An Empirical Investigation on the Influence of Temporal Distance on the Acceptance of Innovations - Using the Example of Urban Air Mobility

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Abstract

Upon reviewing different approaches to explain the acceptance of innovations, it becomes apparent that the temporal proximity or distance of innovations, the possible effects of which could be neglected, are not considered sufficiently. The question is whether the influence on the acceptance can be observed by high or low temporal distance. This assumption is motivated by the implications of the Construal Level Theory, which suggests such an influence of temporal proximity or distance of an event on the evaluation. The concept of Urban Air Mobility was used as an example of application. To test this assumption, the participants (N = 369) of an online survey were confronted with a temporally close or distant condition and asked to complete a questionnaire designed on the basis of UTAUT2 and other measurement aspects.

The results showed that the different conditions had an influence on the time estimation of the participants. Furthermore a significant influence of the moderating effect of the time distance could be determined for the factor safety concerns.

1 Introduction

Acceptance research has become an increasingly relevant topic in recent years (Meyer, 2019; see also Schäfer & Keppler, 2013). Due to the great array of innovations that have managed to fundamentally change everyday life, whether it is the smartphone revolution or the advent of social media, it is in the interest of companies, but also of empirical social research, to discuss aspects that determine acceptance towards these new technologies.

On the whole, no one saw these developments coming or could even guess whether such innovations would be technically feasible at all. It is, therefore, questionable at this point whether the knowledge of these innovations and thus the perceived temporal distance to them has an influence on their acceptance. Perceived temporal distance refers to a mental abstraction level that varies depending on the perceived distance of an event (Trope & Liberman, 2003).

To vindicate the inference, it is no longer unusual to assume that in a few years, air taxis will also be commercially available as a common means of transport in urban areas.

In September 2019, a research group from the Stuttgart University of Applied Sciences (Planing et al., under review; Planing & Pinar, 2019) conducted a field study during the event in front of the Mercedes-Benz Museum in Stuttgart where the first public flight of an air taxi on European soil was demonstrated. Taking advantage of this opportunity, the study measured acceptance towards air taxis before and after participants were able to view the flight. In addition, visitors had the opportunity to view and sit in a 1:1 model on the ground. The study had a high degree of internal validity owing to the accessibility of the innovation object to the participants (Planing & Pinar, 2019). The results of this study showed a fundamentally positive acceptance towards air taxis. This positive attitude is also in line with the results of Al Haddad and colleagues (2020), who investigated the acceptance of air taxis using a hypothetical scenario. However, due to the aforementioned high internal validity, the consideration of the temporal aspect gets out of focus. The participants did not receive any concrete information about the market launch of the air taxis, which raises the question of whether acceptance could also have been influenced by the accessibility of the innovation.

Since acceptance research basically deals with innovations that already exist in draft form and we can already make certain concrete statements about these concepts (Kromrey, 1999), the concept of Urban Air Mobility (UAM) is very well suited for this investigation. In technology acceptance research, it is commonly accepted to use validated models when eliciting relevant factors that influence the acceptance of technologies among the population (Neudorfer, 2004). This approach is particularly common in Anglo-American information systems research. The TAM research models (e.g. Davis et al., 1989; Venkatesh et al., 2003) are among the most prominent representatives of this field. Depending on the model, the complexity varies, and so does the accompanying set of influencing factors that the respective model postulates, although this does not automatically mean that the number of predictors improves the

quality of the model (Agudo-Peregrina et al., 2014). These models were originally developed for measuring the acceptance of technologies in the workplace but have become established in acceptance research because of their adaptability to other study contexts (Venkatesh et al., 2007). Upon reviewing various models and approaches, no influencing variable that takes the temporal distance of an innovation into account has been found, even though the cornerstone of acceptance research, significantly influenced by Rogers' diffusion theory (Rogers, 1962), emphasizes this time variable as a strength (Rogers, 2003).

