Applying the Metaverse to Real-world Citizen Participation – First Results from a Field Experiment

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Abstract

The idea of the Metaverse is expected to find applications in many domains and industries. Cities and municipal politics can benefit through a variety of applications. This paper examines the acceptance of virtual reality (VR) in the context of citizen participation in municipal politics. It contributes to the research on the practical implementation of immersive technologies in municipal contexts. Key factors influencing VR acceptance are identified, and insights into demographic variations in technology perception are provided. A citizen participation event in a virtual environment was conducted as a field experiment involving citizens discussing actual political topics with municipality officials. Utilizing the Unified Theory of Acceptance and Use of Technology (UTAUT), the study analyzed data from questionnaires to assess the acceptance of VR and its effectiveness in facilitating local political discourse. Results indicate a positive reception of VR among citizens, with a notable preference for immersive VR headset experiences over participation via laptop. The study results show the potential of the Metaverse to increase citizens' willingness to get involved in municipal matters.

Keywords: metaverse, municipal politics, citizen participation, UTAUT, virtual reality acceptance

1. Introduction

The Metaverse blends the physical and the virtual world. Both worlds are interconnected, allowing for cross-environmental interaction (Weinberger, 2022), knowing that there is no commonly accepted definition of the Metaverse in literature. The Metaverse, in its various manifestations, is currently being employed primarily within industry and entertainment rather than politics (Maier & Weinberger, 2024). The industrial Metaverse is expected to contribute to process and efficiency optimization (Ren et al., 2024). The application of various Metaverse technologies, such as virtual reality (VR), enables, for instance, realistic simulations through digital twins or virtual components of complex technical systems for training purposes. Metaverse technologies are also utilized in the marketing sector to provide customers with an immersive purchasing experience and to increase brand awareness (Giovanni, 2023).

In politics, the potential of the Metaverse is recognized, too, particularly in the context of cultural exchange, diplomatic relations, and citizen participation (Gaurav, 2023). In the international context, several examples can be found:

- An inter-Korean exchange between North and South Korea in a virtual space, including a virtual representation of the border area (Gaurav, 2023)
- Virtual political party conventions in Turkey using VR headsets (Fuchs, 2023)
- Virtual campaigning by Jean-Luc Mélenchon using holograms in France (Willsher, 2022)
- The first virtual embassy of the Maldives on the Metaverse predecessor, "Second Life," in 2007 (Gupta, 2022)
- Establishment of the Barbados embassy on the Metaverse platform Decentraland (Wyss, 2021)

When looking deeper into a local context, especially in municipal politics and virtual citizen participation, the research is getting tough. According to a white paper published in 2023 (Borkmann et al., 2023), the potential of the Metaverse can well be leveraged by municipalities. The paper describes a multitude of possible applications of the Metaverse, including citizen participation in digital office hours or public budget discussions. The area of citizen services, such as administrative services, can also be transferred to a virtual environment and thus could be more flexibly adapted to citizens' temporal and spatial needs. For example, Metaverse Seoul provides access to administrative services, such as applying for and retrieving residency certificates (Sung-Eun, 2023). This flexibility can also be an advantage when facilitating community meetings virtually, allowing more citizens to participate in discussions without being physically present. By integrating virtual realities into political processes, complex planning and development projects can also be visualized and made

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more accessible to the public. An example of this would be the virtual simulation of urban development plans, enabling citizens to explore various scenarios and provide feedback before final decisions are made (Maier & Weinberger, 2024).

However, VR environments and interaction in virtual spaces via laptops or VR headsets are yet to be commonplace for most individuals. Despite the many advantages of virtual world events, such as location-independent participation or new visual possibilities, VR headsets, in particular, present users with technical and physical challenges. These include issues such as unfamiliar navigation or cybersickness (Rebenitsch & Owen, 2016).

