

Understanding users: a behaviourally-driven approach to LCA and Eco-design

A behavioral scientist working with LCA practitioners

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Identifying some key gaps in LCA

Relative low priority of the use phase

But: High relevance for certain product/services

- Household appliances
- Food waste¹
- Mobility²



LCA studies often rely on aggregated, secondary, average data or straightforward assumption on user behaviour

But: Different behaviours may lead to different intensities of impacts

- type of behaviours
- frequency of behaviours
- share of population expressing those behaviours

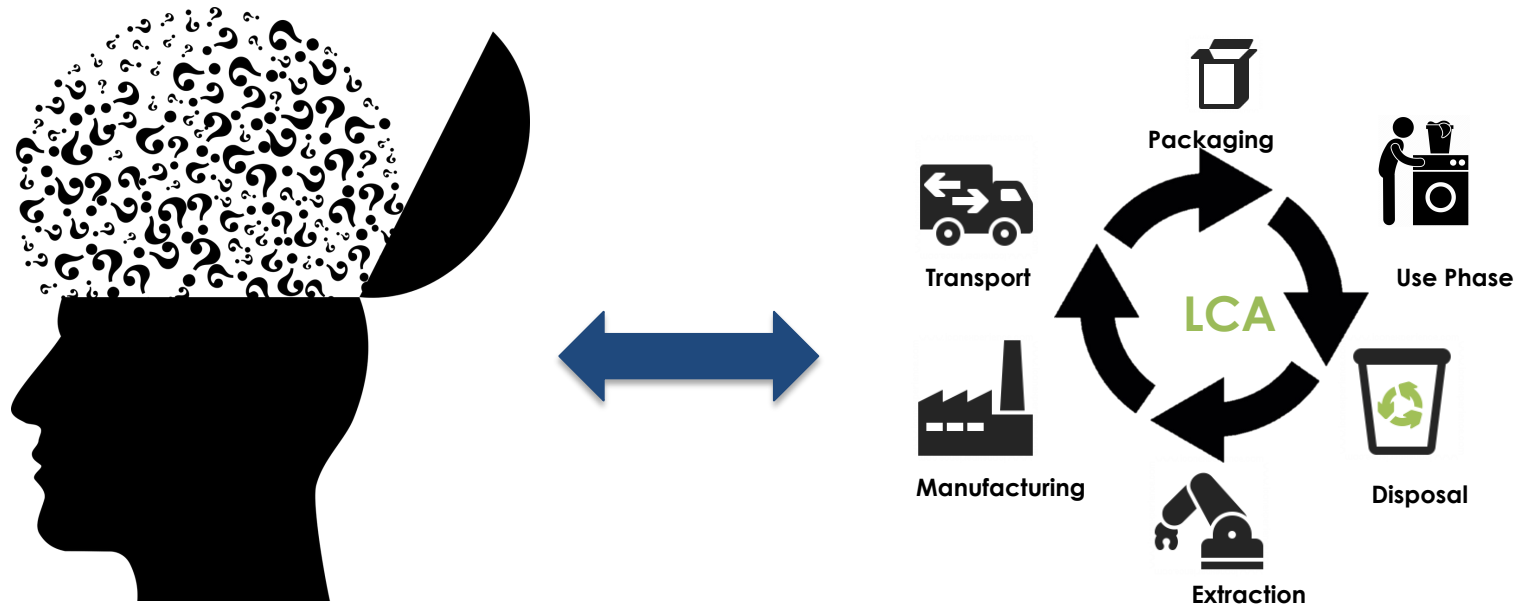
Relative impact due to the use phase may be incorrectly estimated

