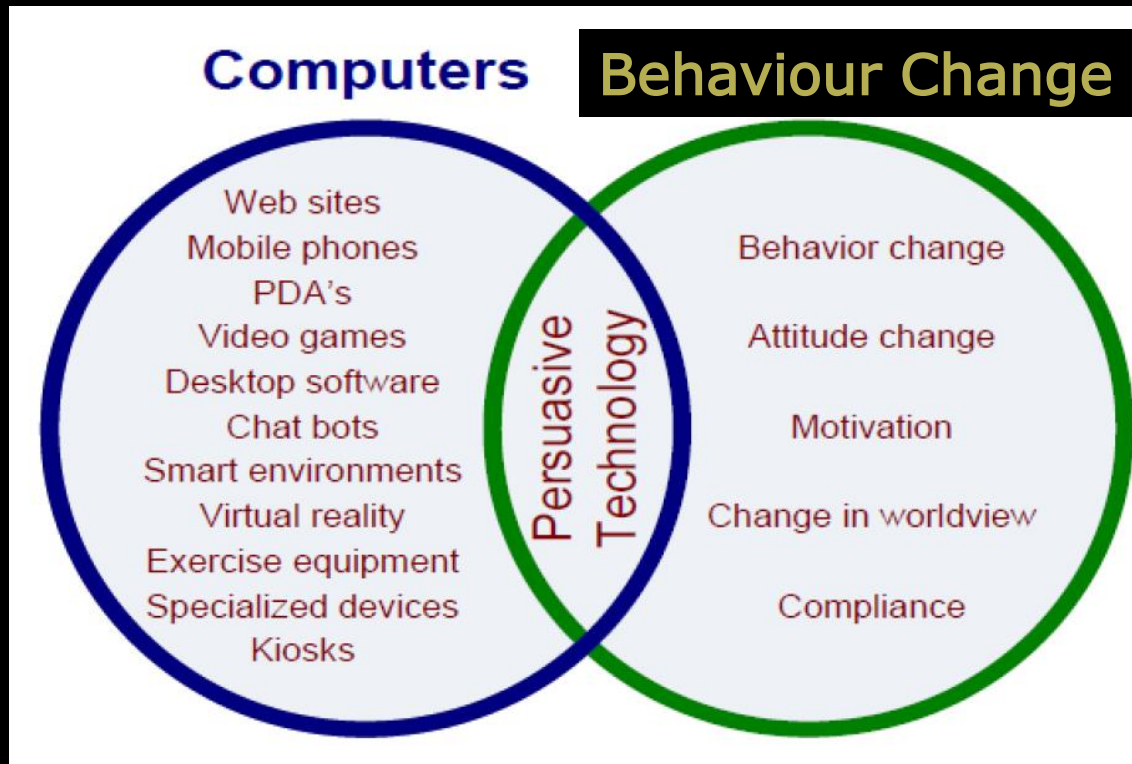
Persuasive Technologies



J. Vassileva (2019) Keynote at EDM'2019, Montreal, July 3, 2019

Persuasive Technologies

Definition: technologies aimed at changing people's attitudes or behavior without coercion



Adapted from B.J. Fogg (2003), Stanford Persuasive Technology Lab.

Theories/Models of Persuasion

Theories	Target Behavior	Constructs	Authors
Cialdini's Principles of Persuasion	Change Attitude	Authority Commitment Consensus Liking Reciprocity Scarcity	Cialdini, 2001
BJ Fogg's Design Principles	Behaviour Performance	Suggestion, Reduction, Tunneling, Simulation, Tailoring, Surveillance/ Monitoring, Conditioning.	Fogg, 2003

Persuasive Design Principles

Theories	Constructs	Authors
<p>Persuasive Systems Design Model</p>	<p>Primary Task Support Reduction, Tunneling, Tailoring, Personalization, Self-Monitoring, Simulation, Rehearsal</p> <p>Dialog Support Praise, Reward, Reminders, Suggestion, Similarity, Liking, Social Role</p> <p>System Credibility Support Trustworthiness, Expertise, Surface Credibility, Real-word feel, Authority, etc.</p> <p>Social Support Social Learning, Social Comparison, Competition, Cooperation, Social Recognition, etc.</p>	<p>Oinas-Kukkonen and Harjumaa 2009</p>



PT in StackOverflow

- How does it influence users to participate in the network?

All PSD constructs and strategies were used in the system design:

- **primary task support** (without tunneling and rehearsal),
- **dialogue support** (without reminders and similarity),
- **social support** (all principles)

How susceptible are users to these influence strategies?

- users are most susceptible to **social learning**
- **recognition** had the greatest influence on the perceived persuasiveness of the system to users
- **social learning, cooperation, recognition, and competition** can explain about 40% of the variance in the perceived persuasiveness

Adaji I, Vassileva J. (2016) Persuasive patterns in Q&A social networks. Proc. Persuasive Technologies, 2016.

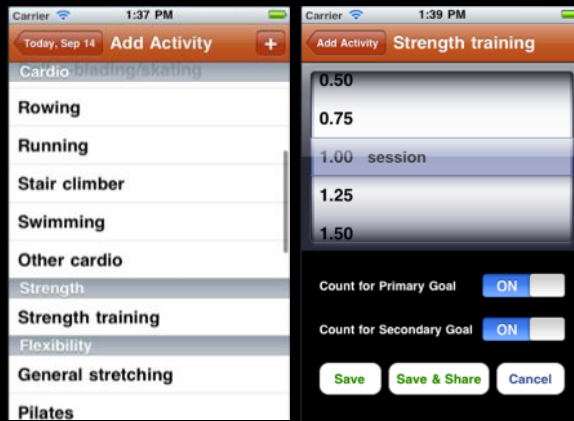
Behaviour Change Techniques

- Michie et al (2008) identifies 137 techniques and maps them to behavioural determinants
- Behaviour change theories predict effective combinations of techniques
- We will discuss several common techniques with examples

Goal setting



Now let's think about a realistic goal for the coming week. Remember that you currently walk 8000 steps a day. What do you think if we aim to add another 10% (800 steps) or 20% (1600 steps) to that? This is entirely up to you, and we can discuss which goal suits you best.