Due to the lack of the influencing variable, a research gap that could possibly be filled by the combination of the already existing approaches emerges. One theory suggesting that the perception of temporal distance of future events can change their assessment is the Construal Level Theory (CLT; Trope & Liberman, 2003, 2010). It presupposes that people's thinking processes are organized in schemas. Depending on how far away an event is in time or space, these schemas are more concrete or abstract. Incidentally, social proximity and hypothetical occurrence probability are also explained by this mechanism. The objective of the present study was to combine these approaches of acceptance research and Construal Level Theory in order to find out whether the expression of the perceived temporal distance of air taxis has an influence on the acceptance of this innovation.

2 Literature Review

This chapter provides a foundation for a theoretical understanding of the approach taken in this study. It is important to clarify how the construct of temporal distance, suggested by the CLT, can be defined and classified in the context of the object of this study, i.e. the acceptance of innovations by the general public, using the example of UAM. Since different research disciplines overlap here, a review of the relevant facets of the individual subject areas is necessary for an orderly entry and a reasoned approach to the hypotheses. Therefore, the acceptance-theoretical and psychological aspects are discussed first, which are then followed by the subsequent analysis in the context of UAM and the reasons for its adaptability. The choice of this approach is justified by the fact that a broad field of literature can be found for each component in detail, which is not the case in terms of the literature that compares them. This reflects the importance of the present study.

2.1 Adjustment of the UTAUT2

As mentioned already, the UTAUT2 (Venkatesh et al., 2012) offers a large scope of application due to its adaptability. This is not least because the UTAUT2 itself is a theory that combines eight of the most significant acceptance theories. The reason I chose this theoretical basis is that its proposed predictors make it possible to elucidate high variance components in the acceptance of technologies (Tamilmani et al., 2019). To establish the model's development, Lee, Kozar and Larsen (2003) define four phases that classify the various models of TAM research, to which UTAUT also belongs., according to their respective stages of development. This classification includes the phases of model introduction, model validation, model extension, and model simplification. The UTAUT is attributed to the phase of model simplification. In order to avoid constant replications of the UTAUT and UTAUT2, the authors emphasize that a continuation of the replications without theoretical progress is senseless. A continuation would only be beneficial under the assumption of gaining new knowledge (Venkatesh et al., 2007). A context-specific continuation of research based on the UTAUT and UTAUT2 basic model is recommended to gain new insights (Venkatesh et al., 2016). Since the UTAUT2 proposes an adaptive model, considering acceptance measurement in terms of time could be insightful and thus beneficial. Because Venkatesh et al. (2016) advocate a context-dependent use of moderator variables, it is logically useful to include temporal distance as a dichotomous moderator variable in the model as it emphasizes the temporal context of the investigation.

2.2 Construal Level Theory as a framework

If an event that lies in the future is far away, it is associated with higher-level schemas, the so-called high-level construals. If the event is closer, we deal with more concrete thought patterns, the so-called low-level construals. According to the Construal Level Theory (CLT; Trope & Liberman, 2003, 2010),

such a premise is, as mentioned before, also likely for spatial, social and hypothetical distance. Both levels of association lead to a different evaluation of the event in question. The quite promising nature of the statements in CLT results in a broad field of application of the theory as a framework for various research contexts (cf. Soderberg et al., 2015; Trautmann, 2019). Advertising research has also used the implications of CLT to try to determine under what conditions advertising interventions are more effective (cf. Kim et al., 2014; Reczek et al., 2018). Such an application in acceptance research is feasible in relation to the issue of the influence of temporal distance on innovation acceptance and the adaptability offered by the UTAUT2. In order to formulate the research question with regard to its novelty, the following option may be proposed: Do the perception of high temporal distance (high-level construal) and the perception of low temporal distance (low-level construal) have an influence on innovation acceptance? If an empirical study be conducted, it would require measures that activate the corresponding construals in the participants. This could be achieved, for example, by providing abstract and concrete information about an innovation (cf. Trope & Liberman, 2003).

