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CARU's Voice-controlled Emergency Call Feature:

Results of the Acceptance Test in Switzerland (CARUcares DEL. 5.2 – part 1)

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Abstract

Background: The emergency call feature of CARU, a voice-assistant and smart sensor, was developed by CARU AG (Switzerland, Europe). The feature is innovative as it allows older people to call for help using their voice only. Little, however, is systematically known about the acceptance of CARU's emergency feature in older adults living in assisted living facilities.

Objective: The aim of this deliverable is to report on the results of the acceptance test (ACTEST) in Switzerland in older adults using the CARU emergency call in their apartments. One focus of the analysis is to provide insight into the distribution of the key variables reflecting acceptance of the emergency call system and the influencing factors. In addition, the paper provides insight into acceptance and related factors across assisted living facilities.

Methods: The start of the trial was delayed by 4 months due to COVID-19, the virus pandemic that affected European states from March 2020 onwards. Nevertheless, as planned, the ACTEST lasted two months (September to November 2020). The ACTEST survey was administered in two waves. ACTEST I included test scenarios for test emergency calls from different rooms followed by survey questions. ACTEST II consisted of survey questions only. Using UTAUT2 as a conceptual model, data on acceptance indicators and predictors were collected from more than 20 customers (in 4 assisted living facilities) of the bonacasa AG, a provider of smart living services, via online-surveys. Quantitative data were analyzed using descriptive, bivariate and multivariate methods. In addition, a short questionnaire captured the view of bonacasa's 24/7 emergency call centre staff.

Results: The results show that trial participants could recall how to trigger the alarm but experienced difficulties with being detected by the CARU sensor, particularly at the first attempt. Most of the successful alarms were triggered from the room within which the CARU sensor was placed. If a connection could be established, both the guidance by CARU and the emergency service centre staff were understood clearly. Most participants rated the emergency call via CARU as easy to learn. However, acceptance, measured as intention to use, was rated very low. Ratings differed substantially across assisted living facilities.

Conclusions: The results indicate that trial participants had trouble triggering the CARU emergency call, which implies that speech recognition needs further improvement to create a reliable alternative to a wrist-worn emergency call system. As it is today, CARU's emergency call feature is a solution for a single room rather than for an entire flat. If used as an emergency call solution for an entire flat, more than one sensor will be needed.

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Content

Definitions, Acronyms and Abbreviations

AAL	Ambient Assisted Living / Active and Assisted Living
ACTEST I	Acceptance Test 1
ACTEST II	Acceptance Test 2
BONA	bonacasa AG
CARU	CARU AG
HSLU	Hochschule Luzern
ISCED	International Standard Classification of Education
TAM	Technology Acceptance Model
UTAUT2	Unified theory of acceptance and use of technology
vs.	versus
WU / WUWI	WU Vienna University of Economics and Business

1 Introduction

The emergency call feature of CARU was developed by CARU AG. The feature is innovative as it allows older people to call for help using their voice only. To date, this emergency call system has mainly been bought by care homes and assisted living providers and has been also sold to some individual customers. So far, however, little is known about the acceptance of CARU emergency call feature, particularly in assisted living settings.

The aim of this paper is to report on the results of the CARUcares acceptance test of the emergency call feature of the CARU sensor in smart living facilities in Switzerland. Details on the study design can be found elsewhere (Trukeschitz/Ebner et al. 2020). This paper investigates ***if and to what extent the CARU's voice-controlled emergency call sensor meets the criteria for acceptance in real-life settings*** by collecting the views and perceptions of both the older people (residents in bonacasa assisted living apartments) and the service providers (bonacasa 24/7 emergency call centre). In addition, the paper ***reflects on and collects lessons learnt for training requirements, roll-out plans, data collection methods, etc. for the pilot and the field trial.***

2 CARU's emergency call feature

CARU's emergency call feature allows older people to call for help in case of an emergency using their voice only. The alarm is triggered either by calling the word "help" twice, or by pressing the CARU smart sensor. If an alarm has been activated, the CARU sensor pulses briefly in white, issues a sound ("Do you want to call for help? The emergency call is about to start." – to date, in German only) and establishes a telephone connection by selecting the first number stored in the system. If the emergency contact cannot be reached, CARU usually establishes a connection to all subsequent contacts (up to 5 contact numbers) that have been added to the cascade in the system (family.caru.app). For this acceptance test (ACTEST) of CARU's emergency call feature, bonacasa's 24/7 emergency call provider was the only contact number implemented; no other contact number was stored. Also, the family.caru.app was not part of the trial. At any time, an emergency call can be deactivated by pressing the smart sensor, which confirms deactivation by a brief optical signal (in blue).

The aim of technology acceptance testing was to predict if users will adopt and adhere to a new technology – such as the voice-assisted emergency call feature of the CARU smart sensor – and to identify factors that influence the decision to further use the device.

3 Conceptual background

3.1 Technology acceptance research and its relevance for CARU's emergency call

Over the past few decades, theories, instruments and models have been developed to assess the user's acceptance of new technologies. Many frameworks build on the renowned *Technology Acceptance Model (TAM)* by Davis (1989) which has its roots in the *Theory of Planned Behavior* from behavioral psychology by Ajzen (1991). The Theory of Planned Behavior states that an individual's behavior is based on his or her intention to perform the behavior and that 'attitudes', 'subjective norms' and 'perceived behavioral control' shape the individual's behavioral intention (Ajzen/Fishbein 1977; Ajzen 1991). Based on the theory of planned behavior, Davis (1989) developed the TAM-Model in order to predict the usage intention of software technologies. In TAM, the variables *perceived usefulness, perceived ease of use,* and *attitude towards the technology* are the main determinants for the intention to use a technology. The TAM (and its adaptions TAM2 (Venkatesh/Davis 2000) and the TAM3 (Venkatesh/Bala 2008)) models were among the first and most influential models of technology acceptance and have served as a grounding framework for several multi-disciplinary studies of acceptance testing (Charness/Boot 2016).

Despite the success of the TAM, the model exhibits two shortcomings for assessing the acceptance of voice-assisted technologies for older people, such as CARU, in private household settings. First, while TAM was developed to predict technology usage in professional work environments, the model is not suitable for predicting the adoption of technologies outside work-environments, where the intention to use, as well as the actual later use of the technology, is voluntary and not driven by work requirements (Wittland/Brauner et al. 2015). Second, as the TAM model was originally designed to analyze employee technology, it is not suitable for consumer technology in private contexts in which end-users usually bear the monetary cost for the technology (Venkatesh/Thong et al. 2012). In order to overcome these shortcomings, Venkatesh/Thong et al. (2012) proposed an extension of the original TAM model, the *Unified Theory of Adaption and Use II* (UTAUT2). UTAUT2 is explicitly designed to predict the adoption of technologies outside work-environments.

3.2 The Unified Theory of Adaption and Use II (UTAUT2)

UTAUT2 is currently the most prominent, most recent and most discussed model for explaining technology acceptance from a consumer's or end-user's perspective (Laumer/Maier et al. 2019). It has been used to explain the acceptance of a great variety of consumer technologies, such as mobile phones (Tak/Panwar 2017), mobile apps (Palau-Saumell/Forgas-Coll et al. 2019), AAL-technologies (Wittland/Brauner et al. 2015), health robots (Alaiad/Zhou et al. 2013) and in particular health chatbots (Laumer/Maier et al. 2019; Melián-González/Gutiérrez-Taño et al. 2019; Mesbah/Pumplun 2020). In addition, prior studies have recently used UTAUT2 to predict the acceptance of chatbots in the health care settings of older people (Laumer/Maier et al. 2019; Mesbah/Pumplun 2020).

The appropriateness of UTAUT2 for consumer technologies, such as chatbots, its emphasis on the consumer perspective and its suitability for a private (non-work) context makes UTAUT2 particularly useful for the CARU acceptance test. Analogous to the TAM model and the Theory of Planned Behavior, the original UTAUT2 model by Venkatesh/Thong et al. (2012) states that an individual's behavior is shaped by his or her intention to perform the behavior. Several studies have shown that UTAUT2 can predict about 74% of the variance in the behavioral intention to use the technology and about 50% of the variance in the actual later technology usage (Venkatesh/Thong et al. 2012; Wittland/Brauner et al. 2015). Hence, the key antecedent to predict the actual use of a new technology is the variable "*intention to use*".

3.2.1 (Behavioral) Intention to Use

Behavioral intention to use is the key predictor of technology use and acceptance. It determines whether an individual will use a new technology in a given situation or not. The conceptualization of *intention to use* within UTAUT2 is consistent with the theory of planned behavior and other social psychology theories. (Palau-Saumell/Forgas-Coll et al. 2019) and Venkatesh/Thong et al. (2012) showed that the *intention to use* has a direct and positive impact on the later actual *use* of the technology (Figure 1). Hence, we assume that:

> *Hypothesis 11 (H11): Intention to use, directly and positively affects the individual's use of the CARU emergency call feature.*

3.2.2 UTAUT2-factors explaining 'intention to use'

UTAUT2 comprises seven key factors that affect the individual's intention to use (Figure 1): *performance expectancy, effort expectancy, social influence, hedonic motivation, price value, facilitating conditions and habit*. All of these factors influence the individual's intention to use and therefore indirectly influence the actual later use of the technology (Figure 1). In addition,

the last two of these factors (*facilitating conditions* and *habit*) not only affect the intention to use but also directly affect the actual later use. Before testing hypothesis H11, it is therefore crucial to test the antecedent hypotheses. In the following, we briefly describe the seven key UTAUT2 factors in more detail and derive the hypotheses for the empirical analysis.

Performance Expectancy

Performance Expectancy is defined as the degree to which using the technology will provide benefits to the consumer (Venkatesh/Thong et al. 2012). The variable is very close to the variable perceived usefulness used within other models such as the TAM and it is considered to be one of the core predictors of the intention to use a new technology (Palau-Saumell/Forgas-Coll et al. 2019). The higher the older person's expectation that CARU's emergency call feature generates a benefit for them, the higher is the likelihood that the individual intends to adopt CARU as his/her emergency call system. The derived hypothesis from this factor can hence be written as follows:

> *Hypothesis 1 (H1): Performance expectancy directly and positively affects the individual's intention to adopt CARU as an emergency call system.*

Effort Expectancy

Effort Expectancy is defined as "the degree of ease associated with the use of the technology" (Venkatesh/Thong et al. 2012). Several studies have shown that perceived ease of use is a key predictor of the behavioral intention to adopt a new technology (Eckhardt/Laumer et al. 2009). Hence, we assume that:

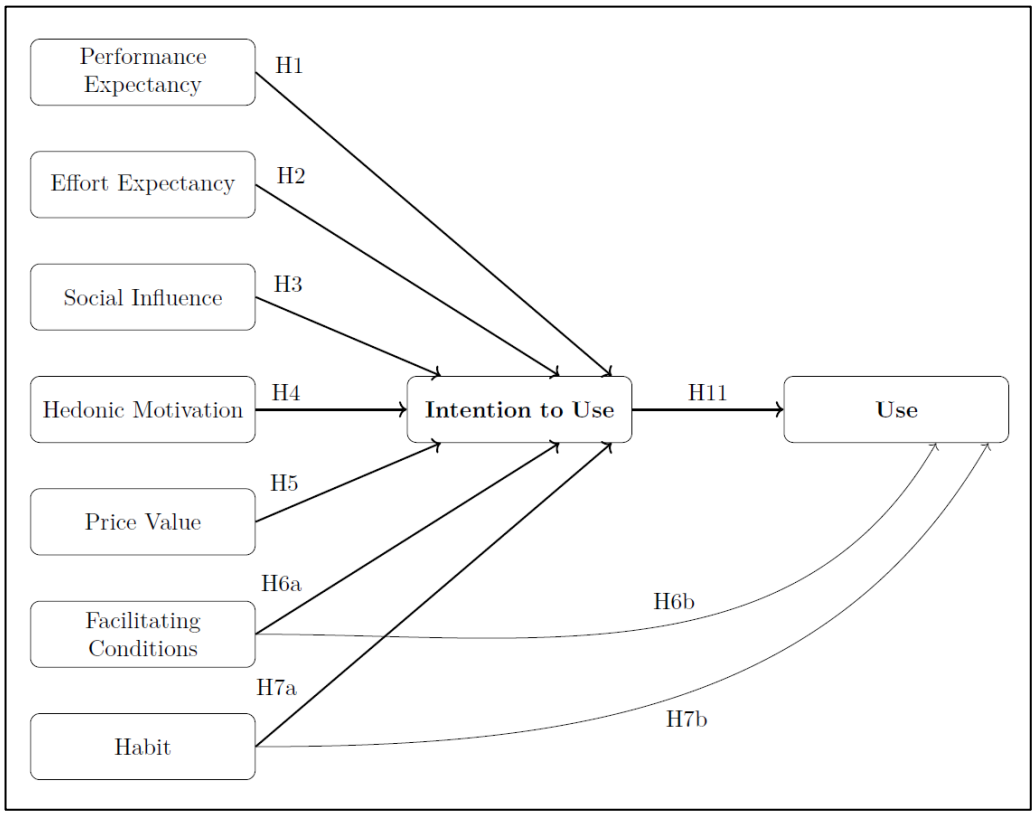
> *Hypothesis 2 (H2): Effort expectancy directly and positively affects the individual's intention to adopt CARU as an emergency call system.*

Social Influence

Social influence measures the influence of friends, peers and family on the adoption process. Several studies from behavioral psychology have shown that an individuals' change in behaviors, feelings and thoughts can be induced by interacting with other individuals and peer groups (Eckhardt/Laumer et al. 2009). Social influence, also known e.g. as peer (group) pressure, can therefore be seen as the tendency to conform to a distinct group behavior (Eckhardt/Laumer et al. 2009). We assume that:

> *Hypothesis 3 (H3): The social influence of friends, family or peers directly and positively affects the individual's intention to adopt CARU as an emergency call system.*

Figure 1: Original Version of UTAUT2



Source: Venkatesh et al. (2012)

Hedonic Motivation

Hedonic motivation refers to the degree to which individuals experience positive emotions, such as pleasure, fun or enjoyment by using the technology. While the factor seems obvious for technologies that involve fun, such as games (Wittland/Brauner et al. 2015) or mobile internet (Venkatesh/Thong et al. 2012), it has also been demonstrated to be relevant in the use of chatbots technologies (Melián-González/Gutiérrez-Taño et al. 2019). We write the derived hypothesis as:

> *Hypothesis 4 (H4): Hedonic motivation directly and positively affects the individual's intention to adopt CARU as an emergency call system.*

Price Value

One of the most important differences between organizational use settings and private use settings, for which UTAUT2 was developed, is that private end-users (consumers) usually bear the monetary cost for the technology, whereas employees do not. *Price-value* measures the cognitive tradeoff between the individual's investment costs into the technology and his or her perceived benefits from using it. Previous studies have shown that the variable strongly influences the adoption of a new technology in private use settings (Wittland/Brauner et al.

2015). The *price value* is positive when the benefits of using the technology are perceived to be greater than the monetary costs. Hence, we assume that:

> *Hypothesis 5 (H5): Positive price values directly and positively affect the individual's intention to adopt CARU as an emergency call system.*

Facilitating Conditions

The factor *facilitating conditions* captures the individuals' perception of whether he or she is able to acquire help from others when using the technology. It is defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the technology (Venkatesh/Morris et al. 2003). The hypothesis reads as follows:

> *Hypothesis 6a (H6a): Facilitating conditions directly and positively affect the individual's intention to adopt CARU as an emergency call system.*

Moreover, while the previous factors only affected the later use of the technology through their effect on the individual's behavioral intention, UTAUT2 also models a direct relationship between facilitating conditions and the actual later use of the technology. Therefore, higher facilitating conditions are also expected to increase the actual later use of CARU directly. The following hypothesis is proposed:

> *Hypothesis 6 (6b): Facilitating conditions directly and positively affect the individual's actual use of CARU's emergency call feature.*

Habit

The need to study the effect of habit and experience on the adaption of new technologies is also well documented by prior technology acceptance research (Venkatesh/Thong et al. 2012). On the one hand, *habit* captures the individual's perception of whether he or she can make using the technology a routine (Wittland/Brauner et al. 2015). On the other hand, analogous to *facilitating conditions*, Venkatesh/Thong et al. (2012) also found that habit directly affects the actual later of use the technology. Therefore, the following two hypotheses are posited:

> *Hypothesis 7a (H7a): Habit directly and positively affects the individual's intention to adopt CARU as emergency call system.*
>
> *Hypothesis 7b (H7b): Habit directly and positively affects the individual's actual use of CARU.*

3.3 Adapted and extended UTAUT2 model for CARU's emergency call

3.3.1 Additional predictors for acceptance

For capturing the characteristics of CARU and its emergency call feature, acceptance criteria were derived from the project proposal, the heuristic evaluation of CARU at the beginning of the project and brainstorming between end-user organizations and technical partners in the General Assembly, held online in March 2020. The comparison of criteria raised by the project partners and the components of the UTAUT2 model reveals a good match and suggest it as particularly suitable as underlying framework for the acceptance test of CARU's emergency call feature.

However, as CARU is applied in a sensitive environment (e.g. emergency call systems for older people living in assisted living facilities) and requires a specific use behavior compared to conventional emergency call systems (e.g. wristband), it is crucial to reflect on the context of our study and the factors that distinguish our particular context from previous studies. Hence, we argue that both the specific requirements of seniors interested in an emergency call system and the special features of CARU make it indispensable to extend and adapt the basic UTAUT2 model according to our context.

We identified thus three further aspects that had to be taken into account for the acceptance of CARU as new emergency call system for older people.

Safety expectancy
The individual perceived degree of safety through the emergency call feature might be a key factor determining the intention to use CARU as a new emergency call system. If seniors feel safe in their homes due to the emergency call feature of CARU, we assume that they are more likely to adopt CARU in their daily routine. Hence, we assume that:

> *Hypothesis H8: The higher safety needs of the trial participants, the higher the intention to adopt CARU as an emergency call system.*

Security expectancy
Previous studies have also shown that data protection risk perceived by end-users as well as the risk of impairment of personal privacy are central factors determining the use of digital technologies (Laumer/Maier et al. 2019). In the context of voice-assistants, senior citizens often take privacy risks into account before adapting to new technologies (Mesbah/Pumplun 2020). Hence, we assume that:

> *Hypothesis H9: The lower the privacy risk expectancy of CARU, the higher the intention to adopt CARU as an emergency call system.*

Technological affinity

Compared to younger cohorts, senior citizens often still have limited experience with new digital technologies, and even small adjustments within the technology and user interfaces can cause major defensive reactions towards the technology. On the downside, previous studies have shown that the adoption of new technologies is significantly increased the more tech-affine the senior (Mesbah/Pumplun 2020). In order to control for different affinity levels towards the technology by senior citizens, we include the variable technological affinity, which is defined, as the degree a person is interested in new technologies and willing to use new and hitherto unknown technologies in their daily life.

> *Hypothesis H10: The more tech-affine the individual is, the higher the intention to adopt CARU as an emergency call system.*

3.3.2 Wording of UTAUT2 questions adapted

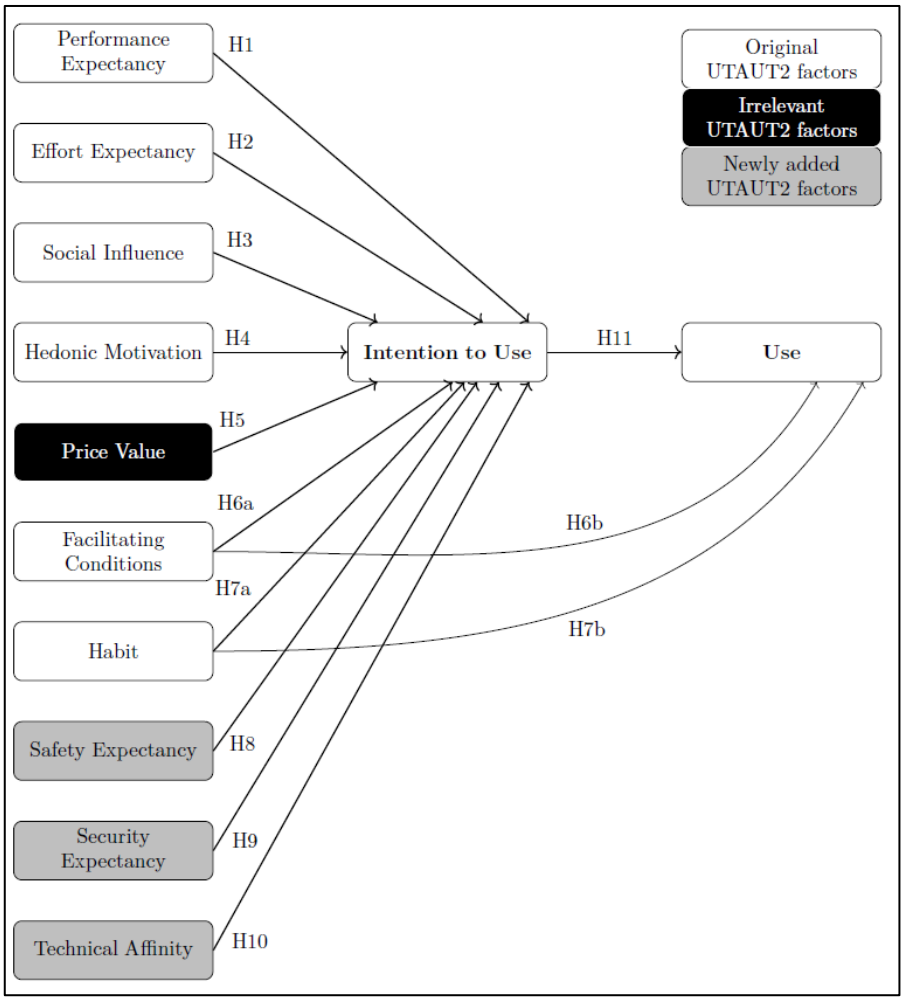
To better match the characteristics of the emergency call feature, some of the original UTAUT2 questions were adapted for three reasons. First, UTAUT2 questions have been developed to assess technologies that – if adopted - will be quite frequently used in daily life. An emergency call system, however, will only be activated in case of an emergency. Thus, UTAUT2 questions reflecting "habit", for instance, were slightly changed. Second, hedonic aspects, such as fun and joy related with new technologies, may not seem appropriate in the context of emergency call systems. Finally, performance expectancy also addressed productivity, did not directly reflect the benefits of emergency call systems. In addition, selected phrases and words could not be directly translated into German. The revision led to a set of UTAUT2 questions that can be used for assessing emergency call systems.

3.3.3 No measure of actual use

While the original UTAUT2 model aims to test hypothesis H11 (the impact of intention to use on the actual later use), it was not possible to test this relationship empirically as our test-scenario setting determines how often end-users will use the CARU emergency call feature (four initiated test-calls within 8 weeks). We thus expected to have only little variation in the variable *use* and cannot test the impact of *intention to use* on *use* empirically. Hence, the central focus of acceptance testing remains to predict the individual's intention to use.