Nguyen & Masthoff, 2010

GoalPost
Munson & Consolvo,
2012



Superhub, 2013

(Self-)Monitoring

- (Self-)record specified behaviour, and provide access to the user



Hi Hien,
Thanks for keeping track of your progress. Monitoring how well you do is the first step to success.
Just enter your pedometer's readings for yesterday or any other day using the form below.

Day:

Steps: steps

Calories: kcal

Distance: km

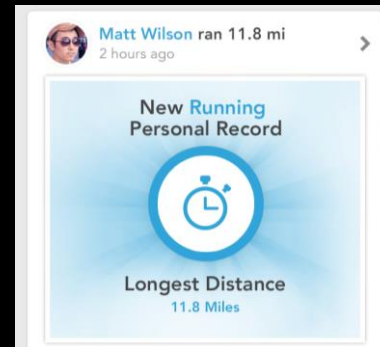
Notes:

Feedback

- Provide feedback on monitored behaviour



Nguyen & Masthoff, 2010

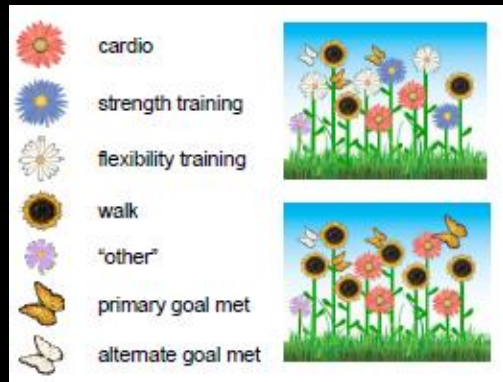


Midden & Ham,
2009



Reward (Conditioning)

- Provide a reward if the behaviour is performed



Consolvo et al, 2008



Superhub, 2013



Berkovsky et al, 2012

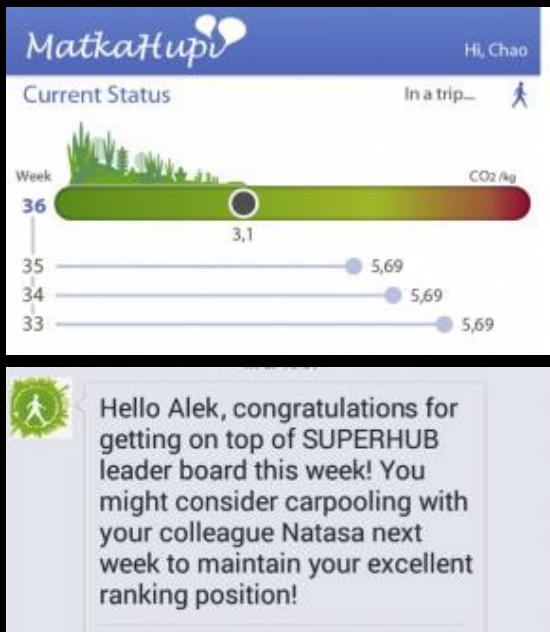


Efteling amusement park, 1959



Social Comparison

- Provide comparative data (cf standard, own past behaviour, others' behaviour)



Gabrielli et al, 2014



Farzan et al, 2008

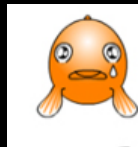
Punish

- Provide a punishment if the behaviour is not performed



If you don't brush your teeth, the aquarium gets dirty and fish get ill.

Nakajima & Lehdonvirta, 2013



Fish become sad and stop growing.

Lin et al, 2006



Power to appliances is turned of.

Kirman et al, 2010



Negative punishment = withholding reward

Prompt (Trigger, Call to action)

- Provide a stimulus to elicit the behaviour


70505: Amnesty free msg: IRAN
Imprisoned woman denied
medical care could go blind <http://amn.st/1nnSTtO> Rply TREAT +
name to help save Zeynab's
sight 2OptOut rply Stop
20/06/2014, 16:04





Papier Hier!
Papier Hier!
(Paper here!)

f [You have new notifications.](#)

A lot has happened on Facebook since you last logged in. Here are some notifications you've missed from your friends.

 **Judith Masthoff**

 [2 pokes](#)

 [4 new notifications](#)

[Open Facebook](#) [View Notifications](#)

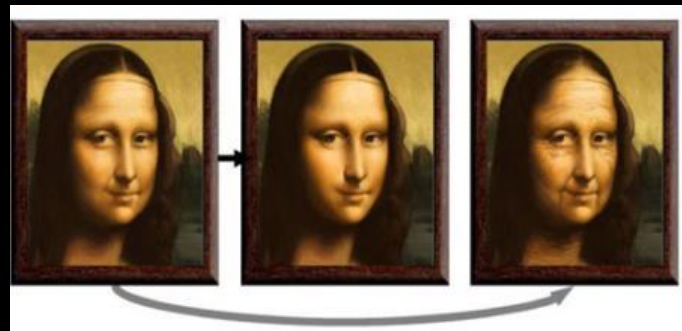
Simulation

- Show positive or negative effects if the user continues the current course of action



“This is what you will look like if you keep smoking”

(Andrés del Valle & Opalach, 2005)



Nakajima & Lehdonvirta, 2013

Verbal persuasion

- A credible source argues, with evidence, in favour of the behaviour

Daphne: *Have you considered eating more fruit?*

User: *No.*

Daphne: *It is good for your health as it helps prevent cancer.*

User: *Fruit is boring! It's granny's stuff!*

Daphne: *May be pears are boring. But avocados are different! Did you know it's Californians' favourite?*

(Grasso et al, 2000)

Portia: *You do sport and look after your health with regular medical check-ups. Why don't you try to increase the quantity of fruit and vegetables in your diet? I'm sure you can do it if you want to.*

(Mazzotta et al, 2007)

Motivational Interviewing

- Elicit self-motivating statements and evaluation of own behaviour to reduce resistance to change

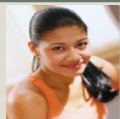


So, what do you personally think of the result and what would you like to do next? Last time we met, you said that you thought that your current level of walking was high. Has the result today affected that?