2.3 UAM Research

Since UAM is an innovative concept, the topic is relevant to acceptance research. Within the UAM research community, aside from researching acceptance, infrastructure requirements, legal regulations, and economic constraints, among others, need to be clarified (cf. Straubinger et al., 2020). From the industry perspective, it is the public and user acceptance that pose the greatest challenges to market introduction (Yedavalli & Mooberry, 2019). In this context, one study shows that assured safety is a key condition for use, followed by factors as price, trip duration, punctuality and maintenance of air taxis (Al Haddad et al., 2020). Another informative finding was revealed by Al Haddad and colleagues (ibid.) who asked 221 participants at which point of time after the market introduction they would take up a UAM offer. 22.17 % were in favour of using it within the first year, followed by the 36.65 % majority who could imagine using it within the second or third year. 14.03 % would wait until the fourth or fifth year, and 3.17 % until the sixth year. 21.27 % remained uncertain. This finding is interesting to this study as it represents an approach that incorporates the dimension of time into acceptance research. The aforementioned results represent a significantly more left-leaning distribution than the normally distributed diffusion curve postulated by Rogers (2003). It is possible that the study design also plays a role in this outcome. Participants were presented with hypothetical scenarios to illustrate what would happen in 2030 (cf. Al Haddad et al., 2020). It can be assumed that the participants' positive intention to use and the implied acceleration of the hypothetical diffusion process, coupled with the demographic factors of the sample, can also be attributed to the temporal dimension.

2.4 Research question

As explained in the research examples, the suitability of the topic of UAM for the issue of temporal influence is apparent. The approach in the study by Planing and Pinar (2019) also provides a methodological basis on which this research project can be based, with the difference that in the present study, the focus is not on the expression of acceptance, but on the change in its expression based on the temporal perception of the study participants. This leads to the following research question, that is, whether the perceived temporal distance to the market introduction of air taxis has an influence on their acceptance.

3 Methodology

In order to test whether the perception of the temporal distance has an influence on the acceptance of air taxis, a quantitative online experiment was conducted.

3.1 Selection of the research approach

For the experiment, an online questionnaire was generated. The research took place in the time frame from 10/16/20 to 10/27/20. The choice of the quantitative survey method is based on the fact that the empirically proven acceptance factors already exist in the applied acceptance model, the significance of which can be ascertained in the population by means of a larger sample. For this reason, a qualitative

approach was not used, considering that the relevant literature points to a lower predictive quality of surveys dealing with innovations.

As this study does not primarily focus on a reliable prediction of the acceptance of air taxis, but rather on the investigation of how the acceptance level behaves under various perceived temporal scenarios with regard to the implications of the CLT, the use of this method is considered legitimate. In addition, the web-based survey and its automated execution eliminate possible test leader effects, i.e. the objectivity and external validity of the data are not influenced by possible test leader factors (cf. Schreier et al., 2013).

3.2 Manipulation of the time dimension

By coding a random trigger, it was possible to show the participants two introductory videos, each about air taxis, at the beginning of the questionnaire. Both videos were composed of reports and image films about the Volocopter 2X air taxi model. In terms of content, they differed in the nature of the statements. In video A (see Figure 1), hereinafter referred to as proximal condition, the statements such as “The goal of the Bruchsal based company is to launch in 2021” or “We believe we are close to the market launch of this technology” were made. These utterances meant to convey the temporal proximity of the innovation. In addition, the live footage of Volocopter 2X test flights could be seen during these interviews.

Video B (see Figure 2), hereinafter referred to as futuristic condition, did not show the live footage. Instead, concept animations of how the use of the air taxis could look like in the future. Statements such as “Now the world is ready to see what is going to dominate the city landscape in ten years” or “This is an interesting market segment that we think could grow in the next ten years” were included. Their goal was to show a greater temporal distance. Both videos were of equal length, and the statements were delivered by credible actors such as Alexander Zosel, co-founder of Volocopter GmbH and Ola Källenius, CEO of Daimler AG.

Based on the implications of CLT (cf. Trope & Liberman, 2003), this approach should activate low-level construals through the proximal condition and high-level construals through the futuristic video. It should be mentioned that the proximal video deals with the implementation aspects of air taxis, and the futuristic video with the benefits they are supposed to provide, which according to CLT is conducive to the activation of the corresponding construals (cf. Wakslak et al., 2007). Consequently, this resulted in two groups of participants given a different background of the topic. Since viewing the video was a necessary condition for the study, participants could not skip this step.