Summing up, our final model largely builds upon UTAUT2 and its hypotheses. We expanded the original UTAUT2 by three further aspects, *safety expectancy, security expectancy* and *technical affinity* in order to capture the adoption of CARU in a more precise and context-specific way (Figure 2).

Figure 2: Adapted Version of UTAUT2 for the acceptance test of CARU's emergency feature



Source: adapted from Venkatesh et al. (2012)

4 Methods

The ACTEST of the CARUcares emergency call features comes with two challenges for the trial design. First, as emergencies occurring in assisted living settings within two months was assumed to be quite low, it was expected that, if any, only a few real emergency calls would be made in a two-month test period. Second, if residents in assisted living facilities already use an emergency call system, it is in the interest of the safety of these people that they can keep their system. In an emergency, it is thus to be expected that people will be more likely to use the system they are used to than a new one.

We thus adjusted the test setting so that users could get used to CARU's emergency call feature and consider the possibility that people will not use the new system even in case of a real emergency. This has implications for the set-up of the acceptance test.

The acceptance test in Switzerland will focus on the emergency call function of CARU. To this end, 20 end-users and 3 care service providers (concierges) were recruited in Switzerland and CARU sensors were installed at the end-users' homes. After the successful installation of CARU by the concierge, test-emergency calls will be initiated by the end-users from different rooms in the presence of the concierge. Within the test-period of the acceptance test, each end-user will independently initiate four more calls to the emergency call provider. After the trial period of 8 weeks, end-users and concierges will provide feedback of the feature via separate online-surveys. Details on the study design are provided in a separate deliverable (Trukeschitz/Ebner et al. 2020).

4.1 Data

4.1.1 Target groups and sample selection

Target group 1: 20+ bonacasa customers aged 75+ (women and men) who are…

- …interested in emergency call systems (not having one) – priority 1
- …already having an emergency call system – priority 2
- …none of the above – priority 3

Target group 2: 3-5 concierges (bonacasa employees) supporting test participants in target group 1

For recruitment strategy, roll-out concept, training strategy and exit strategy see the CARUcares Deliverable 2.3 on the Trail and Validation Requirements for this acceptance test (Trukeschitz/Ebner et al. 2020)

4.1.2 Data collection

4.1.2.1 Test scenarios (LimeSurvey): bonacasa customers & concierges

Tests scenarios were provided using LimeSurvey, an online survey tool. Three to four test scenarios were developed for each trial participant and their concierges. The bonacasa concierges asked the trial participants to go to different rooms and to imagine an emergency (e.g., being no longer able to get out of the bed on their own, or having slipped on the wet floor). Three test-scenarios were mandatory ("living room", "bedroom – doors open", "bath room – doors closed"); one scenario was only tested if the trial participants' flats had a balcony or garden (Trukeschitz/Ebner et al. 2020).

Concierges were asked to conduct the tests together with the trial participants and to note down the trial results (recalling how to activate CARU's emergency feature; number of calls for a successful activation of an alarm, perception of voice quality) (Trukeschitz/Ebner et al. 2020).

4.1.2.2 Two online-surveys (LimeSurvey): bonacasa customers & concierges

Both online surveys ACTEST I and ACTEST II were created and carried out using the LimeSurvey® survey tool. While ACTEST 1 focused on the functionality of participants in various rooms and only contained selected questions from the UTAUT model (pretest-posttest procedure), ACTEST 2 examined all determinants of UTAUT (with the exception of price/value) and the need for and satisfaction with CARU. The ACTEST lasted 12 weeks.

4.1.2.3 Short questionnaire: 24/7 bonacasa emergency call centre

To capture the views of the emergency call centre, a short questionnaire created by WU and administered by HSLU was filled in by bonacasa's emergency call centre. The short questionnaire was divided into two subject areas: 1) emergency calls in general and 2) CARU emergency calls. The first topic covers routine procedures of incoming emergency calls. The second topic deals with experiences receiving incoming calls with CARU. It particularly addressed comprehensibility and connection issues, work processes and the further development of the CARU emergency call.

4.2 Measures

The scales for the UTAUT2 factors (e.g., performance expectancy, effort expectancy, social influence) were taken from Venkatesh/Thong et al. (2012). All UTAUT2 items including the dependent variable (behavioral intention to use the CARUcares' emergency call), were measured using a seven-point Likert scale, with the anchors being "strongly disagree" and "strongly agree". The questions were adopted to the emergency call setting and translated into German.

Future Use (BI1) is measured by whether the participant will continue using CARU in the future. Emergency Use (BI3) is measured by whether the participant intends to use CARU exclusively as emergency feature in the future, if an emergency occurs in their flat. BI2 was included to measure whether participants will try to use CARU in their daily-life (only in ACTEST II). Third, satisfaction (BI4) measures whether the participant is overall satisfied with CARU.

For hypothesis testing, we calculated each determinant factor by taking the mean Likert scale answer from each participant for the corresponding factor (e.g. Performance Expectancy (mean) $= \frac{PE1+PE2+PE3}{3}$).

In addition, socio-demographic characteristics were included, such as age (measured in years) and gender. The living situation was measured by number of rooms in the apartment and whether the trial participants live alone or not. Potential need for an emergency call system was assessed by fall history (measured using HUHN's scale for fall history (Huhn 2000)).

Experiences with emergency call systems were captured by whether or not the person already uses an emergency call system (dummy = 1 if yes).

Survey duration was measured using timestamps implemented in LimeSurvey® at the start and end of the survey.

4.3 Methods for analysis

4.3.1 Statistical analysis of test and survey data

We used descriptive analysis to describe the sample characteristics and the distribution of the intention-to-use measures and their determinants. In addition, we tested the UTAUT2 hypotheses by calculating Pearson's correlation coefficients to show the relationships between each determinant and the acceptance rate. Moreover, we estimated an ordinary least squares (OLS) regression model to simultaneously assess the relationship between acceptance (again measured by `intention to use') and all factors expected to be related.

Further bivariate analysis was conducted using Mann-Whitney-U-Tests.

4.3.2 Analysis of the short questionnaire for the emergency call centre

As just one questionnaire was filled in by the bonacasa emergency call centre, responses – mainly qualitative information - were summarized.

5 Results of the acceptance test

5.1 Sample description

The analysis used a sample of end-users living in assisted living facilities in Switzerland. End-users were recruited by bonacasa, following target group criteria and project-specific guidelines (Sturm/Trukeschitz et al. 2020). CARU sensors were installed at the end-users' homes. All participants were expected to complete surveys at two points in time (ACTEST I – after four weeks of use; ACTEST II at the end of the trial phase). The number of participants differed slightly between the two ACTESTs: ACTEST I (n=21) and ACTEST II (n=23). Two participants of ACTEST II did not answer the survey questionnaire of ACTEST I (see Table 1).

In line with the population characteristics, the majority of trial participants were women (57% women in ACTEST I, 70% in ACTEST II). On average, participants were 78 years in ACTEST I and 77 years in ACTEST II. Participants mainly live alone in their apartment and reported only little

experiences with recent falls. Nearly half of the participants (n=11) already had an emergency call system and a third of the trial participants (n=8) have of their own initiative - additionally to the test-scenario calls - tried to trigger an alarm between ACTEST I and ACTEST II.

Table 1: Sample description

	ACTEST I		ACTEST II	
Variable	Frequency	%	Frequency	%
Gender				
Male	7	33.3	7	30.4
Female	12	57.1	16	69.6
Pair	2	9.5	0	0.0
Age				
under 70 years	4	19.0	4	17.4
70-85 years	11	52.4	13	56.5
over 85 years	6	28.6	6	26.1
Living situation				
Living alone	13	61.9	15	65.2
Living with partner	8	38.1	8	34.8
Fall history (within last month)				
0			19	82.6
1-2 falls			3	13.0
> 3 falls			1	4.3
Emergency call system				
Existent			11	47.8
Willing to purchase			4	17.4
No			8	34.8
Test alarm triggered (within last 7 days)				
Yes			8	34.8
No			15	65.2
Observations	21	100	23	100

Note: fall history and availability of an emergency call system were only asked in ACTEST II
Source: WU, CARUcares ACTEST I, n=21

5.2 Evaluating the functionality of the CARU emergency call using test-scenarios (ACTEST I)

5.2.1 Remembering how to trigger the CARU emergency call

At the beginning of ACTEST I, the concierges were instructed to document whether the trial participants correctly remembered how to trigger the CARU emergency call feature. During test scenario I ("living room"), 18 out of 21 participants remembered independently how to trigger the CARU emergency call feature. Three participants out of 21 needed help to recall how to activate the emergency call. In test scenario II ("bedroom – open doors") and all following, all 21 out of 21 participants independently remembered how to trigger the alarm correctly.

5.2.2 Number of trials for a successful connection with the emergency call center

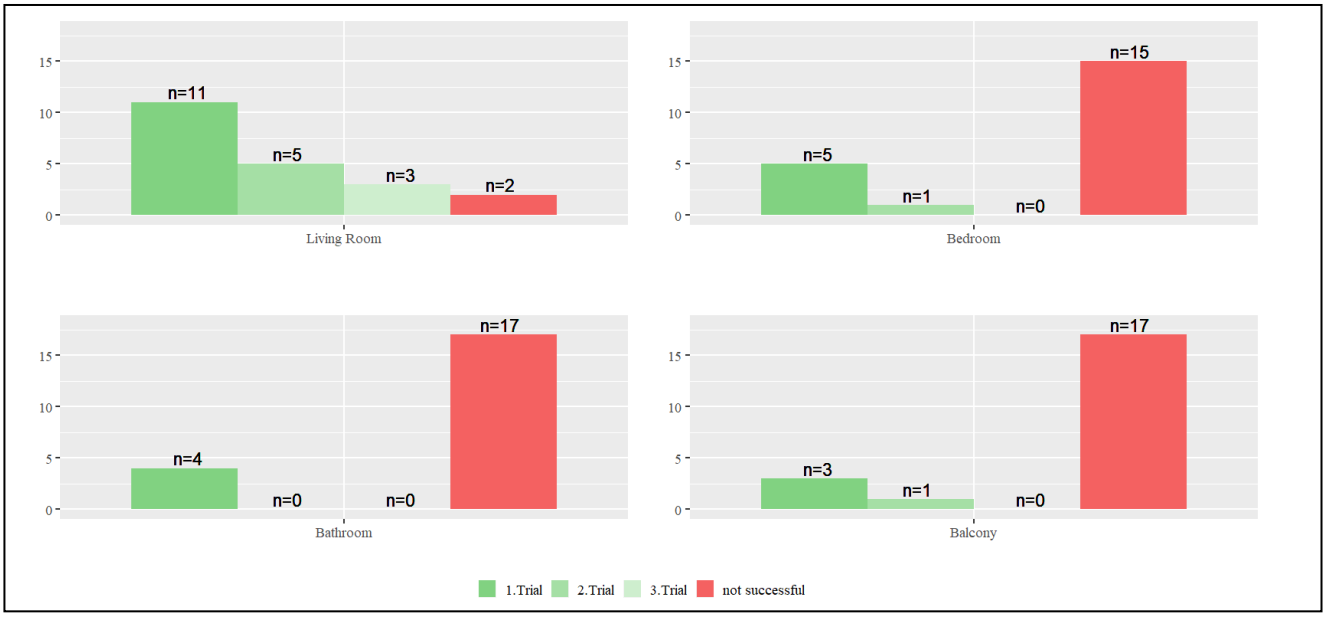
5.2.2.1 Successful alarms by room

In this section, we present the distribution of successfully triggered alarm trials for each room. In each room - living room (test scenario I), bedroom (test scenario II), bathroom (test scenario III) and balcony (test scenario IV) - the participants were instructed to trigger an alarm by calling the word "help" twice. In case the alarm could not be triggered in the first trial, each participant had two additional trials to activate the alarm. The CARU sensor was placed in the living room and remained there for all test scenarios.