Searches for scientific literature were conducted in both Web of Science and Google Scholar to identify existing studies addressing local political engagement using Metaverse technologies, particularly virtual reality (VR). Searching Google for the term "Virtual Citizen Dialogue," only one paper from the first ten results was identified that deals with the topic of participation in politics via VR, albeit from a purely theoretical perspective (Porwol & Ojo, 2018). Expanding the search term to "Virtual Reality in Politics" yielded another paper among the first ten results, which provides a theoretical overview of AR/VR tools in art and politics (Modena et al., 2021). For the international context, a paper was found on the use of VR in humanitarian communication in Syrian refugee camps (Irom, 2018). To further refine the search in connection with the Metaverse and civic participation, the term "metaverse civic participation" was searched. This search revealed a master's thesis by Prince Anim titled "Exploring the Citizen Engagement Metaverse: Testing Virtual Reality for Citizen Feedback on Public Space Design Options." (Anim, 2022) This study has been conducted in a lab setting with citizens and officials. It compares the advantages and challenges of using VR to traditional methods. The search via Web of Science with the search terms "metaverse AND town-hall AND meeting," "metaverse AND public AND participation," and "metaverse AND civic AND participation" yielded only five results, which were thematically irrelevant as they pertained to urban development, entrepreneurship, and political history. A research gap can be identified from the current state of scientific literature, as no study has examined the application of Metaverse technology to civic participation in a real, non-simulative municipal context, i.e., in a field experiment.

This study leverages the UTAUT model to examine whether citizens accept virtual reality as a technology for interactive municipal events. For this purpose, it is beneficial to discover their attitude not in a simulative environment but during an actual citizen participation event, i.e., a virtual town hall meeting. Thus, this paper aims to analyze the acceptance criteria and potentials of using virtual reality in municipal events within a field experiment conducted in a German city in May 2024.

Therefore, this paper asks the following Research questions:

RQ1: Do citizens accept VR technology for citizen participation events?

RQ2: Does the use of VR positively affect citizen participation in municipal political issues?

The study extends the research on Metaverse applications in politics, specifically municipal politics. Results from a field experiment are presented, which involved citizens discussing actual topics of interest with city administration officials in a Metaverse-based, virtual town hall meeting.

The remaining paper is structured as follows: Section 2 presents the paper's theoretical Background. Section 3 explains the methodology and experimental setup. Section 4 presents the results, while Section 5 concludes the paper by discussing results, limitations, and future outlook.

2. Theoretical Background

This study is rooted in different theoretical tenets, which are explained below.

Since Kurt Lewin coined the term action research in the 1930s (Johnson, 2020), the method has been applied successfully to various research domains, including information systems (R. L. Baskerville, 1999). The main characteristics of action research are introducing change to the subject of study and the subjects' involvement. Typically, a two-staged iterative process is applied, with a first diagnostic or analysis stage followed by a second stage introducing change and studying the effects (Baskerville & Myers, 2004). In their 1998 publication “Diversity in information systems action research methods,” Baskerville and Wood-Harper emphasize that action research comprises a variety of forms and overlaps with field experiments and design research (R. Baskerville & Wood-Harper, 1998).

In the area of information systems, various theories are available modeling how users come to accept and use technology (Lai, 2017). The technology acceptance model (TAM) assumes two external variables to ultimately impact individuals' intentions and willingness to accept "computing technologies": Perceived Usefulness (PU) and Perceived Ease of Use (PEU). PU refers to the user's belief that using a particular system will enhance their performance, while Perceived Ease of Use pertains to the extent to

which the user expects the system to be effortless (Davis, 1989). The TAM2 model extended the TAM theory, introducing the aspects of social influence (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, and result demonstrability) (Venkatesh & Davis, 2000). In 2003, again, Davis, Venkatesh, and other co-authors formulated the unified theory of acceptance and use of technology (UTAUT) and published a corresponding model. It is based on the following four determinants of behavioral intention and use behavior: performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). TAM, TAM2, and UTAUT have already been applied to studying acceptance of augmented and virtual reality technology in various applications (Banerjee & Walunj, 2019; Bertrand & Bouchard, 2008; Ustun et al., 2023).

