Affordances and Behavioral Outcomes of Wearable Activity Trackers

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Motivation

- The health sector has considerable optimism about WATs' potential: The intended behavioral outcomes of WAT use, such as increased activity levels and conscious nutrition, are keys to improving public health and reducing pressure on healthcare providers and insurers

- Quantitative studies on effectiveness and behavioral outcomes of wearable use present an ambivalent picture; IS researchers have primarily focused on use itself rather than its outcomes.

- We lack an empirically founded explanation for how behavioral outcomes are achieved.

- Our goal is to explain why users might interact with the same technology in different ways and experience different outcomes.

Sjöklint et al. (2015); Gimpel et al. (2013); Brickwood et al. (2019); Becker et al. (2017); Kari et al. (2016); Rieder et al. (2019);   Image: Suunto.com

Research Question

*How do the affordances provided by Wearable Activity Trackers enable behavioral outcomes?*

Affordances…

… describe "what is offered, provided, or furnished to someone or something by an object" (Volkoff and Strong, 2013, p. 822).

… arise from the relationship between an artifact and a goal-oriented actor,

… refer to the possibilities for action offered by the material properties of an IT artifact to a user in order to achieve a goal in IS research.
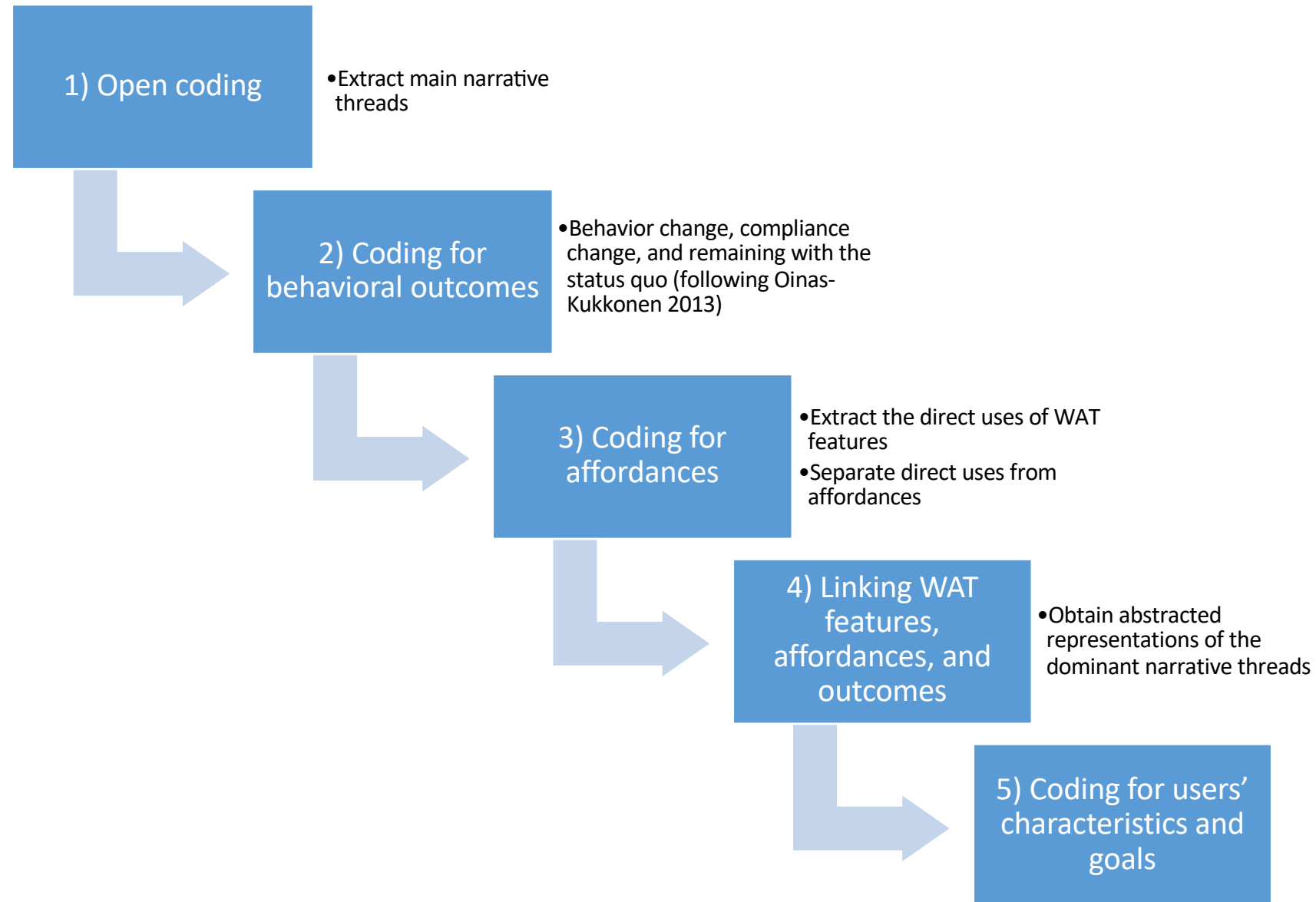
Ex. affordances of an ice axe:

Volkoff and Strong (2013); Volkoff and Strong (2017); Leidner et al. (2018);
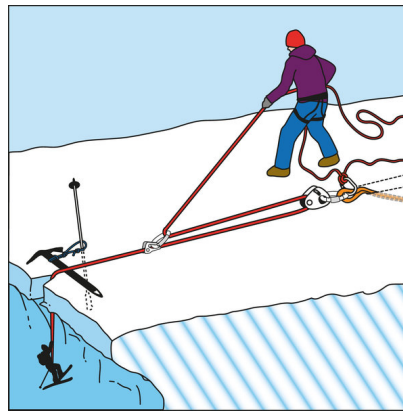
Data Collection

- Qualitative approach

- Narrative interview technique

- Sample: 25 Switzerland-based users of Wearable devices by Fitbit and Apple; f:12, m:13; including students and professionals; ages from 21 to 64 years

- Purposive sampling strategy: use duration > 6 months was primary inclusion criterion

- Average interview length: 48 minutes; min 26 to max 83 minutes

Chatman (1978); Küsters (2009); Miles and Huberman (1994); Saunders et al. (2018)

Data Analysis

1) Open coding

- Extract main narrative threads

2) Coding for behavioral outcomes

- Behavior change, compliance change, and remaining with the status quo (following Oinas-Kukkonen 2013)

3) Coding for affordances

- Extract the direct uses of WAT features
- Separate direct uses from affordances

4) Linking WAT features, affordances, and outcomes

- Obtain abstracted representations of the dominant narrative threads

5) Coding for users' characteristics and goals

Leidner et al. (2018)

Results

- Two classes of affordances:
    - 1) Learning affordances
    - 2) Behavior-focused affordances
- Four user types with distinctive use motivations, uses of featues, affordance actualization, and outcomes:
    - 1) Problem-Solvers
    - 2) Performers
    - 3) Dataficionados
    - 4) Self-Observers

WATs' features	Direct uses of features	Actualized affordances	Behavioral outcomes by type of user			
			PS	P	D	SO
Activity tracker	• Check level of physical activity (e.g., number of steps) • Set personal behavioral goals • Check status of goal attainment	• Working toward short-term behavioral goals (B) • Observing one's own activity (L) • Reviewing one's own activity (L) • Developing awareness of one's activity level (L)	BC	BC, R	R	CC
Challenge feature	• Invite others • Connect with others • Join challenge • Look at rankings	• Competing with others (B) • Ranking own performance (L)	-	R	-	CC
Pulse / heart-rate tracker	• Check pulse / heartrate • Set target pulse range	• Observing one's own physical function (L) • Training in one's optimal pulse range (B)	-	CC, R	R	-
Sleep tracker	• Record sleep stages • Set smart sleep alarm	• Understanding one's sleep patterns and quality (L)	R	BC	R	R
Nutrition tracker	• Enter food / drink intake	• Assessing nutritional behavior (L)	-	-	R	CC
Reminders	• Receive reminders	• Obtaining awareness of ideal behavior (B) • Increasing one's body-mindedness (L)	-	CC	CC	CC

PS = Problem-solvers; P = Performers; D = Dataficionados; SO = Self-observers; BC = Behavior change; CC = Compliance change; R = Remaining with the status quo; (L) = Learning affordances; (B) = Behavior-focused affordances