So at the moment, you think that increasing how much you walk every day is very good. Considering this, where would you like to go from here?

User: **I can't think of any reason to walk more**



If you were to guess, what would be one good reason for you to consider walking more regularly?

Nguyen, 2011

Personalized Persuasive Technology

With respect to what user features?

- Personal features
- Relevant behaviour metrics
- Preferences and goals
- Psychological features
- Context features

Sources of data:

- User demographics, location
- Inferred from interaction data
- Solicited from user input

Example: “Take the Stairs” Interactive Display

Kaptein and co-authors, 2008



Two persuasive messages:

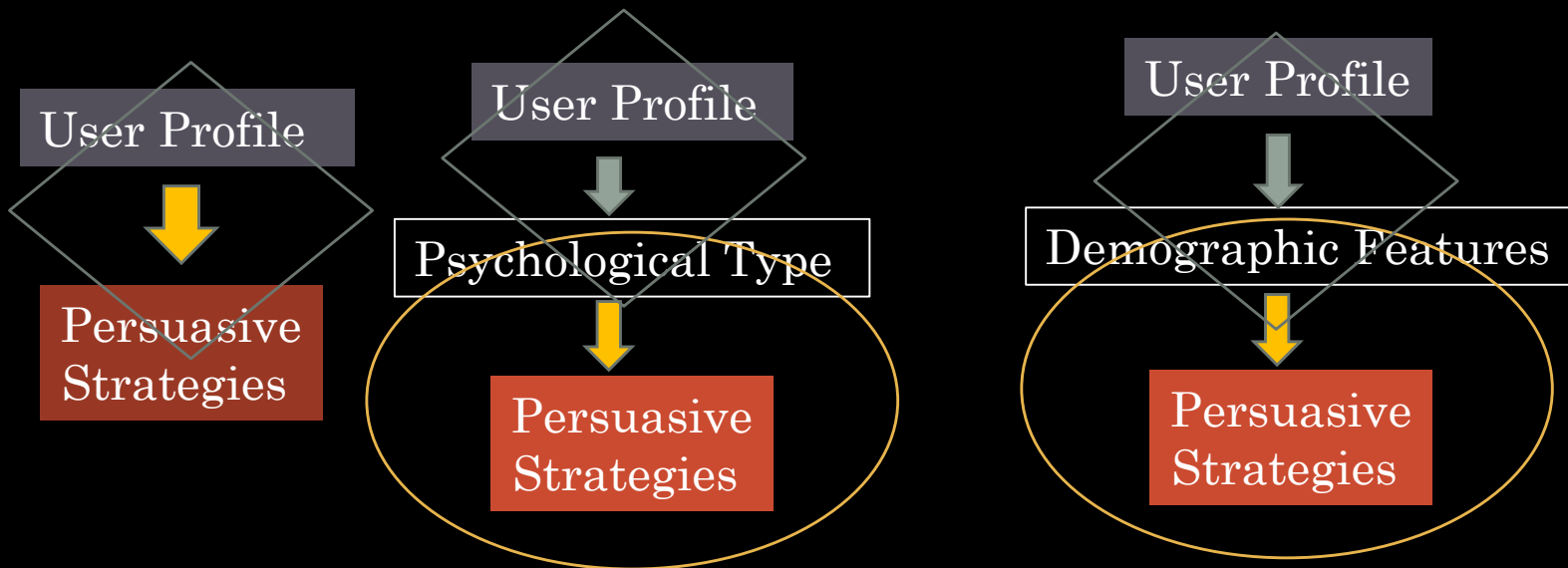


“A large study conducted by health scientists from the Mayo Clinic has shown that taking the stairs instead of the elevator three times a week leads to significant health benefits” (authority)

“Do you know that 80% of your colleagues took the stairs instead of the lift today?” (social proof)

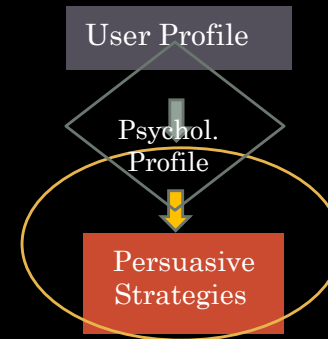
Adaptation Based on Stereotype

- Persuasive Strategy Tailored to abstract user features or to a User Stereotype (classification problem)
- Mapping persuasive strategies to user features/ stereotypes



Mapping Gamer Types to Strategies

Rita Orji, PhD 2014



	Competition & Comparison	Cooperation	Customization	Personalization	Praise	Self-monitoring & Suggestion	Simulation	Reward
Achiever		.15				.10		.10
Conqueror	.25			.12		.12	.14	
Daredevil	-.10					-.14	.11	
Mastermind	.12		.10	.12		.14	.12	
Seeker	.10		.19	.11	.10			
Socializer	.11	.17	-.12		-.12	-.13		
Survivor	.17	-.20	-.13			.27		-.14

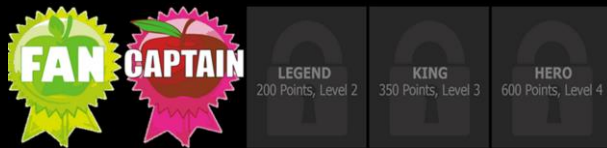
R Orji, J Vassileva, RL Mandryk (2014) Modeling the efficacy of persuasive strategies for different gamer types in serious games for health, UMUAI, 24 (5), 453-498