A better modeling of the use phase is needed

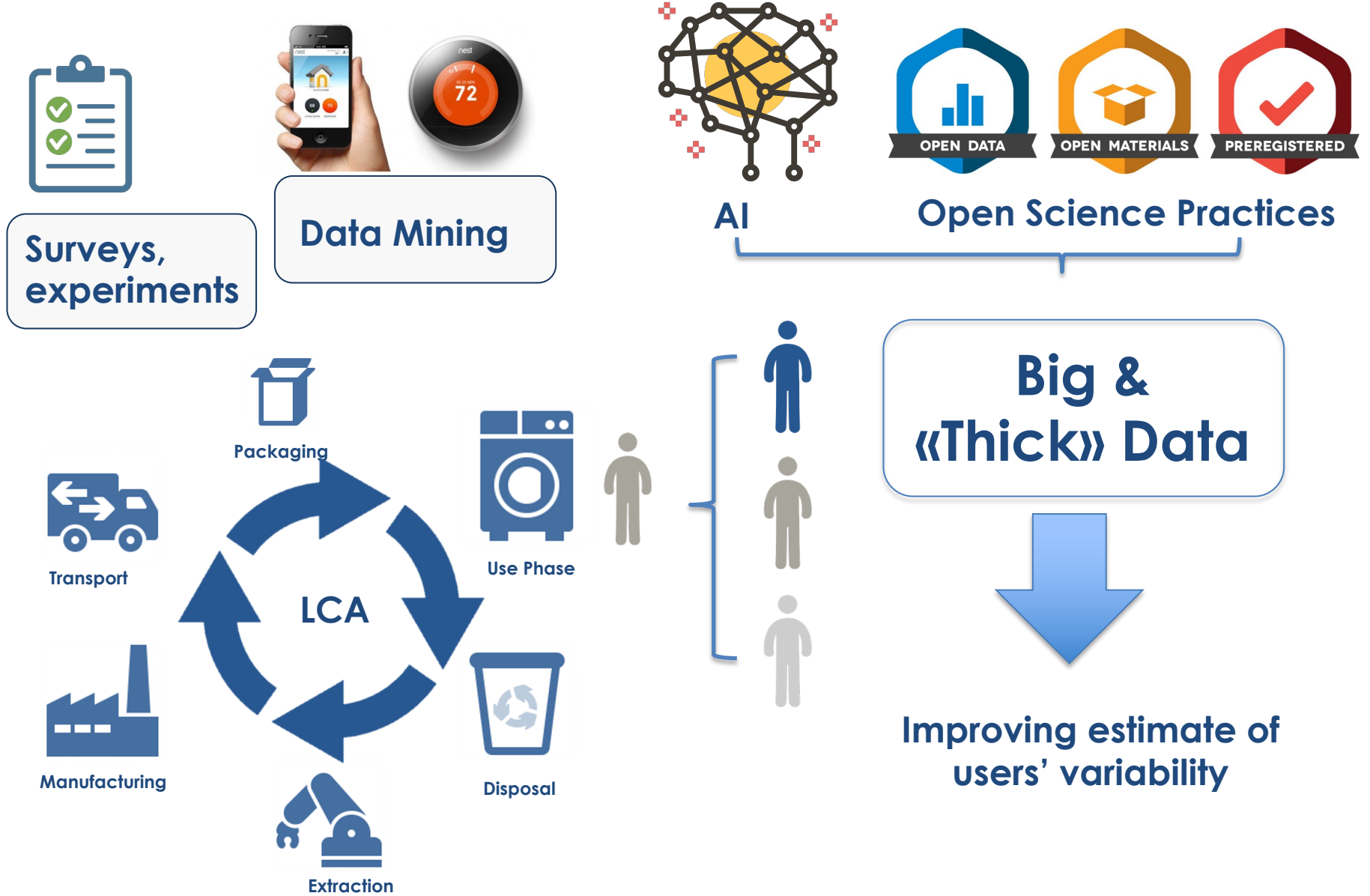
What are the potentials of a BS perspective for LCA?

- support the use phase modeling, by providing insights on how to observe, measure, and predict behaviors³.