	Problem-Solvers	Performers	Dataficionados	Self-Observers
User characteristics	- Have a health issue or health-related dissatisfaction	- Sporty/ active - Seek achievement	- Tech-enthusiasts - Enjoy exploring new gadgets	- Inactive in working life - Interested in wide range of smart features, not only health-related ones
Usage goal/ motivation	- Tackle problem and regain control - WAT mediates between mind and body	- Improve performance - Self-optimization	- Turn life into data - Self-quantification - View data and personal statistics	- Smart features - Gain insights into their behaviors and functioning
Main use of features	- Activity tracking (esp. step couting)	- Activity tracking (esp. sports) - Heart rate monitoring - Social features	Passive use of: - Activity tracking - Sleep tracking	- Activity tracking - Social features - Sleep tracking - Nutrition tracking - Reminders
Actualized affordances	- Gaining awareness - Observing / reviewing	- Reviewing / Assessing - Optimizing training (with regard to pulse range, intensity etc.) - Competing with others	- Observing	- Observing / reviewing / assessing - Working towards goals imposed by WAT - Gaining awareness / learning
Behavioral outcomes	- Behavior Change	- Behavior change only if required to enhance performance, otherwise remaining with status quo	- Remaining with the status quo	- Compliance Change

Contributions

- Our results show that, even when users have established highly sustainable use patterns (i.e., after several years of use), their physical behavior may still be unaffected. Therefore, we posit that the conceptual separation of WAT use and behavior change is central to analyzing and explaining either of them.

- Users' goals are one of the key determinants of differences in behavioral outcomes.

  Proposition 1a: Problem-solvers and performers are prone to show a behavior change.

  Proposition 1b: Dataficionados are prone to remain with the status quo.

  Proposition 1c: Self-observers are prone to show a compliance change.

- Two classes of actualized affordances are identifiable and help to explain the functioning of the individual affordances that users actualize and the behavioral outcomes they give rise to.

  Proposition 2a: If only learning affordances are actualized, users are prone to remain with the status quo.

  Proposition 2b: If behavior-focused affordances are actualized, users are prone to show a compliance or behavior change.

Implications for Research

1. Our results offer explanations for other studies' varying results regarding WATs' ability to change behavior.

2. Researchers should identify the goals and basic motivations that their study participants pursue by using WATs.

3. When using WATs devices that are designed for experimental purposes or commercially available WAT, researchers should consider which affordances the devices—or, more specifically, which of its features—may be useful to which groups of users.

4. A more nuanced view of behavioral outcomes of WATs needs to be employed. We suggest a differentiation in the magnitude of change (i.e., behavior change vs. compliance change) instead of pre-post measurements of measures like physical activity, sedentary time, nutritional intake, and body weight.

5. Longer study periods are needed to assess the devices' effectiveness over the long term.

Practical Implications

1. WAT designers must find a better balance between technically possible affordances and affordances that users actually perceive as useful, understand, and realize.

2. Depending on which of the two broad categories of affordances a feature offers, users may be hindered from arriving at particular sets of outcomes.
    (E.g., a feature that offers only learning affordances might be less powerful in inducing behavioral outcomes since users have to come up with ideas for concrete actions themselves.)

3. Users' goals should be considered when designing WATs, because they play a major part in determining which affordances users are actualizing and which outcomes they are reaching.

4. WAT providers should use more differentiated measures of success, since use statistics lack the power to explain WATs' behavioral effects. In fact, all of our interview participants were continuous, long-term users of WATs, and yet we found evidence of differing behavioral outcomes (i.e., compliance change vs. remaining with the status quo vs. behavior change).

Limitations and Further Research

- We included only WATs by Apple and Fitbit in our analysis, so we cannot claim that our account of affordances is exhaustive .

    → Future research should study other use cases to obtain a more comprehensive picture of the actualized affordances of WATs.

- Swiss sample limits the generalizability of our findings.

    → A follow-up study that takes other cultural contexts into account could determine whether the findings hold in other countries.

- Factors other than affordance actualization might jointly determine the behavioral outcomes of WAT use, so further research may investigate such factors in detail.

- Beyond that, future research efforts should test the propositions derived from our analysis empirically.

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