To test the effect of the manipulation, participants were asked to estimate when they thought air taxis would be introduced, before the video and at the end of the survey.

After viewing the introductory videos, participants were asked to imagine travelling from Stuttgart Airport to downtown Stuttgart by air taxi, with a travelling time of 15 minutes, autonomously controlled and electrically powered. The participants who did not know the Stuttgart area were instructed to imagine the equivalent of their hometown for their response. This scenario was intended to provide a consistent framework for answering the questions. Participants were not informed of the exact research objective, considering this as an ordinary survey.

Figure 1: Still images video A
(© Daimler AG, 2019)

Figure 2: Still images video B
(© Volocopter GmbH, 2018)

3.3 Predictors of individual acceptance

In total, 20 of the 38 questions can be classified as acceptance-measuring items. Of these, eleven items are based on the core statements of the UTAUT2 (Venkatesh et al., 2012) and were measured using a five-point Likert scale (Likert, 1932). Accordingly, questions were asked regarding hedonic motivation, expected benefits, ease of use, and perception of the air taxi as a status symbol. In addition, safety aspects were also queried, as they played an important role in the study by Al Haddad et al., (2020). The safety aspect included three variants: impression of safety to air taxis, safety concerns, and concerns about autonomous flying. Further, the survey included a question about expected price range and expectations of infrastructure integration of air taxis. The model-theoretical predictor habit and social influence were not included, since these could only be used meaningfully in case a technology is available on the market (cf. Planing et al., under review).

3.4 Aggregation of the acceptance criterion

Subsequently, four questions touched upon the specific use intention of the respondents. Two of the questions referred to a general intention to use air taxis and an intention to act (“How likely would it be for you to use an air taxi?”) and a possible everyday implementation (“Can you imagine air taxis becoming part of your everyday life?”). The other two questions referred to the suitability of an air taxi service for Stuttgart and whether an air taxi service would be desirable in the city. These four questions form the latent acceptance construct for the survey and, upon checking the prerequisites, were combined into a criterion variable *acceptance of air taxis* for the application of statistical methods.

3.5 Sample composition

In order to avoid anchoring effects, the collection of socio-demographic data was placed at the end of the questionnaire (cf. McFadden, 2001). This data is relevant for the interpretation of the results, especially because an over-representation of students who might tend to have a positive attitude towards innovations was assumed (cf. Foxall, 1986). Since the acceptance in the population was investigated, no specific target group was defined in advance. The total number of participants amounted to 369 persons and consisted mainly of male and female students from the Stuttgart area, aged between 20-30 years (see Table 1).

Beforehand, exploratory data analysis was employed to identify extreme values that were given when estimating the market introduction of air taxis. The analysis of the extreme values resulted in the exclusion of all cases that gave a value of more than 50 years in the first estimate and a value of more than 40 years in the second. These had to be excluded for the analysis because the mean values of the distributions were heavily distorted, being partly questionable with regard to their accuracy. Exclusion of values beyond the interquartile range is permissible (cf. Field, 2009).

The participants were largely recruited by means e-mail outreach using the internal e-mail distribution list of the Stuttgart University of Applied Sciences, but also via social networks and direct contact. As an incentive to participate, they either received half an hour as a test person or took part in a voucher draw.

Table 1
Sample summary

Characteristics	Expression	Sample (n = 319)
Gender	Female	59.2 %
	Male	40.1 %
	Diverse	0.7 %
Age	< 20	8.5 %
	20–30	81.8 %
	31–40	5.0 %
	41–50	0.6 %
	51–60	2.8 %
	61–70	1 %
	> 70	0.3 %

Educational/Employment status	Pupils	0.3 %
	Students	84.6 %
	Trainee	2.8 %
	Employee	11.1 %
	Retired	0.6 %
	Other	0.6 %
Resident in Stuttgart and surroundings	Yes	81.8 %
	No	18.2 %
Knowledge of air taxis	No knowledge	15.4 %
	Basic knowledge	68.9 %
	Good knowledge	14.1 %
	Very good knowledge	1.6 %

It is advantageous for the study that a clear majority of the sample has no or little experience with the topic of air taxis, which means that a relative lack of bias on the topic can be assumed.