Persuasive Game for Healthy Eating

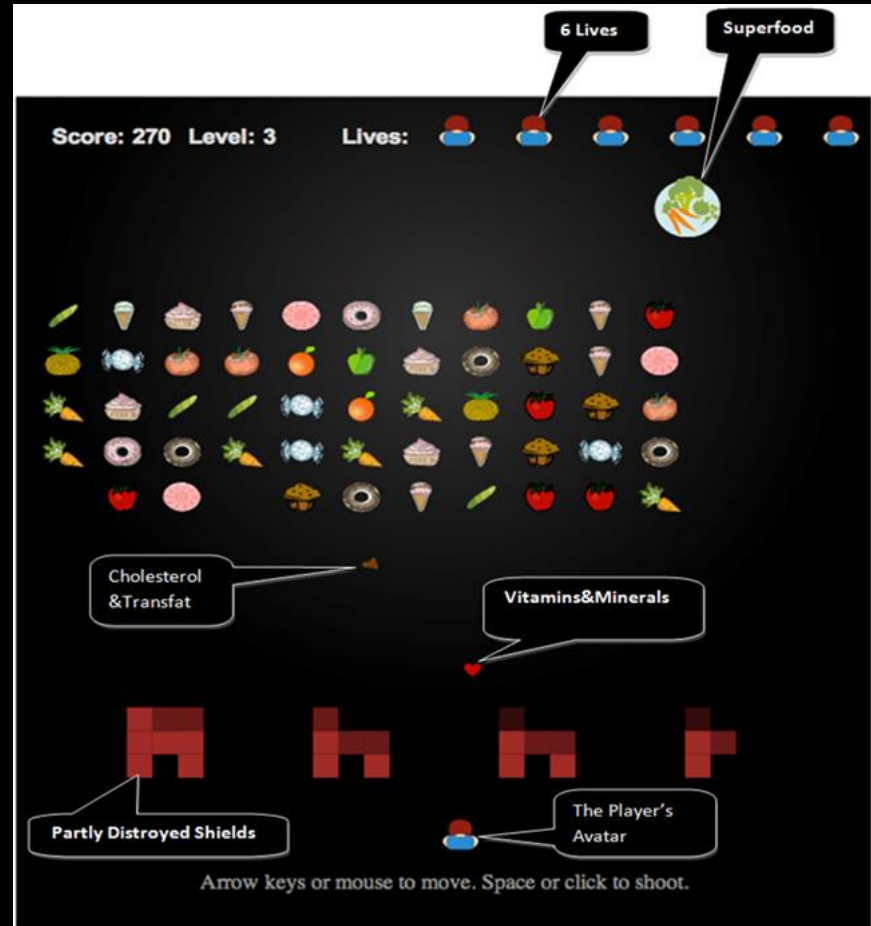
Level: 1			Level: 4		
Game Performance Leaderboard			Game Performance Leaderboard		
Rank	Player Name	Score	Rank	Player Name	Score
1st	Rita	372	1st	Jean	950
2nd	Heather	348	2nd	Charles	886
3rd	Charles	332	3rd	Jane	785
4th	Jean	331	4th	Rita	557
5th	Jane	312	5th	Heather	531

Competition Version

Level: 2
Score: 148

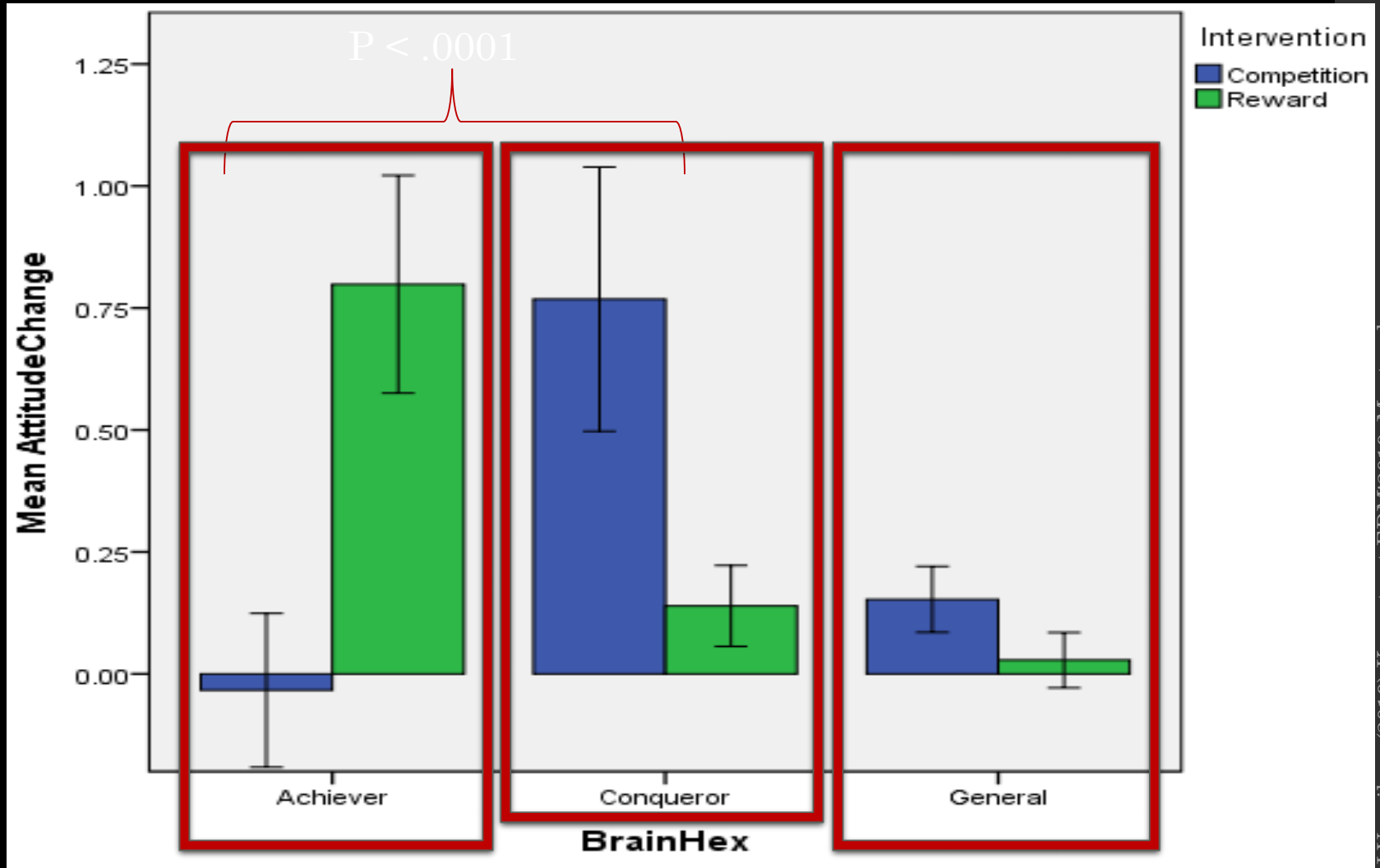


Achievement Version



R.Orji, J Vassileva, RL Mandryk (2017) Improving the efficacy of games for change using personalization models, ACM TOCHI 24 (5), 32

Results



Attitude Change over time – pre to post –by intervention type and gamer type.