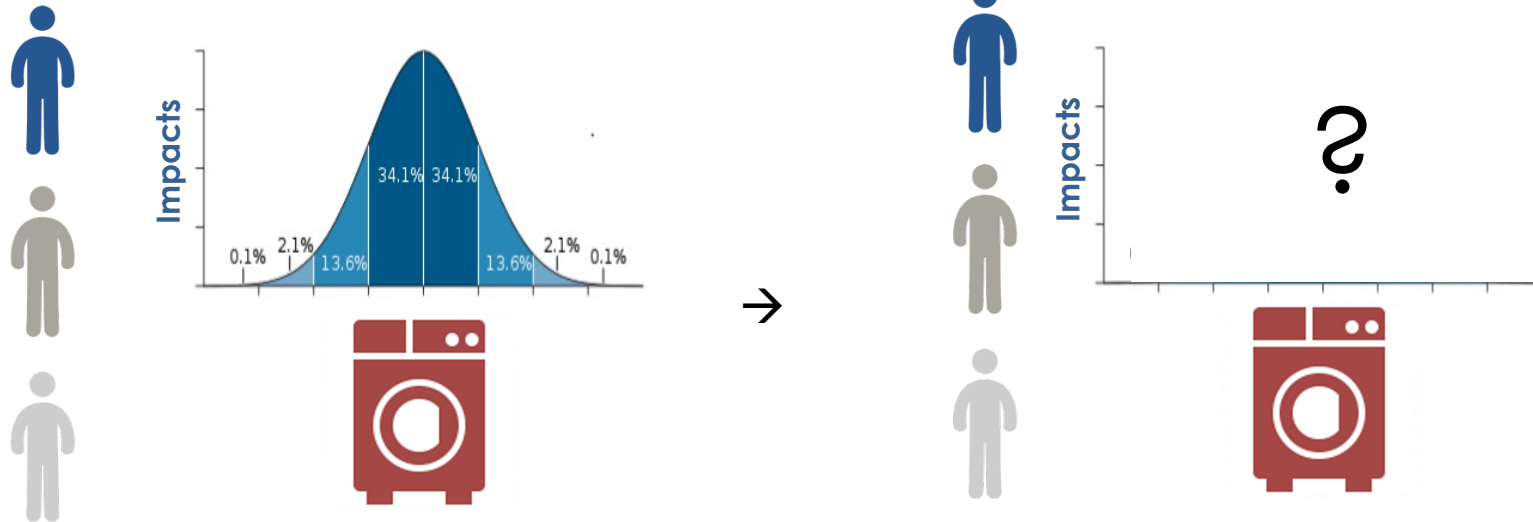
Q:What are the potentials of LCA perspective for BS practitioners involved in sustainability research?




Towards better assumptions in LCA use phase : assessing behavioural variability



Towards better assumptions in LCA use phase : modelling behavioural variability



 Inclusion of new behavioural types

BS insights on:

Cognitive/social determinants of sustainable behaviour

Rebound and Spillover effects

THE COGNITIVE BIAS CODEX

What Should We Remember?

Too Much Information

To avoid mistakes, we need to be skeptical and cautious

We are drawn to details that confirm our own existing beliefs

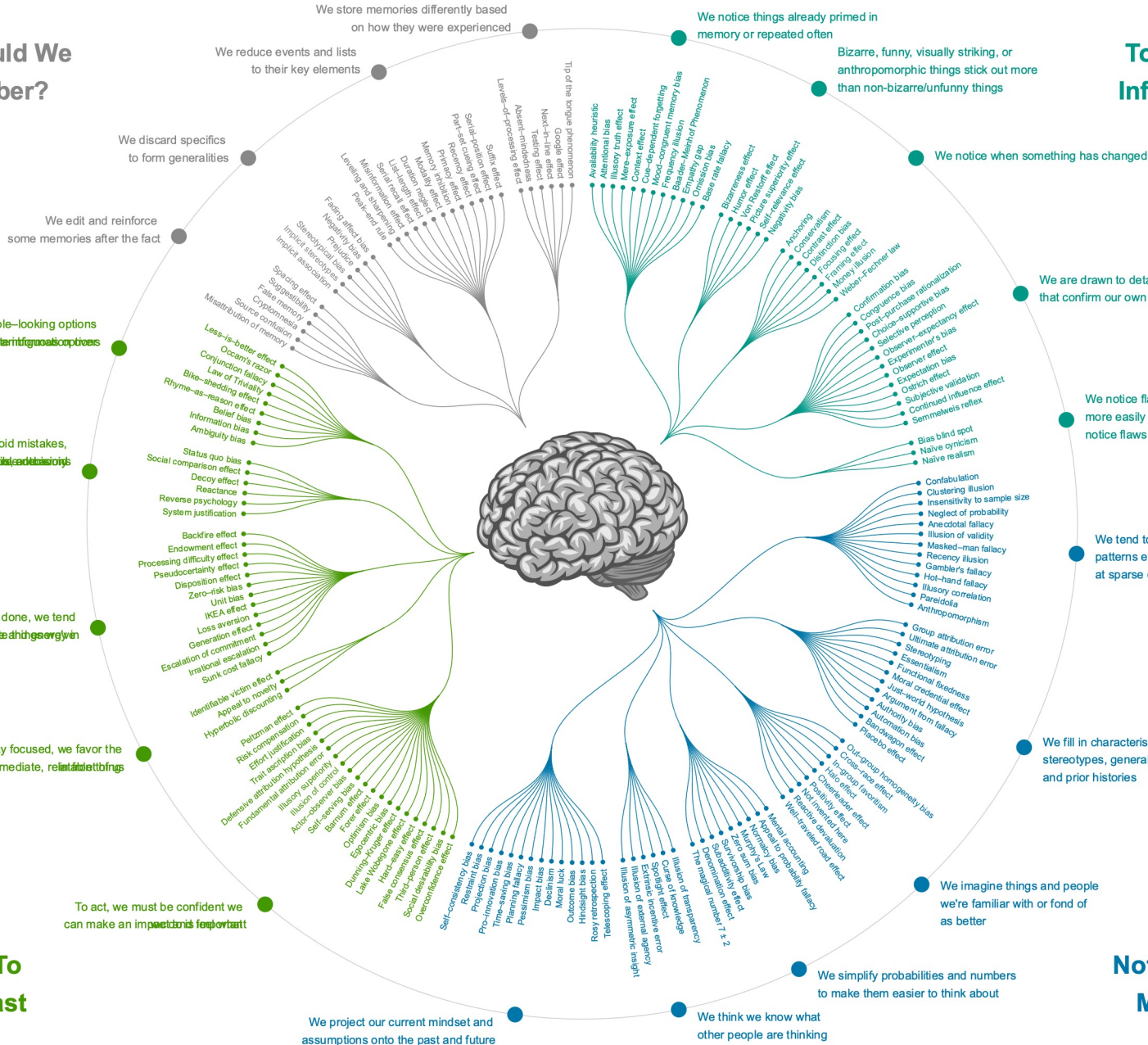
We notice flaws in others more easily than we notice flaws in ourselves