For all statistical tests, a significance level of $\alpha = 5\%$ was set in advance.

4 Results

For the report of the results, a division into four steps is necessary: assumption of possible manipulation, review of the descriptive data, examination of the multiple linear regression results and existing interaction effects of the moderating effect of the construal level.

4.1 Manipulation Check

A descriptive review of the data (see Table 2) shows that in the first set of questions (prior to viewing the video), the temporal distance of the air taxi launch was estimated almost equally by both groups. In the second measurement, the two groups' estimates differed on average.

Table 2

Presentation of the time estimate for the market launch of air taxis by group

Time of Measurement	Intersubject factor	Mean	Median	SD	95 % CI		n
					lower	upper	
1	Proximal	14.64	10	9.171	13.248	16.033	153
	Futuristic	14.99	12	8.354	13.651	16.325	166
2	Proximal	10.41	10	7.169	9.313	11.511	153
	Futuristic	13.57	10	6.659	12.511	14.621	166

The mixed ANOVA yielded the following results after examining the given conditions: there was a statistically significant interaction between the condition and the time of measurement ($F(1,317) = 14.318, p < .001$, partial $\eta^2 = .043$) with a narrow effect size ($f = .212$ [calculated after Cohen, 1988, p. 284]). In this regard, it appears that those who viewed the proximal condition reported a significantly smaller number of years at the second estimate ($F(1,152) = 54.059, p < .001$, partial $\eta^2 = .262$), accompanied by a strong effect ($f = .596$). The group viewing the futuristic video was also significantly different from their baseline estimate at the second measurement time point ($F(1,165) = 8.934, p = .003$, partial $\eta^2 = .051$), with a just-medium effect size ($f = .232$). The results show an effect that could be attributed to the construal level, which legitimizes further action in line with the research question, since a general influence by the presented videos is to be assumed.

4.2 Descriptive results on acceptance

The descriptive values of the acceptance-measuring items all show a positive tendency toward air taxis (see Table 3). The figures show that, on the one hand, the individual acceptance factors were evaluated positively and, on the other hand, in the case of the social factors, according to the participants none of the factors seem to have a negative impact on Stuttgart, but in some points even have a significant improvement.

Table 3

Presentation of descriptive statistics of the acceptance items (n = 319)

Variables	Mean	Median	SD	95 % CI	
				lower limit	upper limit
Acceptance of air taxis (Criterion)	3.22	3.25	0.959	3.11	3.32
Individual acceptance factors (1 = <i>I totally disagree</i> / 5 = <i>I totally agree</i>)					
Hedonic motivation	4.07	4	0.936	3.97	4.17
Safety concerns	3.15	3	1.110	3.03	3.27
Impression of safety	2.83	3	0.943	2.73	2.93
Fear of automation	3.79	4	1.066	3.67	3.90
Advantage in shortened travel time	4.14	4	0.839	4.05	4.23
Ease of use	3.33	3	1.080	3.21	3.45
Perception as a status symbol	2.99	3	1.269	2.85	3.13
Social acceptance (1 = <i>worsen</i> / 5 = <i>improve</i>)					
Cityscape	3.34	3	1.316	3.19	3.48
Sustainability	3.34	3	1.376	3.19	3.50
Noise pollution	2.78	3	1.306	2.64	2.92
Parking situation	3.87	4	1.100	3.75	3.99
Public transport	3.66	4	0.992	3.56	3.77
Safety	2.98	3	0.979	2.88	3.09
Traffic volume	3.86	4	1.012	3.74	3.94
Mobility services	4.37	4	0.705	4.29	4.44
City's innovation potential	4.54	5	0.734	4.46	4.62

4.3 Results of the regression analysis

The planned composition of the criterion acceptance of air taxis was tested with reliability analysis and is admissible with good internal consistency (Cronbach's $\alpha = .857$). To run the regression, the predictors were centred in advance to better interpret interaction effects in the follow-up and prevent multicollinearity (cf. Frazier et al., 2004). Further prerequisites for the implementation of the regression were considered to be given after their review. The results of the calculated models will be found below.