Means for attitude, self-efficacy, and intention change over time – pre to post

	Achiever		Conqueror		General	
	CTC (compet)	TC (reward)	CTC (reward)	TC (compet)	OFA-C (compet)	OFA-R (reward)
	mean	mean	mean	mean	mean	mean
Attitude Change	-0.33	0.80	0.14	0.77	0.15	0.03
Efficacy Change	0.00	0.76	0.08		0.11	0.09
Intention Change	0.18	0.97	0.19	1.24	0.16	0.13
TC – tailored condition, CTC – contra-tailored condition, OFA – One-size-fits-all condition (Competition or Reward)						

Mapping demographics to persuasive strategies



Kiemute Oyibo, PhD thesis

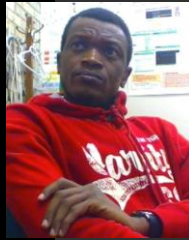
Mapping Culture, Gender, Age on user perception of design aesthetics, usefulness, usability, trustworthiness

Mapping Culture on Socio- Cognitive Theory Determinants of Behaviour Change.

- Canadian → Self-Efficacy and Self-Regulation
- Nigerian, Chinese → Social Support and Outcome expectation

Mapping common PSD strategies to the stages of the TTM in the context of bodyweight exercise.

Evaluating a persuasive coach for bodyweight exercise using the Trans Theoretical Model with Canadian and Nigerian students



User Profile

Demographic features

Persuasive Strategies

J. Vasilescu (2018) Keynote at EDM'2019, Montreal, July 3, 2019

Behavioral Change Theories in Health Sci

Theories / Models	Constructs / Determinants	Authors
Health Belief Model (attitudes and beliefs)	Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Cues to Action, Self-Efficacy	Rosenstock, 1974
Social Cognitive Theory	Self-Efficacy, Self-Regulation, Outcome Expectation, Social Support, Environment	Bandura, 1986
Theory of Reasoned Action / Theory of Planned Action (Belief-Attitude-Intention-Behaviour)	Behavioral beliefs Attitude towards Behavior Normative Beliefs Subjective Norms Control Beliefs Perceived Behavior Control Intention	Fishbein and Ajzen, 1980 Ajzen, 1985

J.Vassileva (2019) Keynote at EDM'2019, Montreal, July 3, 2019

Personalization of PT in Higher Education

243 Biol. students (76 males and 167 females)

Bush's Persuadability Inventory

Fidelia Orji, MSc Thesis

Determine Students' Susceptibility to Four Social Influence Strategies.

Establish if the strategies can be employed in PT for Education.

Establish whether PT for education can be personalized based on strategies.

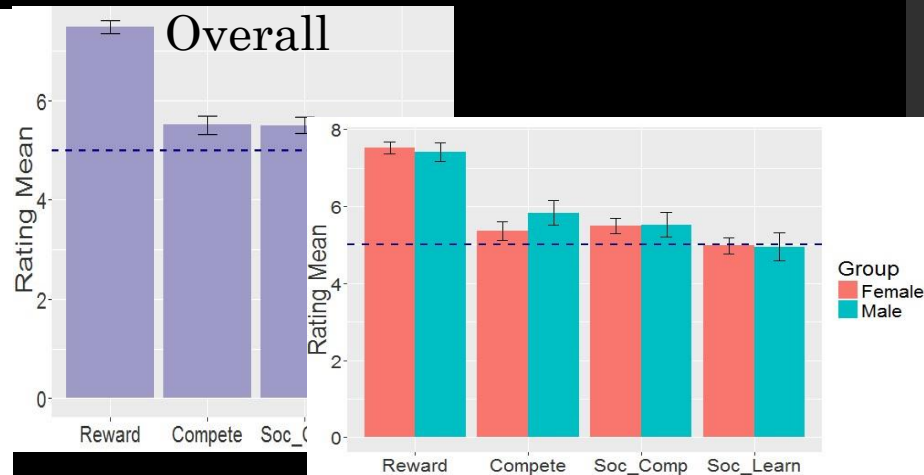
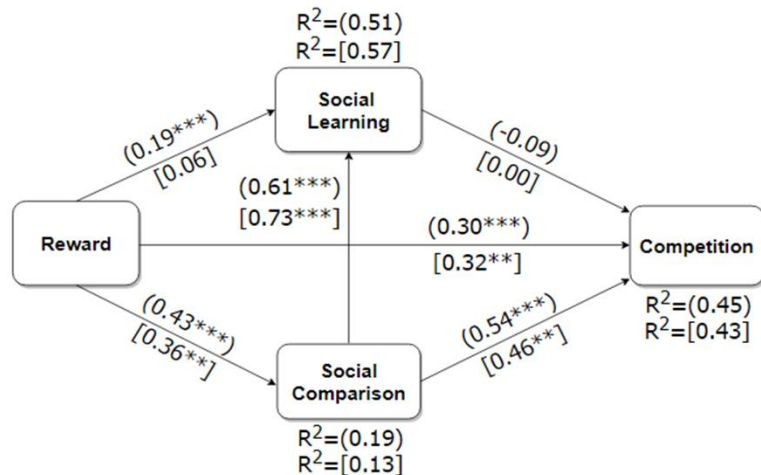


User Profile

Demographic features

Persuasive Strategies

Orji F, Oyibo K, Orji R, Greer J, Vassileva J (2019) Proc. UMAP'2019



*p<0.05 **p<0.01 ***p<0.001 | (Female, GOF = 0.43) [Male, GOF = 0.44]

Ethical Issues of AI and Big Data

BRIEFING • ARTIFICIAL INTELLIGENCE

A.I. Expert Says Automation Could Replace 40% of Jobs in 15 Years

By Don Reisinger January 10, 2019

Nov 2014-Dec 2016: The Magna Charta for Trustworthy AI, by the Irish Center for Data Analytics

Home › Startups in general › Europe'...