Figure 3 shows the distribution of successfully (green) and unsuccessfully (red) triggered alarms. In the *living room*, 11 out of 21 participants could trigger an alarm in the first trial. 5 out of the remaining 10 participants were able to trigger an alarm in the second trial and 3 out of the then remaining 5 participants triggered an alarm in the third trial. Two participants were unable to trigger an alarm in one of the three trials. In the *bedroom (doors open)*, the rate of successfully triggered alarms was lower. In five first trials and one second trial the alarm was successfully triggered. However, 15 out of 21 participants were not able to trigger an alarm. The same held true for the *bathroom (doors open)* and *balcony scenario*, in which only 4 out of 21 trials were successful and 17 trials were not, resulting in a rate of 80% non-triggered emergency calls in the bathroom and balcony scenarios.

In case of a real emergency situation, it is crucial that the alarm is triggered in the first trial. The share of successful first trial alarms was 11 out of 21 (52%) in the living room, 5 out of 21 (24%) in the bedroom, 4 out of 21 (19%) in the bathroom and 3 out of 21 (14%) on the balcony. Overall, the results by room showed that the share of successfully triggered alarms from the bedroom, the bathroom or the balcony is insufficient for a potential real emergency situation. If at all, CARUs emergency call feature worked in the living room, nonetheless a share of 52% successful first trials might be insufficient for a potential real-life emergency.

Figure 3: Successfully triggered alarms by room



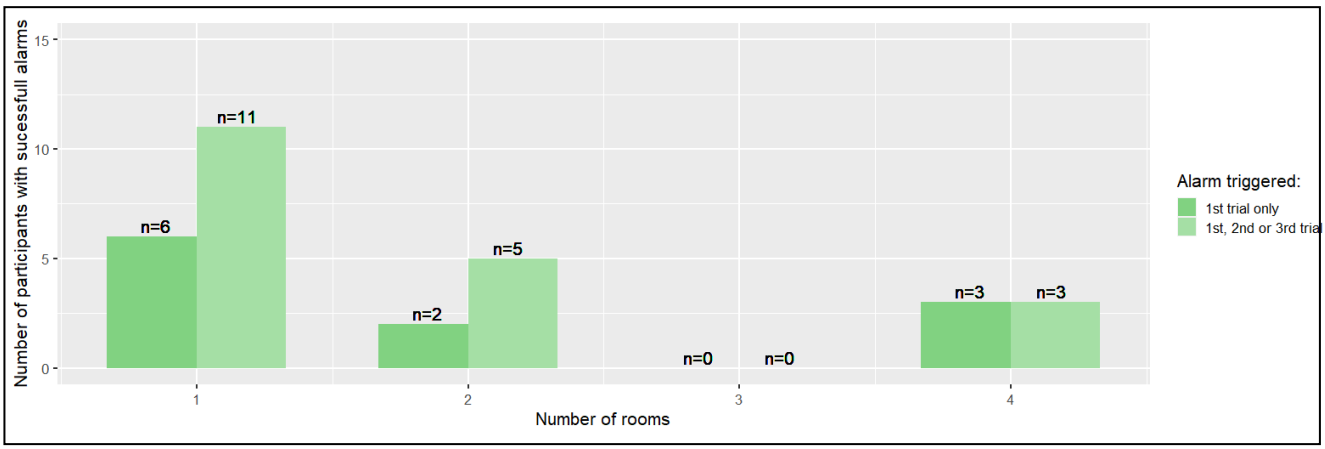
Source: WU, CARUcares ACTEST I, n=21

5.2.2.2 Successful alarms by number of rooms

In addition to the type of room, another important aspect is the distribution of successfully triggered alarms by number of rooms. Figure 4 displays the number of participants who successfully triggered alarms. Room=1 should be interpreted as a successfully triggered alarm in any room regardless of which room (living room, bedroom, bathroom or balcony). Again, as mentioned above, we distinguish between successful first trials and successful alarms in general (1st, 2nd or 3rd trial) in order to meet the criteria for real-life emergency settings.

Figure 4 shows how many participants had successfully triggered an alarm in one, two or more rooms. The majority of participants (17 out of 21) were able to trigger an alarm in only one room. Only a few participant could trigger an alarm in two or all four rooms.

Figure 4: Successfully triggered alarms by participant



Source: WU, CARUcares ACTEST I, n=21

5.2.2.3 Successful alarms by participant

Three out of 21 participants had successfully triggered alarms in all rooms, among which all 3 successfully triggered their alarm in their first trial. 11 out of 21 participants only had a single successfully triggered alarm. As it turned out, this room was alwaysthe living room and among those eleven, six have triggered the alarm in their first trial. Two participants had not successfully triggered alarm at all and 10 participants out of 21 had no successful first trial call in any room, which again might be insufficient for a potential real life emergency.

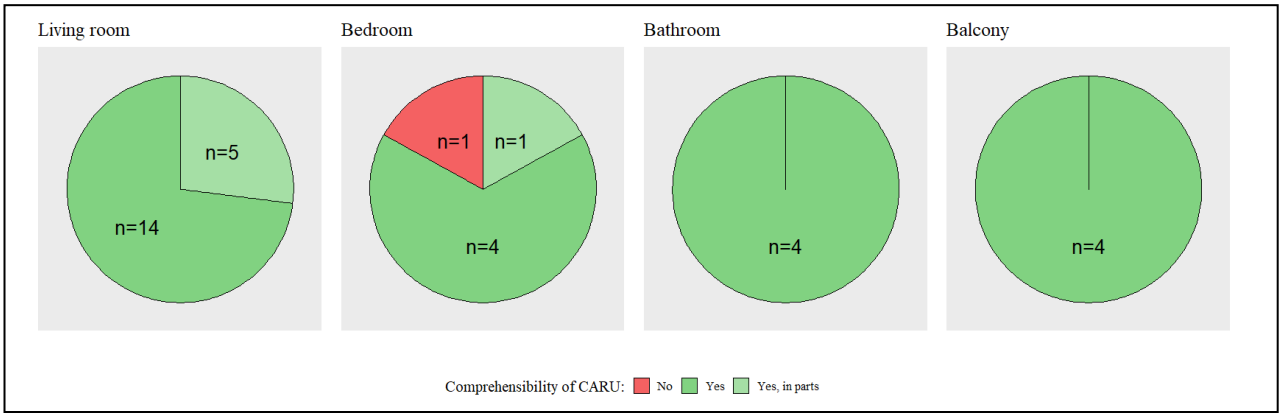
5.2.3 Comprehensibility of connections

In this section, we briefly describe whether the participants understood the instructions of CARU and those of the 24/7 emergency call center staff after establishing a connection. Participants could indicate whether they understood CARU and staff "completely", "partly" or "not at all". Figure 5 shows per room (test-scenario) how well the CARU chatbot – if a connection was established – was understood by the participant.

19 out of 21 participants in the living room had successfully triggered alarms and *understood the instructions of CARU* completely (n=14) or at least in parts (n=5). As the number of successfully triggered alarms was very low for all other test-scenarios (rooms), the results shown in Figure 5 cannot be relied on for this assessment. Taken together, however, the results indicate that *if a connection with* CARU had been established, the chatbot was understood well by the participants.

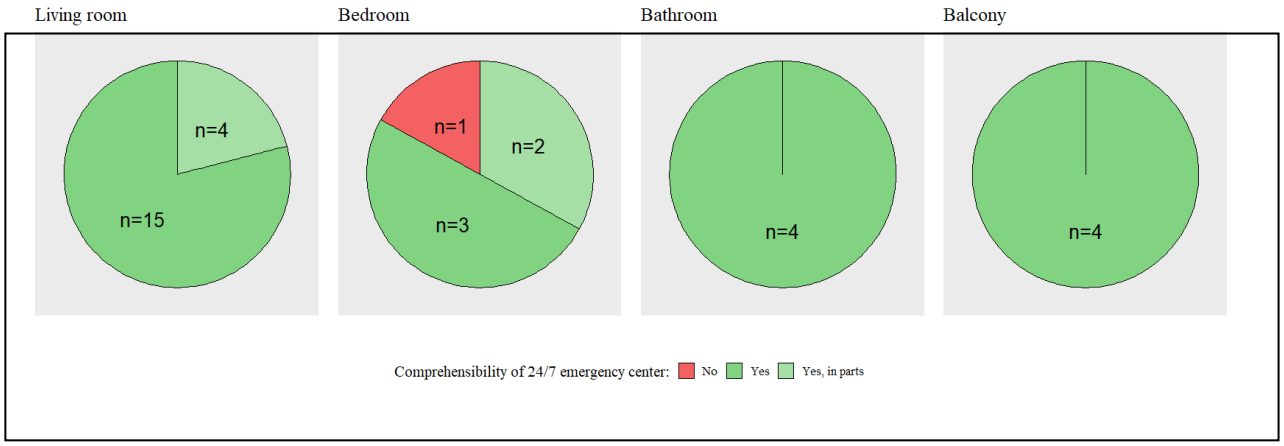
Figure 6 shows how well the *member of the emergency staff team* at the 24/7 bonacasa emergency center *was understood by the participants* triggering the alarm. Most alarms could be successfully triggered from the living room where CARU was placed (see above Figure 3). In this room, most participants were able to hear 24/7 bonacasa emergency call centre staff well. Again, from all other rooms the share of successfully triggered alarms was low and answers were thus likely to be non-representative. However, overall, the results suggest that *if a connection towards CARU* had been established, the participants were able to understand the instructions of CARU and the emergency call center well.