3. Methodology

The event of the so-called "Virtual Citizens Dialogue," which is unique, at least in Germany by now, was initiated by the municipality of Aalen, a city in southern Germany, in collaboration with the German IT company Bechtle AG (conceptional planning and event moderation) as well as Arthur Technologies GmbH (development and implementation of the virtual reality technology during the event). According to Aalen's mayor, the aim of the "Virtual Citizen Dialogue" was to apply technological innovation to municipal politics and citizen participation, especially to motivate the participation of younger generations growing up in digital environments such as virtual reality and to cultivate an interest in political discourse through the adoption of innovative technology. Amongst others, he sees advantages in incorporating citizens in the decision-making phase of construction projects and information updates via 3D images (Dambacher, 2024).

This field experiment, involving actual citizens discussing actual topics of interest with city administration officials, was leveraged to research participants' acceptance of VR technology in the context of citizen participation. Due to the voluntary character of the event, participants have not been recruited actively. The city of Aalen published invitations two weeks before each event in the local newspaper and social media accounts.

3.1 Experimental Setup

A series of preparatory informational sessions was conducted before the event to adequately prepare citizens for the participation event within the virtual environment. The topics of these sessions included conveying a foundational comprehension of the Metaverse to the participants and facilitating hands-on experience with VR headsets to mitigate any technical discomfort.

The sequence of the field experiment is depicted in Figure 1.

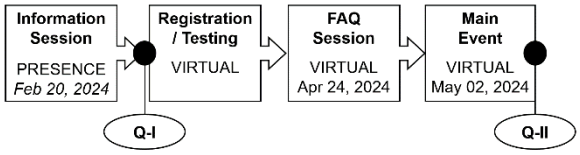

Figure 1: Process Schedule of "Virtual Citizens Dialogue"

The information session was conducted at Aalen University as an in-person event, encompassing topics pertinent to municipal politics, smart cities, and the Metaverse. Participants did not need to register or sign up prior to the event. They learnt about the Metaverse concept and had the opportunity to experience virtual environments using VR headsets and laptops. After the information session, attendees were solicited to complete questionnaire 1 (Q-I). In the following, citizens were invited to register for the main virtual event within two months and to preliminarily explore the virtual spaces on their personal computing devices or via VR headsets provided by the municipality of Aalen. Questions could be addressed during an FAQ session in the virtual environment conducted one week prior to the main event. The main event in the virtual environment took place on May 2, 2024, and spanned approximately 1.5 hours. After the main event, questionnaire 2 (Q-II) was disseminated to the participants, requesting completion.

3.2 Virtual Event Location

The main event was hosted within two virtual spaces, which Arthur Technologies GmbH provisioned.

The larger main room featured an entrance area adorned with images and information about the city of Aalen and an information booth detailing the scientific field experiment. Green arrows on the floor directed citizens toward the auditorium (see Figure 2), where presentations and discussions occurred with the mayor and other officials. An integral part of the event was presenting a new swimming pool, currently under

construction. Consequently, citizens could transition to a second virtual space by clicking a button located at the rear of the auditorium. This space was designed in a lounge style and showcased images of the current construction phase and a video of the 3D model of the completed swimming pool. Avatars representing the citizens could move and converse freely within the spaces before, during, and after the event without restrictions such as automatic muting during presentations or speaking phases.

Figure 2: Auditorium of Virtual Citizens Dialogue

3.3 Questionnaire Design

The primary focus of this field study is to assess the acceptance of VR technology in the context of municipal-political events. To this end, appropriate questionnaires were developed and subsequently analyzed quantitatively and qualitatively.

The questionnaires Q-I (after the information session) and Q-II (after the main event) were based on the UTAUT model, which has been introduced in Section 2. They comprised four parts each and were analyzed both qualitatively and quantitatively. Both had the same structure with slightly different questions in the four parts:

1) General information about the respondent (e.g., age, location, gender)
2) Experiences with virtual reality (e.g., usage behavior)
3) Questions related to UTAUT to explore participants' acceptance and willingness to use VR in a municipal-political context
4) Feedback via free text space

In order to encourage participants to fully engage with the questionnaires and respond to all questions, the questionnaires were visually appealing, reflecting the event's design. Parts 1 and 2 constitute the initial part of the questionnaire, with closed questions featuring a mix of single and multiple-choice items. The aim is to "get to know" the participants through personal and interest-related questions (e.g., "Had you encountered virtual reality/immersive technologies through gaming, etc., prior to this event?") (Taherdoost, 2022). The main body, i.e., part 3 of the questionnaire, consists of items structured and content-wise according to UTAUT in a matrix style, which is cognitively more demanding for participants than the initial questions (Taherdoost, 2022).

