

# Trust in activity tracker measurement and its link to user acceptance

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## Trust in Activity Tracker Measurement

- Activity trackers provide **physical activity data** (e.g., step count, calorie consumption) as **feedback** to users and **facilitate** the **comparison** of the current activity level with a specified activity goal [1, 9]

- Activity trackers constitute a **partial automation of self-regulation** [3]
- What happens when the underlying data is precise but **inaccurate**?



- Key variable: **trust in automation** [e.g. 6]

- User transfers responsibility to automated system and has to rely on the assumption that the automation works correctly [6]
- If assumption is violated: **decreased trust**, possibly leading to **impaired user acceptance** [2]



**Research objective:** Examination of perceived trustworthiness of activity tracker measurement in everyday usage and its relation to user acceptance

**Research questions:**

(Q1) To what extent do users perceive optimal trustworthiness of activity tracker measurement?

(Q2) To what extent is perceived trustworthiness of activity tracker measurement related to user acceptance of activity trackers?



## Method



$N = 79$  current activity tracker users

$M_{age} = 34.4$  years ( $SD = 10.5$ ); 62% female

Day before study participation:  $M = 14,440$  steps,  $M = 2,530$  kcal



Online **questionnaire** examining daily interaction & user experience

Reliability excellent for all used scales (Cronbach's alpha >.9)

### Q1 Perceived trustworthiness of activity tracker measurement

- (TIAS) 12-item *trust in automated systems* (TIAS) scale [7, German translation by 2]
- (FOST) 5-item *facets of system trustworthiness* (FOST) scale [5, see below]

Both scales: 6-point Likert scale (1 – *completely disagree* to 6 – *completely agree*)

### Q2 User acceptance

9-item Van der Laan acceptance scale [8]

## Trust Assessment – FOST Scale

- 5-item** facets of system trustworthiness (FOST) scale [5]
- Specially designed to assess **trust in information interfaces**
- Reference system can be adapted to **specific context** (e.g., present study “information/system” specified as “measurement of step count / calorie consumption”)

How do you evaluate the *[information/system]* (i.e., the display and the calculation algorithm behind it)?

Download German & English version of the FOST scale: <https://goo.gl/WRd6t4>

	completely disagree	largely disagree	slightly disagree	slightly agree	largely agree	completely agree
1 The <i>[information/system]</i> is reliable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 The <i>[information/system]</i> is precise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 The <i>[information/system]</i> is traceable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 I can trust the <i>[information/system]</i> .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 I cannot depend on the <i>[information/system]</i> .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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## Results

### Q1 Perceived trustworthiness of activity tracker measurement

- Substantial **variance** in perceived trustworthiness (e.g., see 25<sup>th</sup>/75<sup>th</sup> percentile values)
- Substantial share of participants with **suboptimal** perceived trustworthiness ratings
- Average trustworthiness for **calories significantly lower than for steps** ( $p < .001$ )
- Significant differences against **test value 6** (i.e., ideal trustworthiness; all  $p < .001$ )

### Q2 User acceptance

- Step count:** **large** significant correlations between trustworthiness and acceptance (all  $p < .001$ )
- Calories:** **moderate to large** significant correlations between trustworthiness and acceptance (all  $p < .001$ )

	TIAS		FOST	
	Steps	Calories	Steps	Calories
$M$ ( $SD$ )	4.65 (0.89)	4.05 (1.04)	4.58 (1.09)	3.93 (1.33)
P25 / P75	4.08 / 5.42	3.17 / 4.83	3.80 / 5.40	2.80 / 5.00
Ratings <6	95%	97%	86%	92%
Ratings <5	63%	80%	48%	70%
Ratings <4	20%	43%	27%	39%
Diff. $M_{calories} / M_{steps}$	$d = 0.58, p < .001$		$d = 0.51, p < .001$	
Test against value 6	$d = 1.52$	$d = 1.88$	$d = 1.30$	$d = 1.56$
Trust - Acceptance	$r = .64, \rho = .60$	$r = .52, \rho = .52$	$r = .59, \rho = .58$	$r = .49, \rho = .53$

## Discussion

### Summary

- Results show high variance in ratings of trustworthiness of activity tracker measurement, indicating **potential for optimization of perceived trustworthiness**
- Perceived **trustworthiness strongly connected to user acceptance**
- High convergence** between TIAS and FOST indicates that **FOST** can be used as a highly **economical alternative** to measure trustworthiness of information interfaces in the context of automated systems

### Implications for interface designers and researchers

- Improving trustworthiness** of activity tracker measurement as key design goal
  - Design approach: deeper understanding of subjective factors influencing trustworthiness of activity trackers necessary (e.g., transparency of measurement and measurement errors)
- Examining **activity tracker abandonment**
  - Issues in trustworthiness might be one factor contributing the high rate of abandonment of activity tracker usage [4]

### Limitations

- Participants reflect certain user group of activity tracker users (users with high usage intensity and rather high activity level)
- Further user groups (e.g., novice users, casual users, former users) should be examined to gain insight concerning generalizability of findings

## Authors at the Conference



### Christiane Attig

Christiane Attig is a PhD candidate in the field of Engineering Psychology. Her current project examines behavioral indicators for helplessness in HCI.

### Thomas Franke

Thomas Franke is a professor of Engineering Psychology and Cognitive Ergonomics. He is particularly interested in user diversity and a resource perspective on user-technology interaction.



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