Startups in general The EU and Europe

Europe's call for human-centric, trustworthy AI will create more opportunities for startups

By Mary Lortitz - July 1, 2019

2019 EU Draft Ethics Guidelines for Trustworthy AI, 5 principles:

- "Do Good",
- "Do no Harm",
- "Preserve Human Agency",
- "Operate Transparently",
- "Be Fair".

- Fairness, Transparency, Accountability (FAT)
- FAT Workshops at AI- and DM-conferences, mostly focused on algorithmic FAT
- Interdisciplinary research area; AI Law & Ethics Conference

Ethical and Trustworthy AI

Montreal Declaration

- 1- WELL-BEING
- 2- RESPECT FOR AUTONOMY
- 3- PROTECTION OF PRIVACY AND INTIMACY
- 4- SOLIDARITY
- 5- DEMOCRATIC PARTICIPATION
- 6- EQUITY
- 7- DIVERSITY INCLUSION
- 8- PRUDENCE
- 9- RESPONSIBILITY
- 10- SUSTAINABLE DEVELOPMENT

EU Draft Guidelines

- 1.Accountability
- 2.Data Governance
- 3.Design for all
- 4.Governance of AI Autonomy (Human oversight)
- 5.Non-Discrimination
- 6.Respect & Enhancement of Human Autonomy
- 7.Respect for Privacy
- 8.Robustness
- 9.Safety
- 10.Transparency

2019 EU Draft Ethics Guidelines for Trustworthy AI

Principles

- “Do Good”,
- “Do no Harm”,
- “Preserve Human Agency”,
- “Operate Transparently”,
- “Be Fair”.

Paying particular attention to:

- situations involving **vulnerable groups** such as children, the elderly, persons with disabilities or minorities, or to
- situations with **asymmetries of power or information**, such as between employers and employees, or businesses and consumers.

What do these principles mean

- **DO GOOD**: improve individual and collective wellbeing.
- **RESPECT AUTONOMY**: freedom from subordination to, or coercion by, AI system
- **ENSURE FAIRNESS**: individuals and minority groups maintain freedom from bias, stigmatisation and discrimination. Additionally, the positives and negatives resulting from AI should be evenly distributed
- **AVOID HARM**: Protect the dignity, integrity, liberty, privacy, safety, and security of human beings. Protect societies from ideological polarization and algorithmic determinism
- **BE TRANSPARENT**: how system operates should be auditable, comprehensible and intelligible by human beings

How AIED, EDM and PPT can meet these principles?

- “Do Good” -- Whose goals define what should be learned and what is a “Desirable behaviour”?
- “Preserve Human Agency” -- Student agency OR manipulation?
- “Be Fair” - How to ensure data collected is unbiased and complete?
- “Transparency” - Are people aware that they are being persuaded?
- “Do no harm” – Are we making people addicted?


Too much engagement?

“And it’s persuasive design that’s helped convince this generation of boys they are gaining “competency” by spending countless hours on game sites, when the sad reality is they are locked away in their rooms gaming, ignoring school, and not developing the real-world competencies that colleges and employers demand.”

Richard Freed


Medium Sign

★ Member preview

 **Richard Freed** [Follow](#)
Child and adolescent psychologist, and the author of “Wired Child: Reclaiming Childhood in a Digital Age”
Mar 12 · 24 min read