We tend to find stories and patterns even when looking at sparse data

We fill in characteristics from stereotypes, generalities, and prior histories

Need To Act Fast

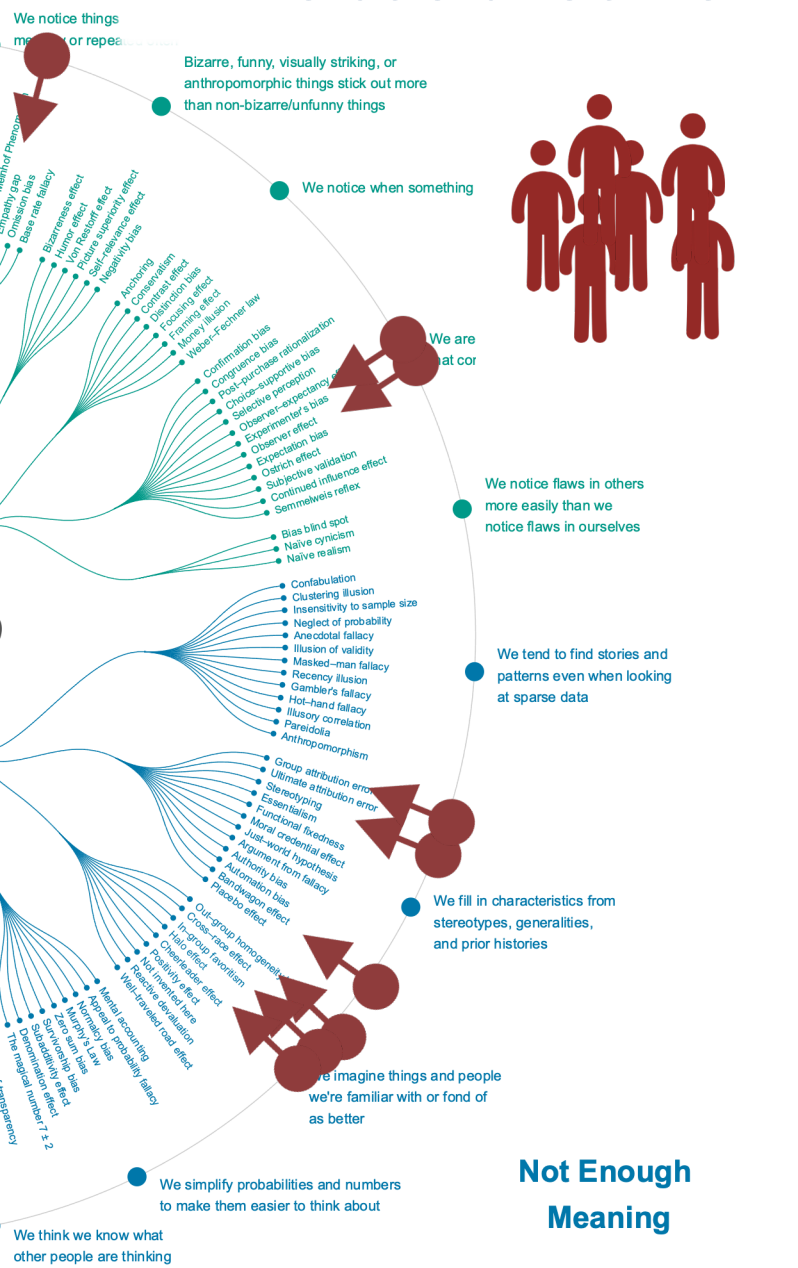
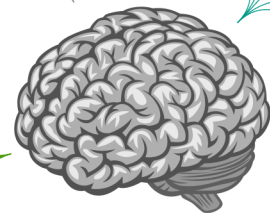
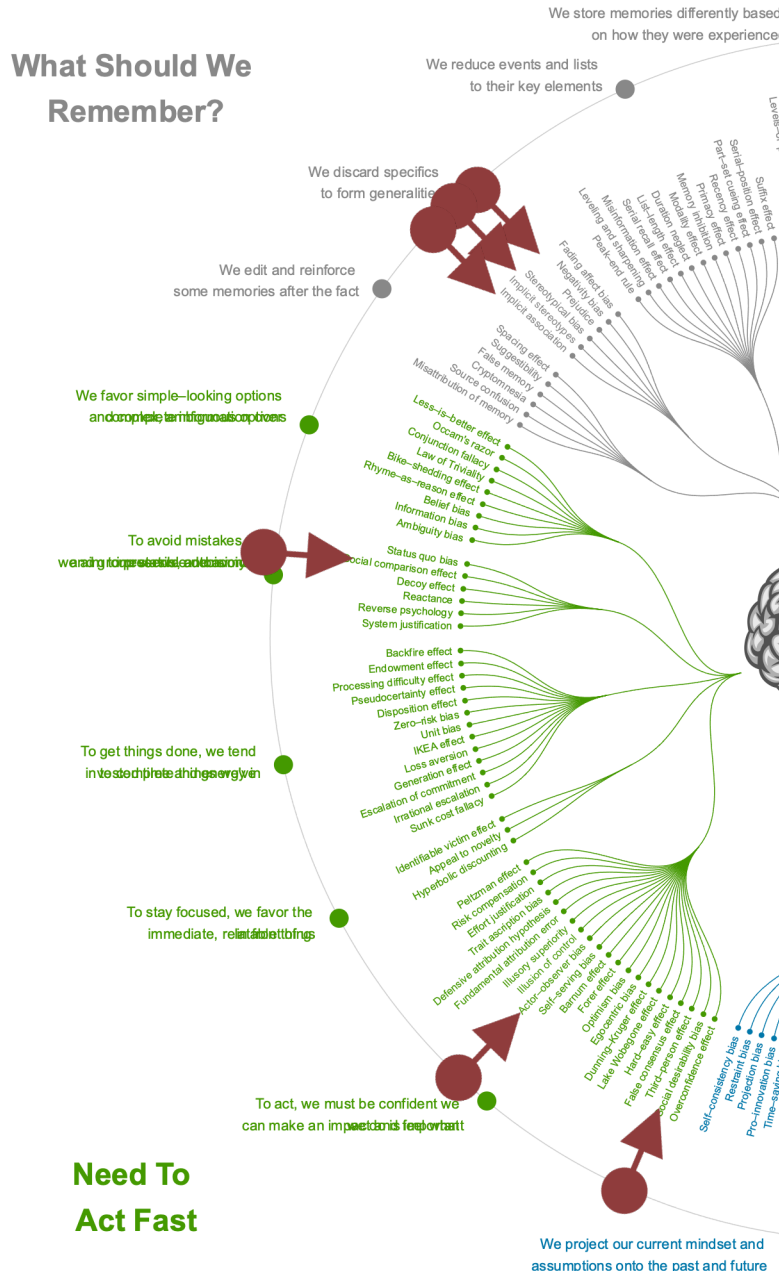
Not Enough Meaning



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The social context

What Should We Remember?