Table 1 shows the questions the participants were asked to answer in part 3.

Table 1: UTAUT-Questions

Block	ID	UTAUT-Questions *(*prospective Questions in Q-I)*
Block A *Performance Expectancy*	PE1	The utilization of VR will enhance* / has enhanced my understanding of municipal political issues.
	PE2	Facilitating citizen dialogues within virtual environments will simplify* / has simplified my active participation in municipal politics.
	PE3	Using VR in the "Citizen Dialogue" will quicken* / has quickened my comprehension of the topics.
Block B *Effort Expectancy*	EE1	Learning to use VR will be* / was easy for me.
	EE2	The adoption of VR will not* / did not require additional efforts on my part.
	EE3	Interacting within the virtual space will be* / was straightforward for me.
Block C *Social Influence*	SI1	My friends and colleagues also engage with VR technologies.
	SI2	My friends and colleagues recommend using VR.
	SI3	My interest in utilizing VR was sparked by the availability of the "Citizen Dialogue" in a virtual environment.
Block D *Facilitating Conditions*	FC1	I will have* / had access to the necessary resources (Laptop, VR Headset, etc.) to participate in the "Virtual Citizen Dialogue."
	FC2	I will independently test* / independently tested the technical solution prior to the event.
	FC3	Technical support will be* / was provided by the event organizers in case I encounter* / encountered any issues with VR usage.
Block E *Behavioural Intention*	BI1	The immersive experience in the "Virtual Citizen Dialogue" met or exceeded my expectations.
	BI2	I intend to use VR for future citizen dialogues.
	BI3	I would be more inclined to attend municipal political events if similar immersive technologies were employed.

The questionnaire for the information session (Q-I) included blocks A-D, as these can be posed in a prospective form (e.g., "will help"). The questionnaire connecting to the main event (Q-II) was distributed to the participants after the main event and included all five blocks of questions. These feature single-choice items rated on a 5-point Likert scale (ranging from

"strongly disagree" to "strongly agree"). In formulating the questions, negations were avoided as they are cognitively more challenging for participants to process (Acharya, 2010). Moreover, by asking several questions (three per block) on similar topics, efforts were made to avoid inconsistency effects (Brosius et al., 2016).

The questionnaires conclude with open-ended questions in part 4, which require the most time for participants to respond and are the most labor-intensive to analyze. Hence, the number of such questions was limited to a maximum of two per questionnaire (Aithal & Aithal, 2020). The questions are kept simple and easy to answer, serving as optional, individual feedback on the respective event from the participants. Overall, simple language was employed without unexplained technical terms, as this field study involved a heterogeneous group of participants, where all participants needed to understand and respond to the questions to the same extent (Acharya, 2010). The surveys were conducted anonymously in both instances.

Q-I and Q-II differ in their respective question domains as follows:

- Parts 1 & 2: An expansion in Q-II includes the questions "How did you attend the event (VR headset or laptop)?" and "Did you attend the Info Session?"
- Part 3: Q-I encompasses only question blocks A-D, which represent predictive factors and are characterized by prospective questions. In Q-II, the same questions were posed in the past tense. Additionally, Q-II was expanded with question block E (Behavioral Intention) to measure the fulfillment of expectations and the intent to use VR.
- Part 4: The concluding questions in both surveys are slightly different but consist of open-ended questions soliciting participants' suggestions and feedback.

Since the information session took place in person, participants could complete Q-I either on paper or online on the same day without additional processing time. Following the virtual main event, Q-II was offered exclusively online and distributed via email with a one-week completion deadline set.

4. Results

This paper presents a descriptive analysis of the data only. This is due to the short time between the field experiment, with surveys completed only by mid-May 2024, and the submission of this paper. Further statistical analysis, specifically of the UTAUT-related parts, will be conducted in the future.