Figure 5: Comprehensibility of the CARU chatbot



Source: WU, CARUcares ACTEST I

Figure 6: Comprehensibility of the 24/7 emergency center staff connected via CARU emergency call

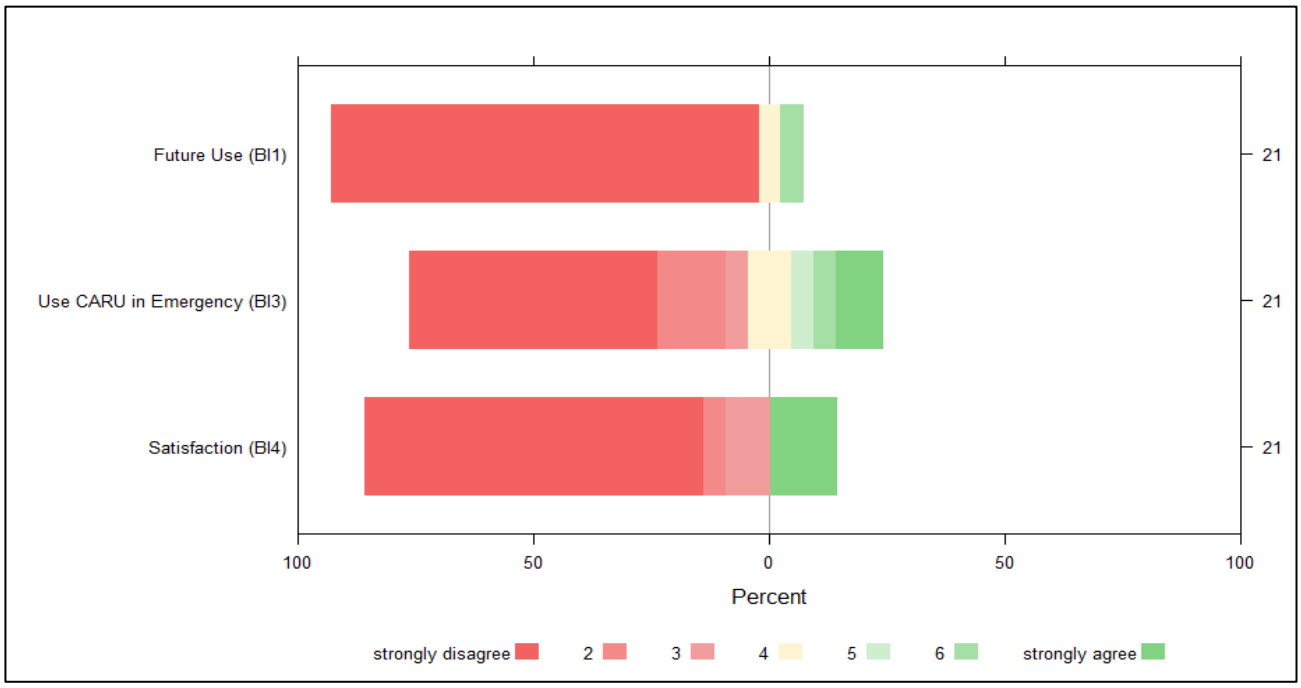


Source: WU, CARUcares ACTEST I

5.3 Acceptance of the CARU emergency call (intention to use)

Following our theoretical considerations and our adapted UTAUT2 model (section 3), in this section we evaluate the central variable for acceptance: behavioral intention to use. Figure 7 shows that the vast majority of participants strongly disagreed with each of the three acceptance-statements in ACTEST I. 90% of the trial participants strongly disagreed with the statement that they will continue using CARU in the future (BI1), 52% strongly disagreed with the statement that they intend to use CARU exclusively if an emergency occurs and over 71% strongly disagreed with the statement that they are satisfied with CARU.

Figure 7: Acceptance ACTEST I (Intention to Use)



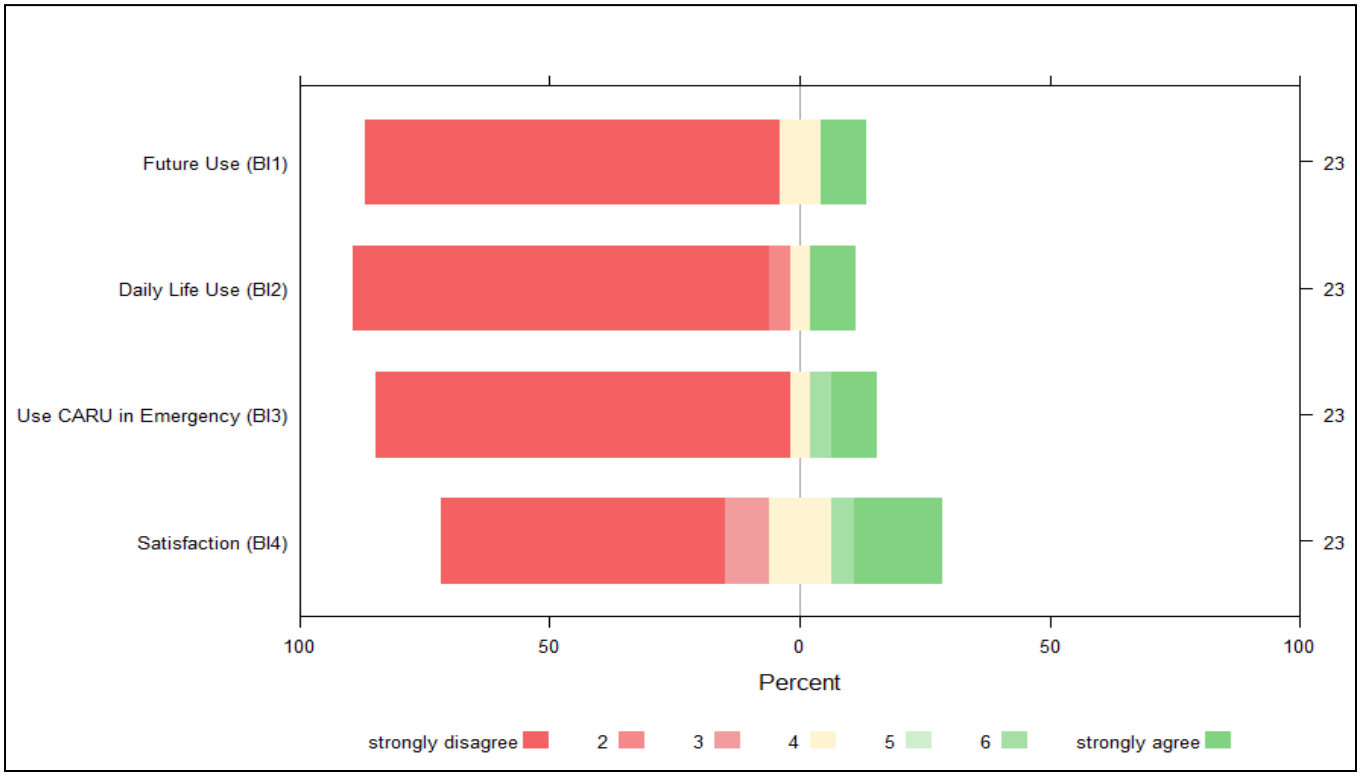
Source: WU, CARUcares ACTEST I, n=21

Only a few participants gave a positive response. One out of 21 participants intended to use CARU in the future (by choosing response option 6 out of 7) and one participant indicated they were neutral about his or her future use (response option 4). Four out of 21 participants intended to use CARU exclusively if an emergency occurs in his or her apartment in the future (by choosing response options 5, 6, or 7) and two participants were neutral (choosing response option 4) about the statement. Three trial participants out of 21 strongly agreed with the statement that they were satisfied with CARU.

The results of ACTEST I were confirmed by ACTEST II. In ACTEST II (Figure 8), 82% of the trial participants strongly disagreed with the statement that they will continue using CARU in the future (BI1) and 78% strongly disagreed with the statement that they will try to use CARU in their daily life. More than 82% now strongly disagreed with the statement that they intended to use CARU exclusively if an emergency occurs, compared to 52% in ACTEST I. Lastly, a few more participants rated their satisfaction as neutral or positive (answer of 5, 6 or 7), however, again over 65% were not satisfied with CARU's emergency call feature (answers of 1, 2 or 3). As both samples are very small, a key thing to remember is that differences between ACTEST I and ACTEST II may partially be explained by a difference in samples sizes. Overall, however, the results between ACTEST II and I were quite similar.

Summing up, although sporadic positive ratings occurred, the CARU emergency call feature was not well perceived by the participants. The results of the acceptance test suggest that participants were not willing to continue using CARU in the future.

Figure 8: Acceptance ACTEST II (Intention to Use)



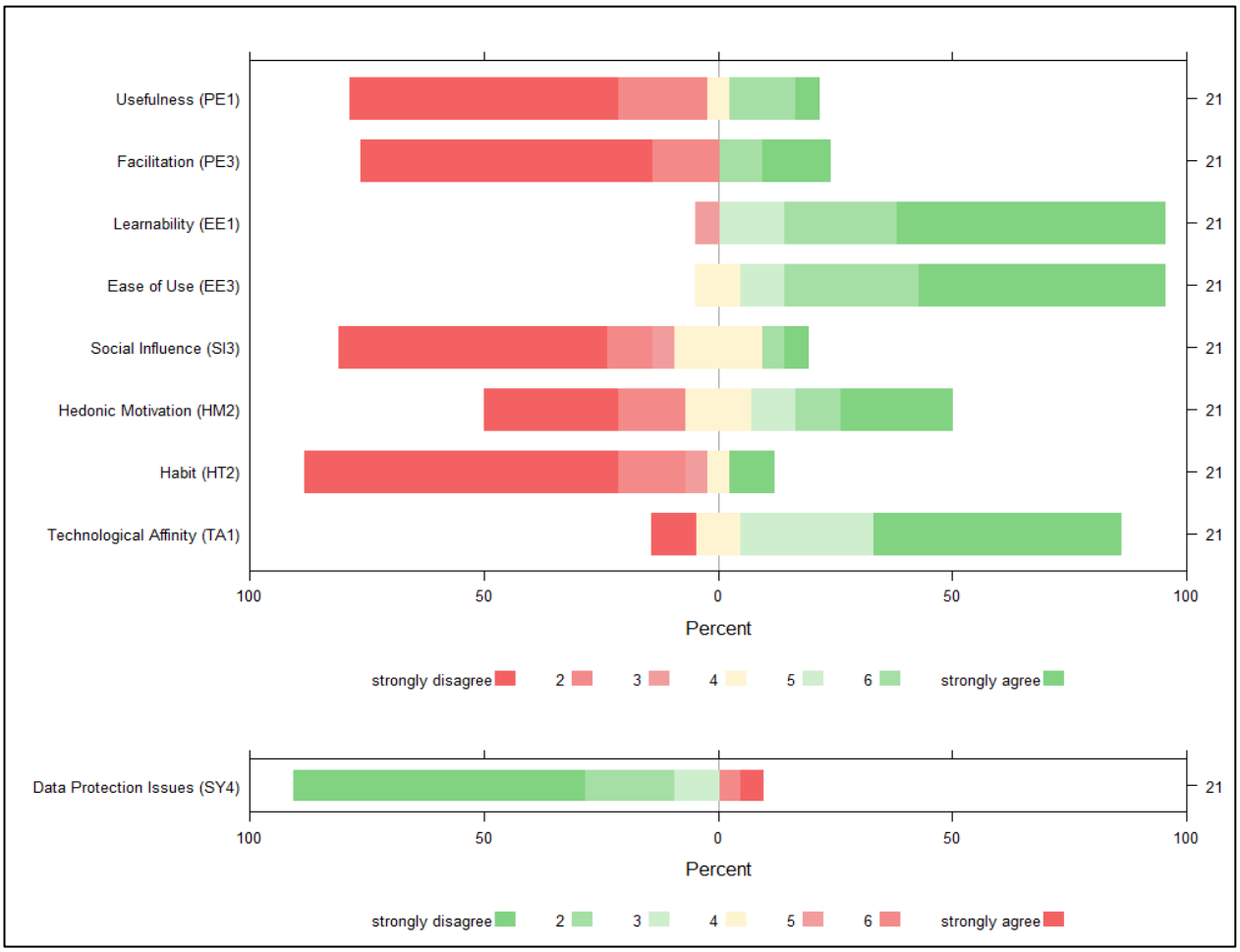
Source: WU, CARUcares ACTEST II, n=23

5.4 Determinants of acceptance (ACTEST I and II)

In this section, we shed light on the determinants of acceptance. Following the adapted UTAUT2 model, the individual's valuation of CARU is determined by several factors. All determining factors are measured using a seven-point Likert scale, with the anchors being "strongly disagree" and "strongly agree".

Figure 9 displays the distribution of answers to the range of factors influencing the individual's acceptance in ACTEST I. The results show that trial participants mainly disagreed with the statements on perceived usefulness (PE1), perceived facilitation of calling an emergency (PE3), social influence (SI3) and habit (HT2). Hedonic motivation, however, was evenly distributed. Participants mainly agreed with the statements on learnability (EE1), ease of use (EE3), technological affinity (TS1) and data protection (SY4).