4.3.1 Regression model I: sample with proximal condition

With the predictors, and under consideration of this subsample's predictors, the model can elucidate about 71.1 % variance of the criterion acceptance of air taxis, which lends a high level of significance to the present research. The results (see Table 4) show that hedonic motivation, the advantage in reduced travel time, ease of use, concerns about autonomous flying, and a predicted change in cityscape are significant predictor variables of the acceptance of air taxis. Hedonic motivation, the advantage in shortened travel time, and cityscape are the strongest predictors.

Table 4

Results of multiple linear regression of the experimental group: proximal condition (n = 153)

Source	β	<i>t</i>	<i>p</i>
Constant	3.126	65.715	.000***
Individual acceptance factors			
Hedonic motivation	.241	4.157	.000***
Safety concerns	.024	0.417	.677
Impression of safety	.098	1.672	.097
Fear of automation	-.122	-2.018	.046*
Advantage in shortened travel time	.172	2.988	.003**
Ease of use	.126	2.305	.023*
Perception as a status symbol	.040	0.788	.432
Social acceptance			
Cityscape	.249	4.393	.000***

Sustainability	.080	1.206	.230
Noise pollution	.087	1.314	.191
Parking situation	-.093	-1.476	.142
Public transport	.093	1.483	.140
Safety	.096	1.598	.112
Traffic volume	.117	1.754	.082
Mobility services	.116	1.811	.072
City's innovation potential	.009	0.144	.886
Model summary: $R = .843$, $R^2 = .711$, $F(16, 136) = 20.929$, $p < .001$			
Legend: $<.001$ '***', $<.01$ '**', $<.05$ '*'			

4.3.2 Regression model II: sample with futuristic condition

With the predictors, and under consideration of this subsample's predictors, the model can elucidate about 61 % variance of the criterion acceptance of air taxis, which lends a high level of significance to the present research. The results (see Table 5) show that safety concerns, impression of safety, ease of use, a predicted change in the cityscape, sustainability and the parking situation are significant predictor variables for the acceptance of air taxis. The factor cityscape is by far the most influential predictor, followed by ease of use and a negative influence of safety concerns.

Table 5

Results of multiple linear regression of the experimental group: futuristic condition (n = 166)

Source	β	t	p
Constant	3.143	61.944	.000***
Individual acceptance factors			
Hedonic motivation	.043	0.706	.481
Safety concerns	-.189	-2.797	.006**
Impression of safety	.134	2.084	.039*
Fear of automation	-.066	-1.161	.247
Advantage in shortened travel time	.061	1.101	.273
Ease of use	.229	4.147	.000***
Perception as a status symbol	.001	0.024	.980
Social acceptance			
Cityscape	.319	5.407	.000***
Sustainability	.158	2.327	.021*
Noise pollution	.035	0.567	.571
Parking situation	.140	2.119	.036*
Public transport	-.023	-0.349	.727
Safety	.061	0.960	.339
Traffic volume	.039	0.567	.571
Mobility services	-.044	-0.619	.537
City's innovation potential	-.003	-0.049	.961
Model summary: $R = .781$, $R^2 = .610$, $F(16, 149) = 14.551$, $p < .001$			
Legend: $<.001$ '***', $<.01$ '**', $<.05$ '*'			

4.4 Moderator analysis

The three identified strongest regression weights of both regression models are only similar in the influencing factor cityscape. For the temporally proximal condition, hedonic motivation and the advantage of shorter travel time emerged as significant influencing variables. For the temporally futuristic condition, ease of use and safety concerns were considered as such.

A moderator analysis was conducted for these five predictors in total since the very same predictors proved to be particularly influential on the criterion.

In order to consider possible effects in isolation, each predictor was successively subjected to a moderator analysis, while the remaining predictors were included in the model as covariates. The moderator variable was contrast coded (-1 = proximal condition / 1 = futuristic condition).