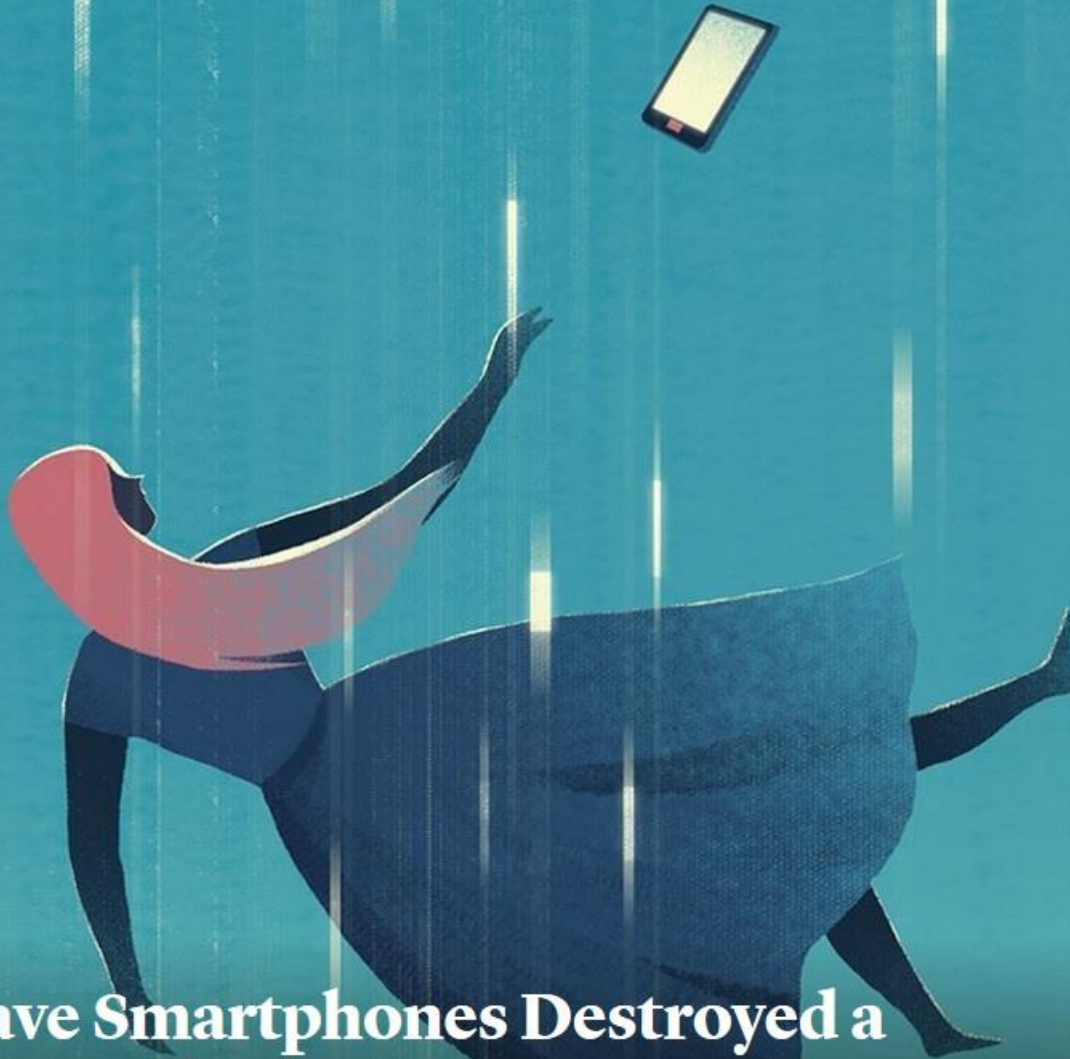
The Tech Industry’s War on Kids

How psychology is being used as a weapon against children



Donald Iain Smith/Blend Images/Getty Images

We called the police because she wrecked her room and hit her mom... all because we took her phone,” Kelly’s father explained. He said that when the police arrived that evening, Kelly was distraught and told an officer that



Have Smartphones Destroyed a Generation?

More comfortable online than out partying, post-Millennials are safer, physically, than adolescents have ever been. But they're on the brink of a mental-health crisis.

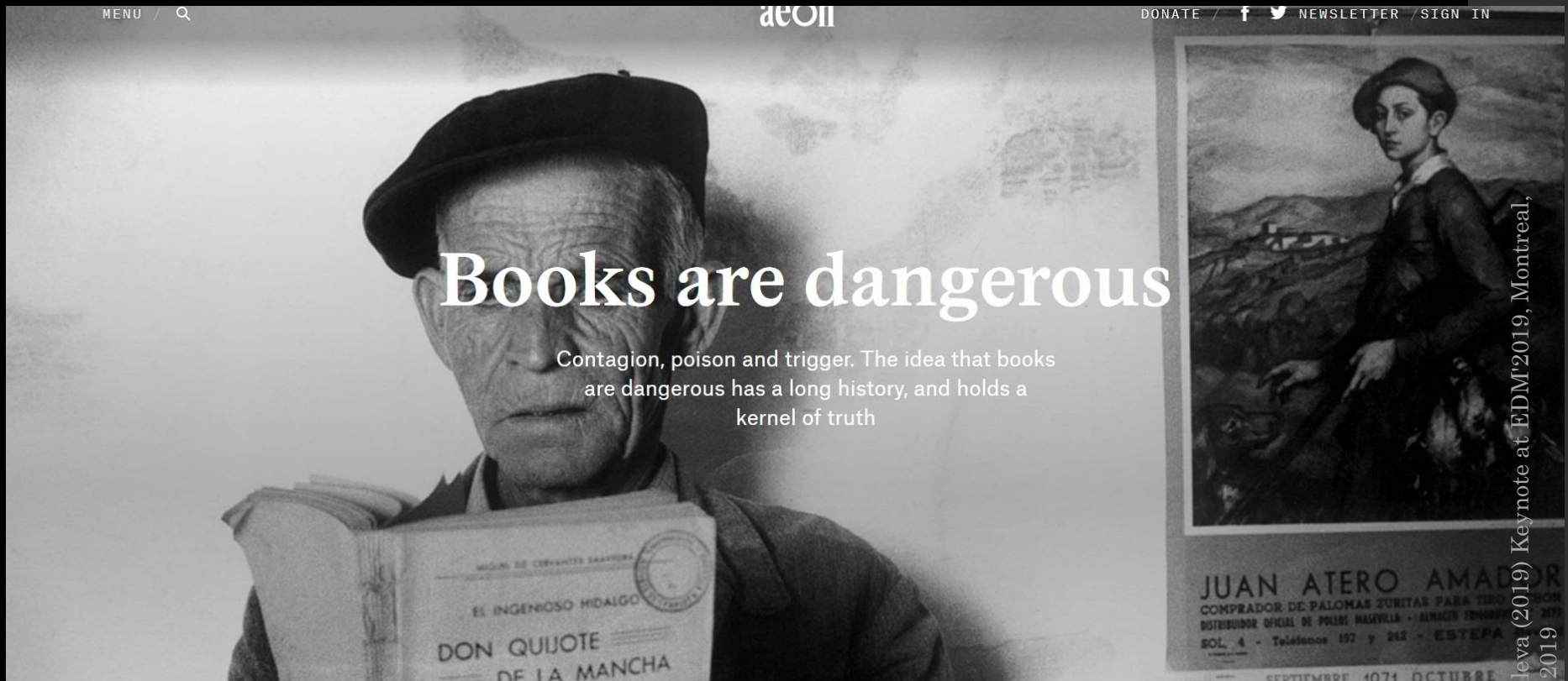
THE SCIENTISTS WHO MAKE APPS ADDICTIVE

Tech companies use the insights of behaviour design to keep us returning to their products. But some of the psychologists who developed the science of persuasion are worried about how it is being used



Media Panic

History shows that media panics happened every time when new transformative technologies appeared.