Figure 9: Determinants of acceptance (ACTEST I)



Source: WU, CARUcares ACTEST I, n=21

Figure 9 shows that trial participants expected a low performance from the CARU emergency call (PE1). They also expected low benefits (PE3), but perceived the CARU emergency call feature as easy to use (EE3) and the interaction with the system as easy to learn (EE1). Participants indicated they were not socially influenced (SI3) and they presumably had not (yet) developed a habit regarding the use of CARU in their daily life. Participants mainly ranked themselves as open towards new technologies (TA1) and they have had low concerns about their data being misused.

Regarding response behavior, the determinants of acceptance were strongly distributed towards the anchors, with either strong positive responses (strongly agree/ agree) or strong negative responses (strongly disagree / disagreed), indicating relatively homogenous perceptions of the CARU emergency call in our trial sample.

In ACTEST II, participants were asked to answer all UTAUT2 questions (Figure 10). After a trial period of 8 weeks, participants still expected a low performance of the CARU emergency call (PE1, PE2 & PE3). As in ACTEST I, trial participants still perceived the CARU emergency call

feature as easy to use (EE3), the interaction as easy to learn (EE1) and as clear and understandable (EE2). In addition, participants felt competent enough to use CARU (EE4). Again, participants indicated they were not strongly influenced by others (SI1, SI2, SI3), though in ACTEST II participants indicated that they had the necessary resources (FC1) and the necessary knowledge (FC2) to use CARU.

For over 50% of the trial participants in ACTEST II CARU was not perceived as compatible with other technologies the participant uses (e.g. Radio, TV or other emergency call systems). The hedonic motivation seemed to be rather low (HM1, HM2, HM3) and participants have had not been able to develop a habit regarding the use of CARU in their daily life yet. For the most part, CARU's emergency call feature does not make the participant feel safe (SA1) and participants mostly did not believe that CARU would work in the case of an emergency (SA2). Comparable to ACTEST I, participants again ranked themselves as affine towards new technologies and most participants were not concerned about potential data protection issues or wire tabbing worries. Summing up, ACTEST II and ACTEST I generated similar results, suggesting that participants did not change their views on the CARU emergency call feature over time.

Figure 10: Determinants of acceptance (ACTEST II)

Source: WU, CARUcares ACTEST II, n=23

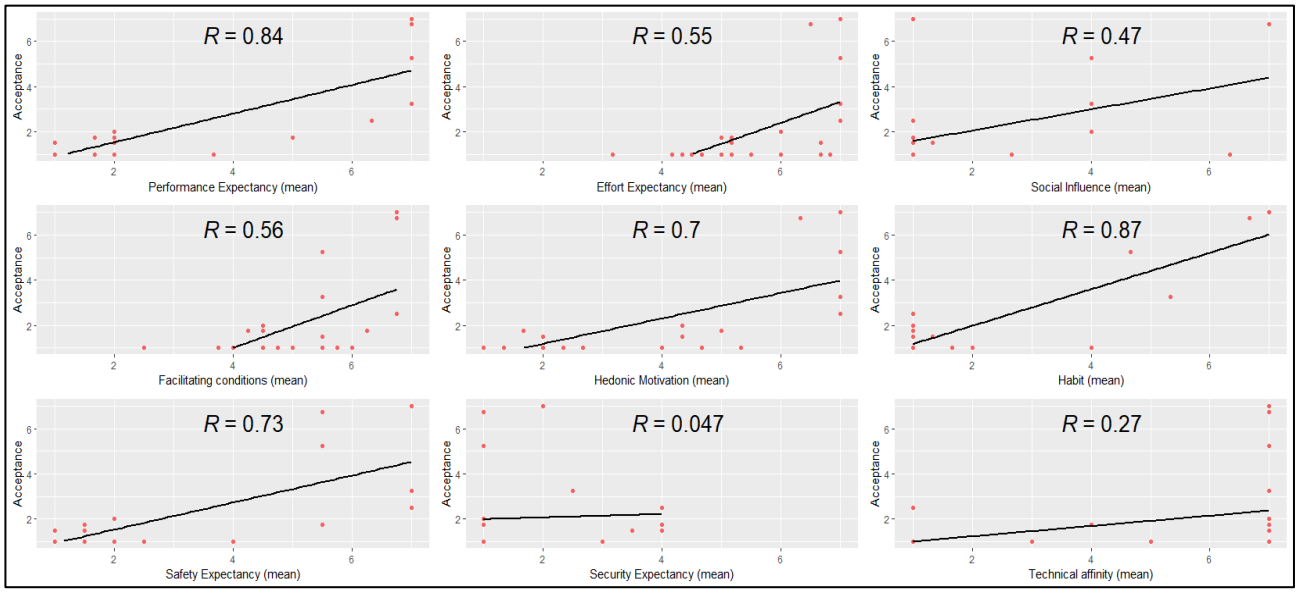
5.5 Results of UTAUT2-hypotheses testing (ACTEST II)

In this section, we evaluate the relationship between acceptance, measured by intention to use, and the determinants of acceptance following the extended UTAUT2 model. We start by testing our hypotheses from section 3 by analyzing independent correlations between each UTAUT2 factor and the acceptance rating of the participants (5.5.1). What follows is a joint-analysis of all factors - analogous to the original UTAUT model calculations - by jointly estimating determining factors of acceptance rates (5.5.2).

5.5.1 Correlations between acceptance and single UTAUT2-determinants

Figure 11 shows most determinants are positively correlated with acceptance, hence results support most of our hypotheses from section 3 (e.g. the higher the performance expectancy, the higher the intention to use CARU as an emergency call feature in the future). Only security expectations (H9) and technical affinity (H10) appear to have no or only low correlations with acceptance. However, these are only correlations and it is unclear whether a causal relationship between determinants and acceptance can be claimed.

Figure 11: Single correlations between determinants and acceptance



Source: WU, CARUcares ACTEST II, n=23

5.5.2 Regression model results (UTAUT2)

Table 2 provides a summary of the joint estimation of all determinants for acceptance within the ACTEST II sample. Our adapted model was able to explain about 78% of the variance in acceptance rates (AdjR^2 = 0.780), which is a strong result and in line with previous findings

(Laumer/Maier et al. 2019). Again, habit and performance expectancy appear to be a key driver for acceptance in this test, which is in line with our results from section 5.2. As the sample size is relatively low (n=23), the result may be affected by low statistical power which calls for further assessment in future tests.

Table 2: UTAUT 2 model estimation (using OLS)

	Dependent variable:
	Intention to Use
	β SE
Performance Expectancy (PE mean)	0.513* (0.272)
Effort Expectancy (EE mean)	0.158 (0.257)
Social Influence (SI mean)	−0.193 (0.146)
Facilitating Conditions (FC mean)	0.182 (0.241)
Hedonic Motivation (HM mean)	0.007 (0.215)
Habit (HT mean)	0.596** (0.201)
Safety Expectancy (SA mean)	−0.323 (0.279)
Security Expectancy (SE mean)	−0.082 (0.204)
Technical Affinity (TA1)	0.012 (0.099)
Constant	−1.091 (1.676)
Observations	23
R^2	0.870
Adjusted R^2	0.780
Residual Std. Error	0.851 (df = 13)
F Statistic	9.689*** (df = 9; 13)
Note:	*p<0.1; **p<0.05; ***p<0.01

Source: WU, CARUcares ACTEST II, n=23

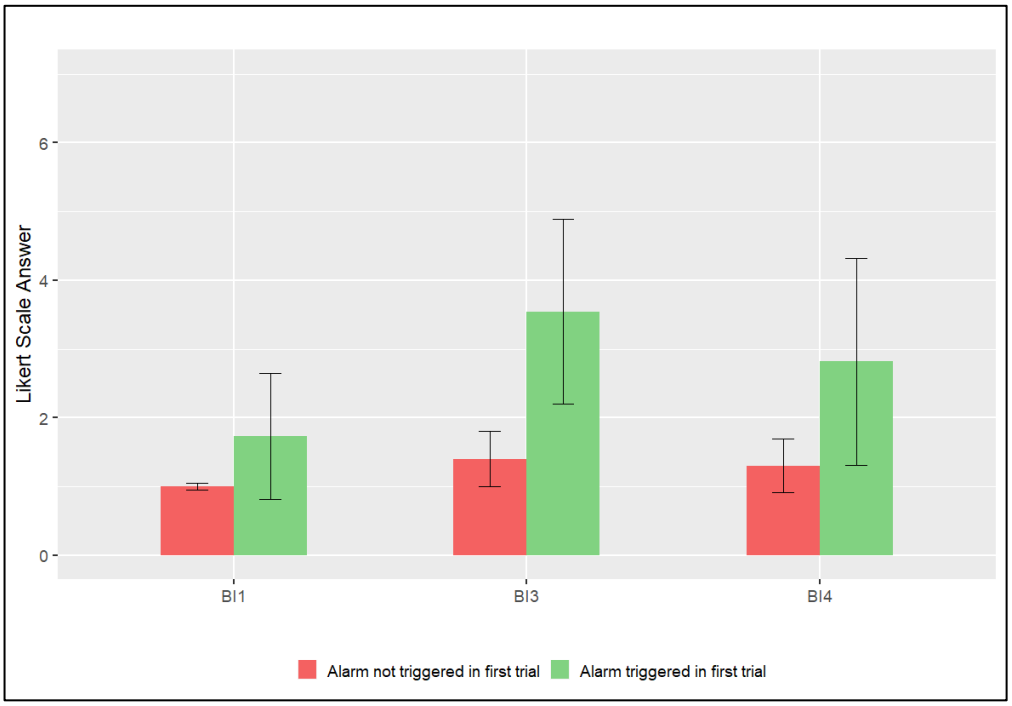
5.6 Acceptance rating and the role of functionality (ACTEST I)

Our previous results showed that the functionality of the CARU emergency call from the bedroom, the bathroom, and the balcony was low (section 5.2). Moreover, we showed that acceptance rates were low and potentially caused by low performance expectancies. Hence, in a next step, we investigate the relationship between the functionality of the CARU emergency call and higher acceptance rating by trial participants. We assume that participants who successfully triggered the emergency call were more likely to intend to use the CARU emergency call feature in the future. As already mentioned, in case of a potential real emergency, it is crucial that calling for help can be achieved in the first trial. We therefore restricted this analysis to the living room since it is the only room in which a critical number of successful first trials was triggered. Group 1 is defined as participants whose first trial in the living room did not lead to a successful emergency call (n=10). Group 2 is defined as

participants whose first trial in the living room triggered an alarm successfully (n=11). The variables of interest are again the acceptance variables (BI1, BI3 and BI4).

Figure 12 shows the mean value between both groups (alarm triggered successfully vs. not) across our three behavioral intention to use variables. In addition, 95% confidence intervals for the mean values are displayed. The results seem to indicate differences between both groups for all three variables for intention to use, with higher answers on the seven point Likert scale for the group with successfully triggered alarms (group 2). However, Mann-Whitney-U-Tests for statistical differences between both groups showed that only the mean values of BI3 is statistically different on a five percent significance level (p-value=.04). For BI1 and BI4 differences between the two groups are not statistically significant, which may be due to the low sample size. Nevertheless, the results suggest that if participants are able to trigger an alarm in the first trial, they are more likely to use CARU in the future compared to participants whose first trial did not trigger an alarm.