Need To Act Fast

Not Enough Meaning

Social drivers of sustainable behaviour

Sustainable Behaviour is sometimes driven by how we want others to see us (social status, reputation)



Top reasons customers cited for buying a Prius	2Q'07 1Q'04	
	2Q'07	1Q'04
"Makes a statement about me"	57	34%
Other (including incentives, business, etc.)	42	42
Higher fuel economy	36	27
Distinctive styling	33	41
Lower emissions	25	36
New technology	7	19

Source: CNW Marketing Research

Consumer choice: based on functionality, but also as signal to express membership and sustainable attitudes⁴

Social drivers of sustainable behaviour: the case of social norms

People beliefs and actions are heavily influenced by what they perceive their peers think or do^{5, 6}

Misalignment bw perception and others true beliefs may account for the persistence of unsustainable behaviour⁷

Why relevant for LCA/eco-design?

Norm-based interventions can increase the uptake of sustainable solutions (e.g., social feedback⁸, trending norms⁹, belief realignments⁷)

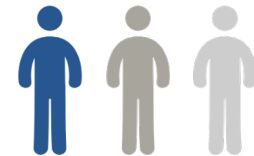
Many more people than you think are using product x

Every day, more people are adopting product x

informing
eco-design



model
usage scenario



Social drivers of sustainable behaviour: the case of social norms

Segmentation of users based on propensity to follow social norms?



«empirical type» 11,6%
behave according to what they expect others will do



«normative type» 14,1%
behave according to what they expect others want them to do



«social norms followers» 10,9%
empirical+ normative

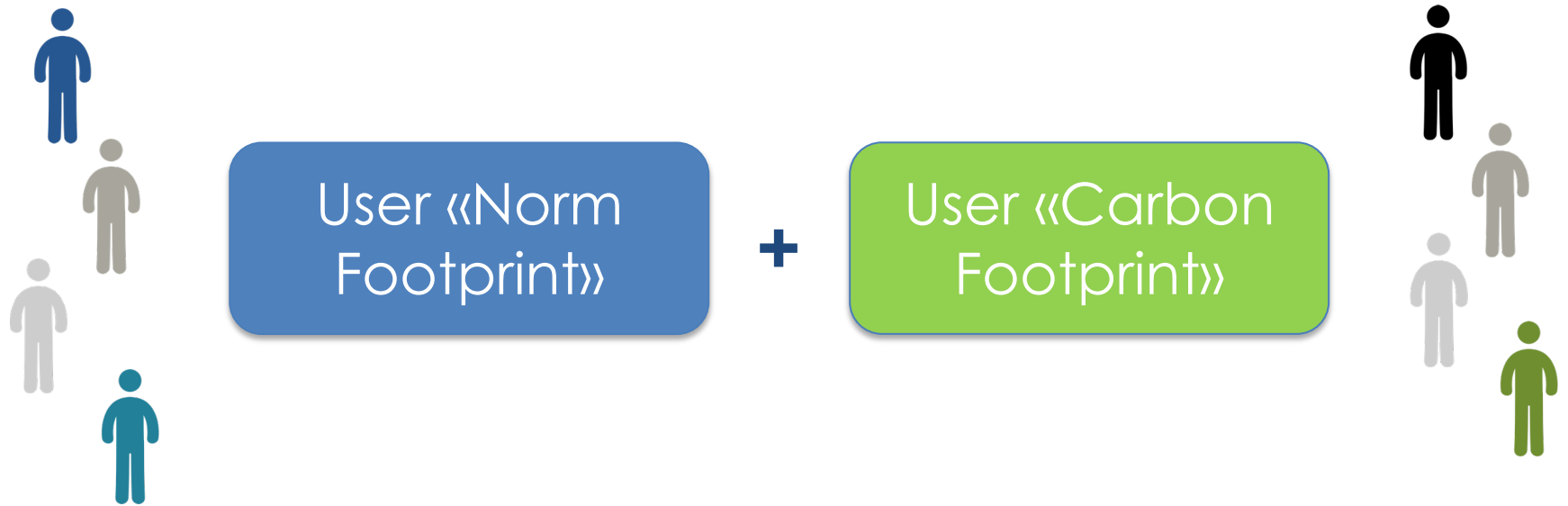


“threshold-driven participants” 26,5%
strategically selfish



«unconditional type» 37%
resilient to changes

Norm Footprint



Modelling variability in behaviour and norm sensitivity can optimize the potential for behaviour change (impact reduction of use phase)

Modelling behavioural variability: the case of ABM in LCA

A product or a service may cause changes in user behaviour (e.g., rebound effects) which need to be included in the environmental assessment.