The overall model of this moderation analysis became significant ($F(18,300) = 28.53, p < .001$) with a variance resolution of 63.13%. Having added the moderator variable *condition*, a significant interaction effect of the relationship between safety concerns and acceptance of air taxis ($\Delta R^2 = 1\%$, $F(1,300) = 4.56, p = .03$, 95% CI [-0.13, -0.01]) appeared. The follow-up analysis shows that this relationship is significantly affected when the futuristic video is shown ($\beta = -.146, t(300) = -2.98, p = .003$). Given the wording of the item (“Travelling by air taxi in the air would worry me”), this means that the relationship between safety concerns and acceptance of air taxis is negatively affected by the moderator level of high-level construals. In other words, safety concerns decrease as acceptance increases.

5 Discussion

A manipulative effect caused by the presented videos is apparent. The first estimate of the two groups was about the same, the second differed by about three years in that the temporally proximal video resulted in a closer estimate of the market launch. The mean values of both estimation times did not show any major differences as many participants reported the same value at both estimation times despite having seen the videos. Consensus effects are suspected here since the question about the time estimate (“How many years do you estimate it will take until air taxis will be available in German cities?”) was formulated in the same way at both time points, which meant that the subjects possibly did not want to negate their first estimate (cf. Moosbrugger, 2008). A possible alternative to this approach would have been to explain the actual research background of the survey, but we decided against it since the activation of high- and low-level construals by corresponding information about the temporal distance is described as a subconscious process (cf. Bar-Anan et al., 2007).

5.1 Influence factors on the acceptance of air taxis

The differences in the indexed temporal perception of the introduction of air taxis can be seen in the form of differently significant regression weights of both models. In hypothesis testing, it is important to test whether the perception of high and low temporal distance of air taxis has an impact on the acceptance of the latter. This test can now be accomplished by considering the two regression models separately.

For the temporally concrete condition, the affective factor “hedonic motivation” towards using an air taxi was emphasized, followed by the cognitive factors “advantage of reduced travel time” and “ease of use”. The other group, in turn, emphasizes the cognitive factor “ease of use”, followed by “safety concerns” and the affective “impression of safety”. It can thus be observed that for the low-level construals, the emotional factor of individual acceptance has a strong involvement. For high-level construals, the opposite pattern can be observed, namely that cognitive factors of individual acceptance outweigh the affective factor of the impression of safety, whereas hedonic motivation cannot be considered as a reliable predictor. Moreover, it becomes clear that factors of usefulness are relevant for low-level construals.

With regard to the social acceptance factors, a significant influence of the factor cityscape becomes clear in both models. It is remarkable that the assessment of the sustainability and the consequences for the parking situation in Stuttgart are the significant influence factors for the acceptance of air taxis only for the futuristic condition group. In this respect, the abstract presentation of the air taxi concept shots seems to be more relevant to social factors than the presentation of real shots. Thus, it can be deduced that social acceptance factors for the perception of higher temporal distance are relevant influencing variables for the acceptance of air taxis. Given the relevance of the sustainability, this tendency would also be in line with the results of the study by Reczek et al. (2018) where high-level construals were found to be related to the choice of environmentally friendly product alternatives.

However, these findings alone are not sufficient to fully answer the research question, since a comparison of the two groups with one another when considered separately is not meaningful enough. Only when looking at the results of the moderating effects of the construals, significant differences become clear. It can be observed that high-level construals have a clear negative influence on the relationship between safety concerns and the acceptance of air taxis. In the light of these results, the

research question can be answered positively, since a direct influence of the construal on this correlation between acceptance predictor and criterion was found.

In general, the issue of safety stands out as a relevant predictive variable for the futuristic video group. This would be in line with the results of some studies that also identified safety as a significant factor influencing the acceptance of air taxis (Al Haddad et al., 2020; Planing et al., under review). For the participants who watched the proximal video, safety issues seemed to have been poorer predictors of acceptance because, except for concerns about autonomous control, none of them showed a significant influence on the criterion.