The return of completed surveys after the information session (Q-I) amounted to 37 responses, and after the main event (Q-II) to 18 responses. The response rate for the information session cannot be precisely calculated, as the number of participants during the on-site event was not recorded. Of the 60 citizens who had registered for the main event, 48 actually took part, meaning that 18 completed questionnaires correspond to a response rate of 37.5 % for Q-II.

The surveys revealed missing values, with an average of two unanswered questions per incomplete dataset. Table 2 shows the number of incomplete datasets after the entry (parts 1 and 2) and the central part (part 3) of the survey.

Table 2: Complete and incomplete responses to questionnaire parts

Values	Number of Responses Q-I	Number of Responses Q-II
Complete P.1/2	*25*	*17*
Incomplete P.1/2	*12*	*1*
Complete P.3: UTAUT	*33*	*13*
Incomplete P.3: UTAUT	*4*	*5*

Data harmonization is not required in the analysis as parts 1 to 3, except for the question regarding participants' age, were posed as closed questions (Plaue, 2021). No patterns suggesting systematic non-response by participants are evident. Hence, the unique sample size n will be provided for tables and charts in the subsequent data analyses.

4.1 Demographic Data

Table 3 comprises the distribution of demographic characteristics of the participants of the information session and the main event based on the number of responses.

In both events, more males participated in the questionnaire than females, and most (73%) participants lived in the city or near Aalen. This can be attributed to the "Virtual Citizen Dialogue" being exclusively promoted in Aalen and addressing city-specific issues. Notably, a significantly higher proportion of information session participants (68%) had previously attended a political event compared to main event participants (39%). This may indicate an increased interest in local political events by giving the opportunity to use VR. This hypothesis is examined in more detail in Section 4.3.

The demographic analysis reveals a notable difference in the age group distribution between Q-I

and Q-II. The age group of 20-39 years comprises the largest segment, with 40% in Q-I, but the smallest at 11% in Q-II. Conversely, the proportion of participants aged 40-59 years increases from 30% to over 60% in the main event. The share of participants aged 60-80 years remains relatively constant. These findings are also reflected in the calculation of the median and arithmetic mean. The median age in Q-I is 44 years, while in Q-II, it rises by 11.5 years to 55.5 years. Similarly, the arithmetic mean for Q-I is 45.6 years, and for Q-II, 53.5 years, indicating a difference of 7.9 years. Interestingly, the overall range of age data is nearly identical, spanning from a minimum of 23 years in Q-I to 21 years in Q-II, with the oldest participant being 75 years in Q-I and 74 years in Q-II.

Table 3: Demographic Data Overview

	Q-I		Q-II		Total	
	Resp.	%	Resp.	%	Resp.	%
Gender	***n = 37***		***n = 18***		***n = 55***	
Female	14	38%	7	39%	21	38%
Male	23	62%	11	61%	34	62%
Age Group	***n = 27***		***n = 18***		***n = 45***	
20-39	11	40%	2	11%	13	29%
40-59	8	30%	11	61%	19	42%
60-80	8	30%	5	28%	13	29%
Living in Aalen	***n = 37***		***n = 18***		***n = 55***	
Yes	27	73%	13	72%	40	73%
No	10	27%	5	28%	15	27%
Prior attendance in political events	***n = 37***		***n = 18***		***n = 55***	
Yes	25	68%	7	39%	32	58%
No	12	32%	11	61%	23	42%

4.2 VR Background Information

Participants were asked whether they had previously encountered VR and how frequently they used it to analyze their prior interaction with VR. Many citizens completed Q-I directly after the information session, where they had the opportunity to test the virtual space using both the provided VR headsets and laptops. Therefore, it is unclear whether participants would have responded differently to questions about prior interaction and frequency of VR usage if they had not had the opportunity to test it on-site that day. Hence, only the feedback from the main event will be analyzed subsequently.

82% of the main event participants reported not having attended the information session. This means that the information session largely did not influence the response to whether participants had prior contact with VR. In Q-II, 44% of participants indicated they had not encountered VR before the event, meaning nearly half of the participants had no prior experience with VR before the "Virtual Citizen Dialogue," which indicates that the results about the acceptance of VR are primarily unbiased. The frequency of VR usage, as depicted in Figure 3, also reflects that citizens have limited experience with VR. Merely 2 use VR regularly, while most never use VR or do so less than once a month.