Increasing need to model complex production and consumption patterns (e.g., sharing economy)

ABM: artificial agents interacting with each other and their environment over time → emergent dynamics in complex systems (bottom-up)^{13, 14}

Individual decision rules:

- Sophisticated cognitive agents (cognitive biases)
- Social determinants of behaviour (social norms, peer pressure)

Homogeneity is not assumed!

Suitable framework to study complex systems in LCA and sustainability studies¹⁵

Application of ABM in LCA: smart homes vs default homes (Walzberg et al 2019)

empirically validated theories+empirically based data

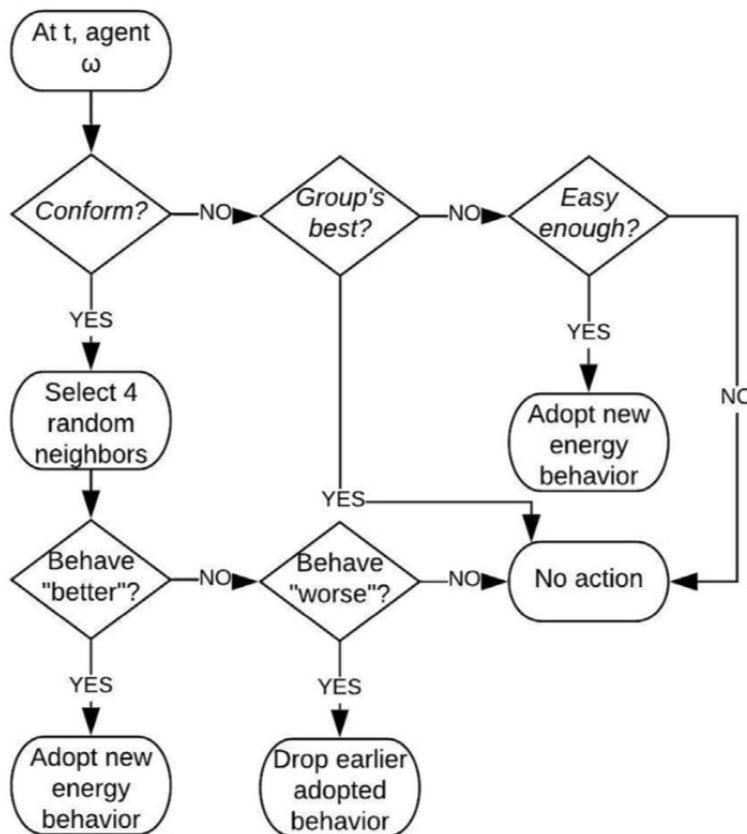


Table 2

Factor levels in a 2_{IV}^{7-2} fractional factorial design for smart homes use.

Factor	Low level	High level
<i>Contextual factors</i>		
Price scheme	Constant	TOU
Geography	Toronto	Thunder Bay
Load scheduling metric	CAD	DALY
<i>Personal capabilities factor</i>		
PV battery system	No	Yes
<i>Attitudinal factors</i>		
Probability of engagement	0.2	0.3
Probability to conform	0.275	0.375
Distribution of agent types	Majority of passive consumers	Majority of stalwart consumers

What-if scenario by changing relevant parameters

e.g., the effect of conformity on the probability of adopting pro-environmental changes over time

Fig. 3. ABM's decision rules for household agents following energy feedback.

Current challenges and opportunities

Difference in perspective impact-based vs intent-based¹⁷: are they reconcilable?

Spillover effects: high level of complexity, not easy to model

Moving beyond environmental LCA: BS and Social-LCA?

Increase opportunities for knowledge sharing between LCA experts, eco-designers and behavioural scientists (workshops, round tables)

THANKS!

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