5.2 Limitations and outlook for further research

It must be taken into account that, according to CLT, the different dimensions of psychological distance can influence each other (Liberman & Trope, 2008). Since 81.8 % of the respondents are from Stuttgart and the surrounding area, the fact that Volocopter, the air taxi manufacturer from the video is a company from Bruchsal (≈ 100 km distance) might have had an additional influence on the formation of low-level construals, which could have been expressed in the reduction of the spatial distance. In addition, in the proximal video, the flight was conducted in front of the Mercedes-Benz Museum in Stuttgart. In order to better control this possibly confounding variable, the choice of a manufacturer from another continent might have been more advantageous for the video material. However, this would again conflict with the lack of personal involvement of the interviewees. Upon consideration, a possible bias was eventually accepted.

Another issue is the complexity of the regression model. In general, only predictors that have a theoretical basis should be included in a model (cf. Field, 2009). With reference to the theoretical basis of UTAUT2, this fact was taken into account. Nevertheless, the inclusion of the social acceptance factors resulted in a total of 16 model predictors. For this number of predictors, the size of the sample ($n = 319$) could possibly have turned out to be too small, since a need for a larger sample arises with an increasing number of predictors (ibid.).

Going further, the demographics of the participants should be taken into consideration. 90.3 % of the study participants are 30 years old or younger. According to Roger's diffusion theory, this is not directly an indication that this age group should be assigned to the innovators or early adopters with an affinity for innovation, but factors such as the level of education (84.6 % students) and knowledge of innovations (84.6 % had knowledge of air taxis, 15.7 % of which was good or very good) nevertheless suggest a bias in this direction (Rogers, 2003). This aspect should be taken into account when interpreting the results as they could possibly neglect innovation-bearing groups such as the early or late majority and laggards in particular, which would lead to an overestimation of acceptance towards air taxis.

For further research, some aspects of these findings raise questions worth pursuing. For example, a closer look at hedonic motivation is worth mentioning. That this did not become significant for the futuristic video group raises the question of whether emotional attitude may play a subordinate role for innovations that are far away in time, and whether, on the other hand, the advertising communication of providers should only be prioritized for innovations that are closer in time. For this issue, a consideration from the point of view of the CLT is recommended. In connection with this, it would also make sense to include the three other psychological distances. The issue of spatial distance, but also hypothetical distance, could have an influence on innovation acceptance in the population, for example, because some providers initially aim to launch mobility innovations far away from Germany in the Far East or the United Arab Emirates.

The limitations of the study make it clear that the implications of this work are subject to some caveats. Nevertheless, it draws attention to a prevailing deficiency in the inclusion of temporal distance in acceptance research.

Whether the change in the estimate of temporal distance at the beginning and at the end of the survey is caused by the shown videos, and thus, whether there is a causality between the activation of high- and low-level construals, cannot be fully guaranteed in an Internet-based survey. Here, a laboratory experiment under controlled conditions would certainly be better suited to guarantee a higher internal

validity. However, this would involve cuts in the sample size, which could, in turn, affect the external validity of the study.

Another finding is that the dichotomous coding of the construal level is not suitable as a good moderating condition. For this purpose, an interval-scaled variable would be more advantageous, since it would allow a more precise view in the simple slope analyses for the temporal distance of which the moderating effect is significant. Basic context-dependent inclusion of the moderator (cf. 2.1) has proven to be promising. The same applies to the predictors used in the UTAUT2. It has proven to be an adequate model in the context of this work, with which the influences of temporal distance could be well uncovered.

6 Conclusion

“Time will tell” - so says a Russian proverb. If used in the context of this study, time shows that a consideration of its perception in the form of the perceived distance of innovations should not be neglected. Arguments for this are provided by the differences found in the present study, namely in the factors influencing acceptance which have emerged through the appropriate formation of construals. The issue of safety was found to be a significant influencing factor, taking into account the manipulated temporal perception of the participants. In general, it became clear that high- or low-level construals could be activated by the choice of different terms and visuals.

The inclusion of temporal perception as a moderator variable was made on the basis of UTAUT2, which proved that conventional acceptance models of information systems research are compatible with this kind of undertaking. The consideration of temporal distance was extracted from the CLT, and its application as a framework for the interpretation of the results as well as for the reasoned inclusion of temporal distance as a variable was perceived to be insightful.

On balance, these findings lead to the following attitude towards the raised question: the temporal influences on the acceptance of innovations are apparent and are still insufficiently considered in theory.

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