Figure 12: Functionality and acceptance rates by intention to use question (ACTEST I)



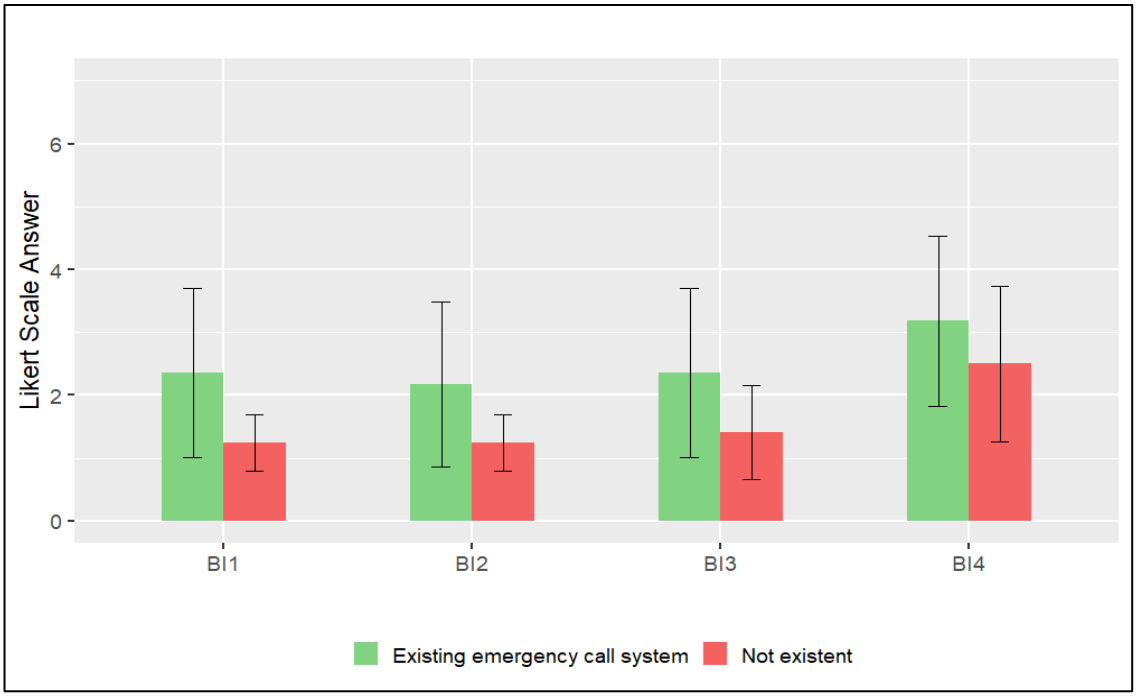
Notes: BI1: "I intend to continue using CARU in the future." BI3;"In case of an emergency, I want to use CARU." BI4: "I am satisfied with CARU."
Source: WU, CARUcares ACTEST I, n=21

5.7 Acceptance rating by experience with an emergency system (ACTEST II)

Another dimension of our analysis is whether the trial participant is interested in obtaining an emergency call system. Differences in interest or need may explain differences in acceptance ratings. Within our sample, approximately 50% of the trial participants already have an emergency call system, which signals that the trial participants have experience with such systems and a need for or a general interest in getting an emergency call system. We assume that participants having an emergency system or being interested in emergency call systems are more likely to continue using CARU in the future.

Figure 13 displays the differences in acceptance ratings between the two groups (group1= already having an emergency call system; group2 = without emergency call system). Mean values for both groups as well as 95% confidence intervals are displayed. The results seem to support our initial assumption that participants with experience or interest in emergency call systems seem to be more likely to want to continue using CARU in the future (BI1), try to use CARU in their daily life (BI2), use CARU in case of an emergency (BI3) and were generally more satisfied with CARU. However, due to low sample sizes the differences are not statistically significant and further tests will be needed to support the assumptions.

Figure 13: Experience with an emergency system and acceptance rates (ACTEST II)



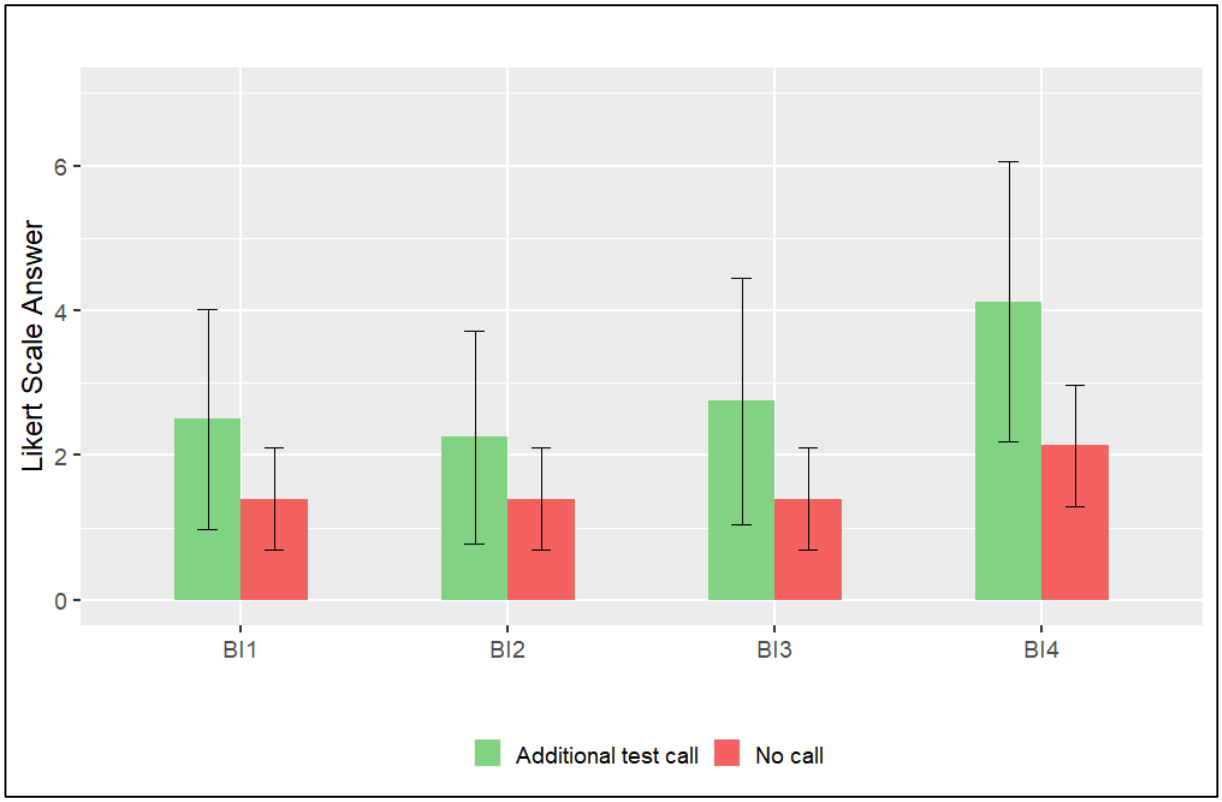
Notes: BI1: "I intend to continue using CARU in the future." BI2: "I will try to use CARU in my daily life." BI3;"In case of an emergency, I want to use CARU." BI4: "I am satisfied with CARU."

Source: WU, CARUcares ACTEST II, n=23

5.8 Acceptance rating by additionally triggered test-calls (ACTEST II)

In addition to trial participants already having an emergency call system, independently trying to trigger an alarm within the test period also signals a general interest in the emergency call feature. Figure 14 shows the differences in the acceptance rating between two new groups (group1= triggered an alarm independently within the test period; group2 = no additional call in the test period). Again, mean values for both groups as well as 95% confidence intervals are displayed. The results suggest anew that trial participants having triggered one or more additional test-emergency calls on a voluntary basis between the ACTEST I and II, seemed to be more likely to accept CARU as a new emergency call feature, but again, due to low sample sizes the hypothesis cannot be statistically confirmed.

Figure 14: Additional test emergency calls and acceptance rates (ACTEST II)



Notes: BI1: "I intend to continue using CARU in the future." BI2: "I will try to use CARU in my daily life." BI3;"In case of an emergency, I want to use CARU." BI4: "I am satisfied with CARU."

Source: WU, CARUcares ACTEST II, n=23

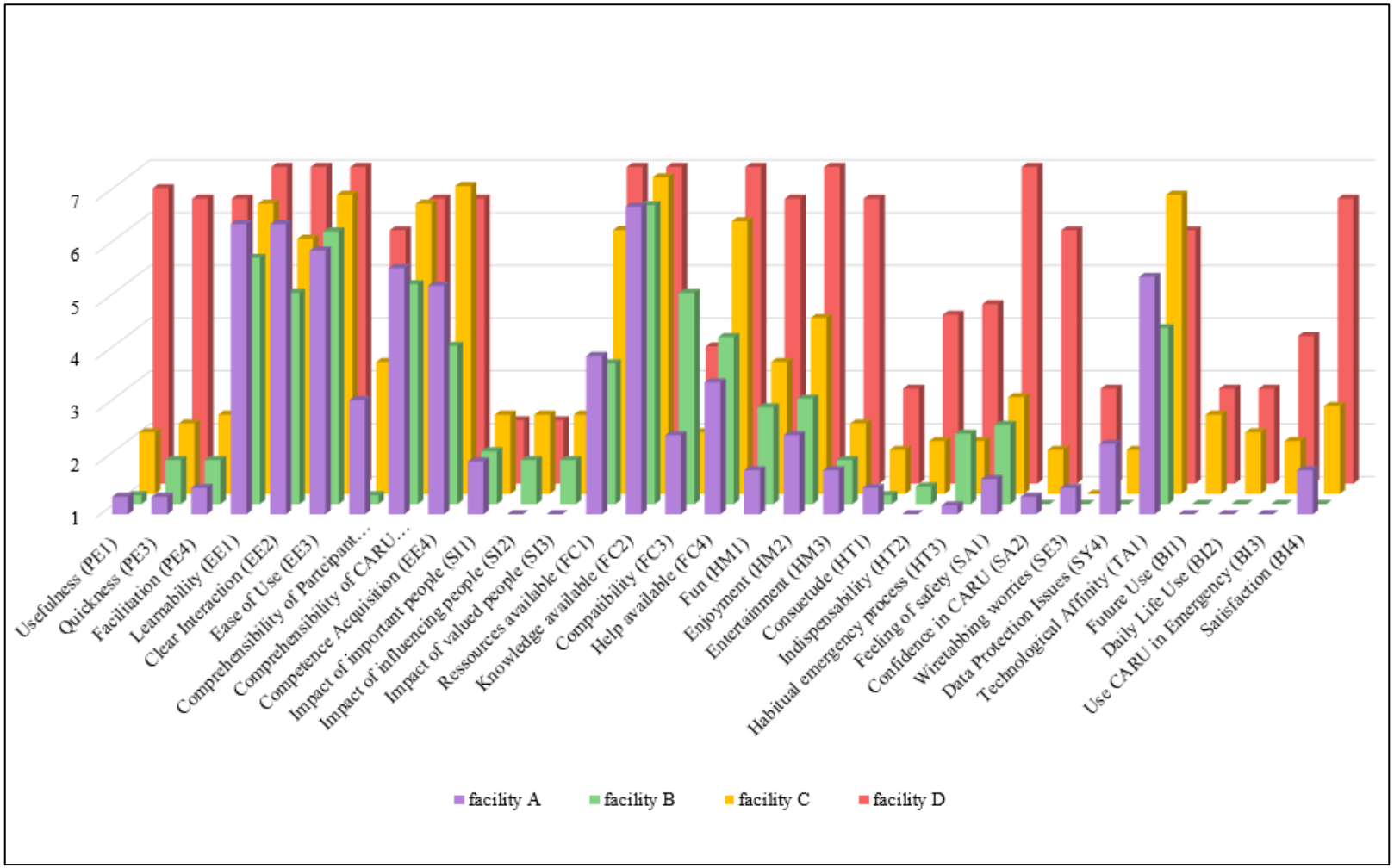
5.9 Acceptance rating by assisted living facility (ACTEST II)

The aim of this section is to provide an overall picture of acceptance rates and predicting factors across assisted living facilities. For this purpose, the mean values for each facility and each variable were calculated.