Books are dangerous

Contagion, poison and trigger. The idea that books are dangerous has a long history, and holds a kernel of truth

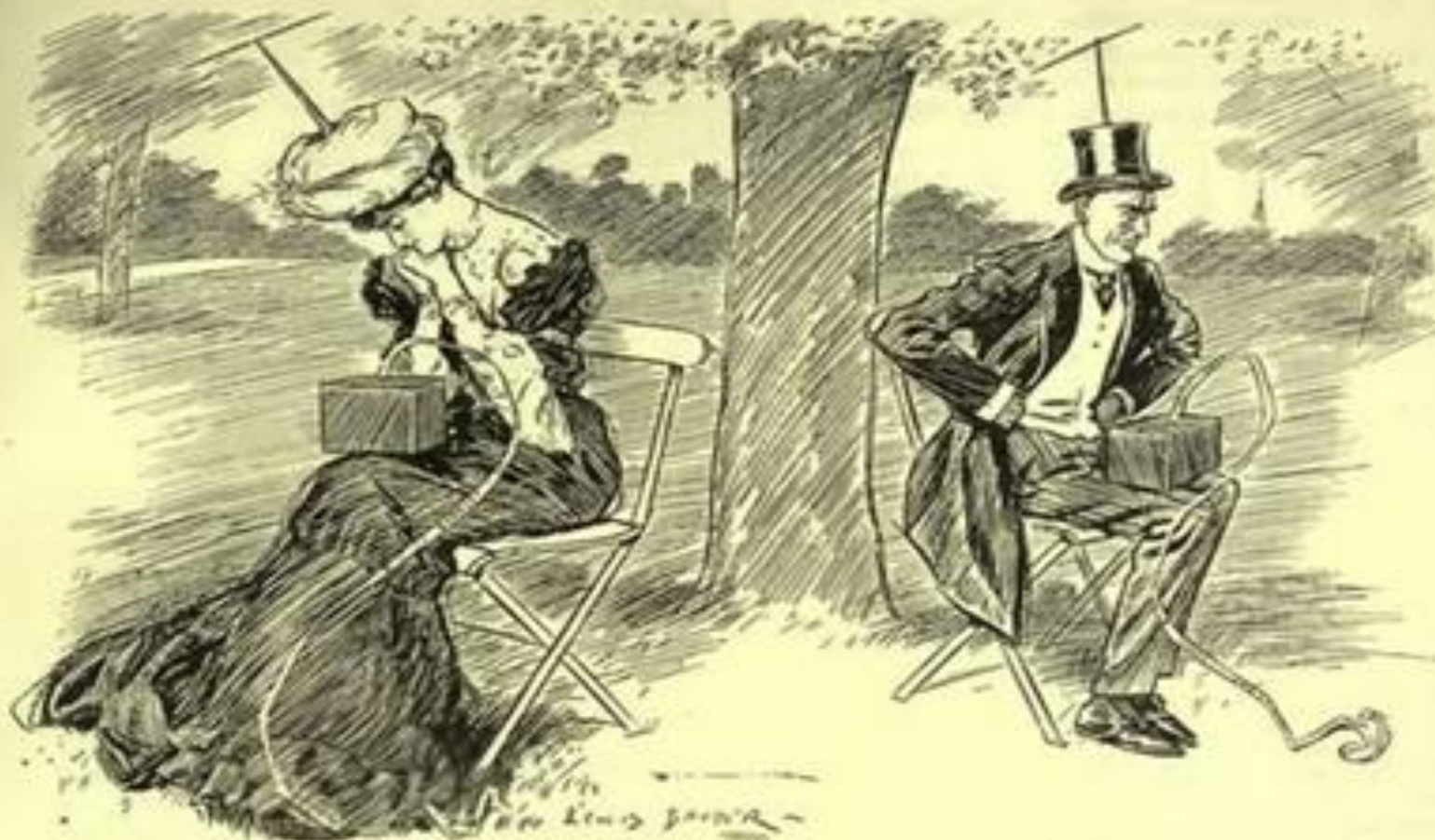
Society evolves, people adapt.

J. Vassileva (2019) Keynote at EDM'2019, Montreal, July 3, 2019

There was a media panic in the 18th century about reading novels - a very dangerous occupation for young women



FORECASTS FOR 1907.



IV.—DEVELOPMENT OF WIRELESS TELEGRAPHY. SCENE IN HINDU PARK.

[These two figures are not communicating with one another. The lady is receiving an amatory message, and the gentleman some racing results.]



From Sleepers To Creepers: The Wo...

CollegeTimes.com

Don't even try and talk to a person reading their book, they aren't interested and will be pissed off if you make them lose their place.

Visit

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View saved

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STRESSED,
DEPRESSED,
TV SERIES
OBSESSED.

800 x 640 - Images may be subject to copyright

Ethical Issues of the Use of Personal Data and Datamining

Privacy (Montreal Declaration)

Personalized technology needs to collect data to model users.

How is this data safeguarded and how it is shared? With whom? For what purpose? Do the users have a say? Do they own their data?

My interpretation:

- The data should be stored safely (**Do no harm**).
- Users should understand for what purpose, with whom and how their data is used (**Be transparent**),
- Users should have control over the sharing (Preserve **Human agency**).
- They should benefit from their data sharing! (Do Good and **Be fair**)

A modest proposal for ethical user data sharing



The technology exists already,
rapidly developing: Distributed
ledgers

Shrestha A., Vassileva J. (2016) Towards decentralized data storage in general cloud platform for meta-products. Proc. Big Data and Advanced Wireless Technologies, ACM

“Data is the new oil”.

No hoarding of user data!

Ecosystem of services produce and consume user data.

User data, securely stored and access control flexibly managed by the user through Distributed Ledgers (Blockchain).

Flexible and transparent policies (smart contracts) regulate the purpose of use, type of data, terms of use, and price.

Incentives for sharing user Data, User Awareness and Control of how the data is used.

Legally binding in contracts.

Take home message

- AIED and Intelligent Tutoring Systems can benefit from Personalized Persuasive Technologies (PPT):
 - Engage learners, increase motivation, change attitudes and behaviours
- EDM can power PPT by
 - Learning user susceptibility to persuasive techniques
 - Learning relationships between demographic, psychological and context features and susceptibility to persuasive techniques
 - Learning optimal combinations / sequences of persuasive techniques
- The Questions related to Ethics need to be asked from the start, through the entire lifecycle of an application

More Info

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- <http://madmuc.usask.ca>