The descriptive results in Figure 15 for some variables show a diverse rating across the four assisted living facilities. For acceptance, measured by four intention to use variables, the best ratings can be found in facility D. For *satisfaction* (BI4), for example, the mean value for facility D amounts up to 6.4 (indicating a high satisfaction) compared to the other facilities rating between 1.0 (B) and 2.67 (C), indicating a very low or no satisfaction with CARU's emergency call feature. Similar to these results, although not as strong, were the ratings for *using CARU as an emergency call system*, (BI3) which were higher for facility D (3.8) in comparison to all other facilities ranging from 1.0 (A and B) to 2.0 (C).

In terms of the determinants of acceptance, some factors were rated similarly across facilities (e.g. *learnability* (EE1), c*lear interaction* (EE2), *ease of use* (EE3)). Others, on the other hand, were rated quite differently across the four assisted living facilities. *Usefulness* (PE1) achieved a mean rating of more than 6 points out of 7, while all other facilities rated usefulness on average only up to 2 points. The same holds for *quickness* (PE3), *entertainment* (HM3), *feelings of safety* (SA1) and to a lower extent *confidence in CARU* (SA2). As the differences in ratings are quite remarkable, the results will be discussed in the project consortium.

Figure 15: Comparison of acceptance ratings across assisted living facilities



Source: WU, CARUcares ACTEST II, n (participants) = 23, n (assisted living facilities) = 4

5.10 Results for the emergency call center

Overall, the emergency call center usually deals with 20 to 50 alarms per month from customers of bonacasa; between 3 to 15 are emergencies. During CARU testing, the call center received 111 calls comprising 70 trial alarms, 41 false alarms and one real alarm.

The emergency call center staff reported calls had a good sound quality. Customers of bonacasa using CARU could be understood very well, even when speaking from a balcony (which was part of one trial scenario). The staff felt that the conversation was clear and bonacasa's customers could understand them well.

In case the line was interrupted, the emergency call center staff would call back using the telephone number of the client. Staff reported that there is no difference in the workflow when clients use CARU.

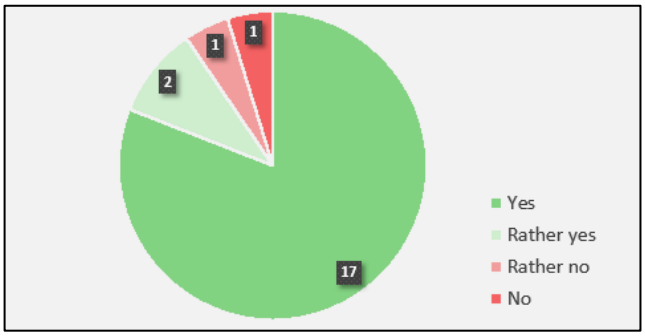
Compared to other devices, however, staff noted that establishing a connection between the client and the emergency call center took longer. Detailed recommendations for the developers would require a longer trial period.

5.11 Evaluation of the online survey used for assessing acceptance

5.11.1 Understandability of survey questions

Both surveys for the ACTEST were administered using the online survey software LimeSurvey®. The UTAUT2 questions were adapted to the emergency call technology and translated into German. To check the understandability of the survey instrument, we examined the questions to ensure they were formulated in a clear and comprehensible manner. Figure 16 shows that 17 out of 21 participants (>90%) understood the questions well (Figure 16).

Figure 16: Understandability of survey questions

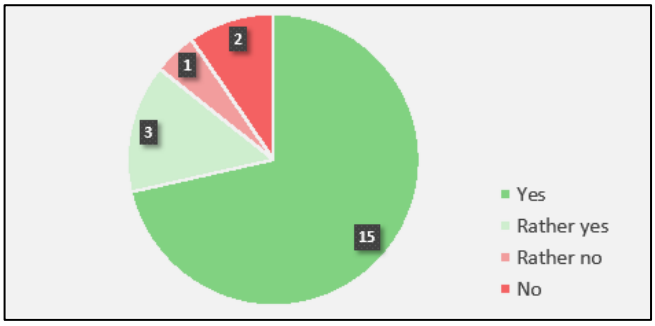


Source: WU, CARUcares ACTEST I, n=21

5.11.2 Usefulness of show cards

Due to the current COVID-19 crisis, the end-user organization responsible for executing the ACTEST preferred that responses to the survey questions be entered into the tablet by the concierges and not by the participants themselves. We thus provided show cards in an effort to reduce the cognitive burden felt by respondents. The show cards allowed participants to visualize the response options on a 7-point scale ranging from "strongly disagree" to "strongly agree". Further, we were also interested in whether or not the show cards were perceived as helpful in answering the questions. As Figure 17 shows, 18 participants (>85%) perceived the show cards to be a helpful or rather helpful tool in answering the statements. Only three participants found the show cards not to be useful.

Figure 17: Usefulness of show cards used for rating the UTAUT2 questions



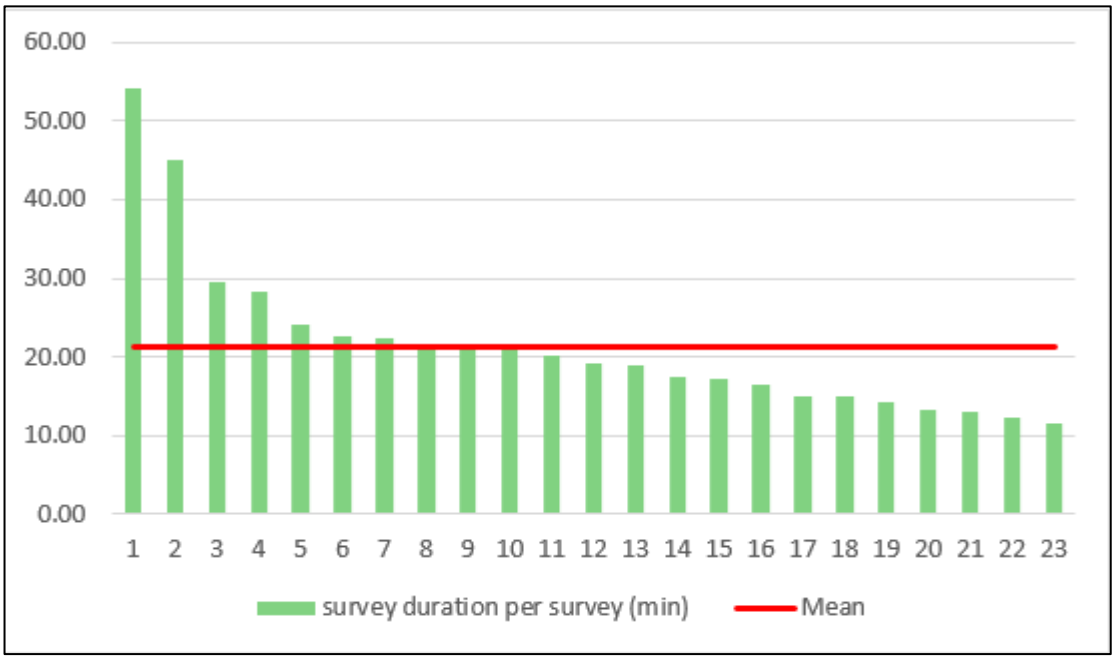
Source: WU, CARUcares ACTEST I, n=21

5.11.3 Survey duration of ACTEST II

As the rate of COVID-19 infected persons in Switzerland increased after the start of the ACTEST, we agreed with the responsible end-user organization and CARU AG to restrict the contact time for collecting data from their residents to approximately 15 minutes. In pre-trials the completion time was tested and the design of the survey was slightly adapted as explained in the study design paper (Trukeschitz/Ebner et al. 2020).

Figure 18 shows that on average the completing the ACTEST II survey took 21.38 minutes. Two outliers with 54.26 and 45.07 minutes were identified. Adjusted by these values, the average survey duration was 18.57 minutes.

Figure 18: Survey duration by participant



Source: WU, CARUcares ACTEST II, n=23

6 Conclusions

The smart sensor CARU, developed by the Swiss company CARU AG, offers an emergency call feature that can be activated using the voice only. Calling “help” twice activates a telephone hotline to a person or an emergency center and thus has the potential to replace traditional emergency systems using wristbands. Although CARU sensors equipped with the emergency call feature are available on the market, little is systematically known about the acceptance of this feature, particularly in assisted living facilities.

For the purpose of assessing acceptance, a two-month field trial was conducted in Switzerland, involving four assisted living facilities and 23 older people. The results indicated that trial participants experienced difficulties in triggering an alarm (at the first attempt). Most of the successful alarms were triggered from the room where the CARU sensor was placed. However, if a connection was established both the guidance by CARU and the emergency call staff was understood clearly. Most participants rated the emergency call via CARU as easy to learn. However, acceptance, measured as intention to use, was rated very low. Ratings differed substantially across assisted living facilities.

As it is today, CARU’s emergency call feature is a solution for a single room rather than for an entire flat. If used as an emergency call solution for an entire flat, more than one sensor will

be needed. In addition, speech recognition needs further improvement to be a reliable alternative to a wrist-worn emergency call system.

The strengths of the study lie in both the innovative new technology being tested and the design and implementation of the trial. Beginning with the technology, tested and voice-supported emergency devices offer new opportunities for vulnerable people to call for help in their homes, making wristbands with emergency buttons no longer necessary. Therefore, it is promising to test such a technology as alarms triggered by voice may improve older people's feeling of safety and as little is known about the acceptance of such devices. Second, the concept for the implementation of the trial was developed by people with different disciplinary and occupational backgrounds, including business, end-user and research partners which facilitated the execution of the trial. In addition, data collection did not rely on questionnaires only but also on integrated test scenarios. Testing the CARU emergency call feature under such controlled conditions was found to be particularly useful for a more realistic assessment of acceptance and factors of acceptance. We thus recommend this approach, particularly for prototypes and for devices that are used under specific circumstances, as in case of an emergency. Third, going beyond the proposal, we collected survey data in two waves, which allowed us to assess the acceptance of CARU's emergency call feature over time. Fourth, the UTAUT2 questionnaire was revealed to be a useful instrument, however, a few adaptations were required in order to address certain specific emergency call characteristics. Finally, online data collection was supported by the concierges of bonacasa, which made it possible for the surveys to be conducted while the rate of COVID-19 infections in Switzerland was increasing. Participants confirmed that show cards visualizing response options were useful.

The study has several limitations. To begin with, data collection was not conducted by trained interviewers but by staff members of the end user organization. Second, to facilitate data collection during a pandemic, trial participants were not allowed to complete the survey on their own but were supported by a member of the end-user partner's staff, which did not allow for a confidential rating by the trial participants. Third, the UTAUT2 model was not developed for emergency call features and thus some influencing factors, such as hedonic aspects, did not really fit and had to be adapted. Forth, we could not assess the impact of pricing on acceptance as this was dropped to keep the survey short. Finally, although, the trial was conducted at four assisted living facilities and drop-out was very low, the number of trial participants (21 to 23 participants) was quite low, which resulted into challenges for detecting statistically significant associations, particularly when using regression models to simultaneously account for several potentially influencing factors.

The acceptance test of the CARU emergency call feature revealed valuable starting points for improving factors related to its feature use and its implementation process. Further tests to be conducted in the CARUcares project may benefit from these experiences.

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