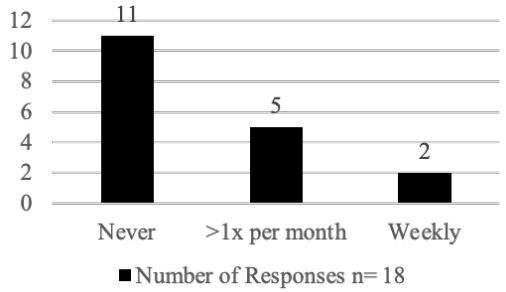

Figure 3: Frequency of prior interaction with VR

These facts are particularly relevant for the subsequent evaluations of the UTAUT section, to explore the extent to which a positive perception of VR in relation to local political events has been formed among participants without prior VR experience.

4.3 UTAUT-Analysis Q-II

Part 3 (UTAUT) of the main event's Q-II is analyzed to address the research questions regarding VR's acceptance in the context of local political events and its influence on such events. The Q-I from the information session is not suitable for this purpose due to the prospective nature of questions in blocks A-D and the absence of block E. Nevertheless, in Section 4.5, feedback from Q-I and Q-II is compared and interpreted.

Table 4 presents an overview of the Q-II questions in the blocks "Performance Expectancy," "Effort Expectancy," "Social Influence," "Facilitating Conditions," and "Behavioral Intention," with a calculation of mean and median values for both, individual questions and for each block. The overall results of each block are color-coded in shades of green. The intensity of the green color increases from a weak hue at 1 ("disagree") to a stronger hue as the value approaches 5 ("agree fully").

Overall, the table presents a positive picture, as all values, except for Social Influence, are above the neutral value of "3." It is also evident that the median and mean values do not deviate strongly. If the median

and mean are equal, this indicates a symmetrical data distribution (Hippel, 2011). The data distributions for PE and SI are slightly left skewed, while EE and FC exhibit slight right skewness. Only BI is symmetrical, indicating a normal distribution. Due to the minor skewness, it was decided that the subsequent descriptive analysis in this paper should continue working with the mean, as it is not expected to distort the results.

Table 4: UTAUT results for Q-II

Block	ID	Mean	Median
Block A *Performance Expectancy*	PE1	3,12	3
	PE2	3,71	4
	PE3	2,94	3
	PE total	*3,25*	*3*
Block B *Effort Expectancy*	EE1	3,65	4
	EE2	3,53	4
	EE3	3,39	4
	EE total	*3,52*	*4*
Block C *Social Influence*	SI1	2,18	2
	SI2	1,88	1
	SI3	2,94	3
	SI total	*2,33*	*2*
Block D *Facilitating Conditions*	FC1	4,53	5
	FC2	4,29	5
	FC3	4,33	5
	FC total	*4,39*	*5*
Block E *Behavioral Intention*	BI1	3,65	4
	BI2	4,12	4
	BI3	4,24	5
	BI total	*4,00*	*4*

The following main statements can be made based on these results:

A) *Performance Expectancy:* Participants, on average, did not experience a deterioration but rather a slight improvement in performance using VR (PE total > 3 "neutral"). Notably, PE3 was rated lower with a value of 2.94, indicating that participants felt VR did not help them understand political topics more quickly.

B) *Effort Expectancy:* An average value of 3.52 suggests that VR was perceived as relatively easy to learn and did not require significant participant effort.

C) Social Influence: The participants' friends and acquaintances do not use and, accordingly, do not recommend VR, which is not unusual for a new technology in the political environment. Therefore, social influence might not be a facilitating factor in the acceptance of VR.

D) *Facilitating Conditions:* The highest average value of the table shows that the technical conditions and perceived support from the organizers in case of technical issues during the use of VR were seen positively.

E) *Behavioral Intention:* A value of 4.00 indicates that citizens' expectations of having a positive experience with VR at such an event were met or exceeded. Noteworthy is the value of 4.24 for BI3, which means that participants would be more likely to attend local political events if they took place in a virtual environment.

Due to the high difference in the number of responses in the age groups, it is useful to examine the mean values within these groups in more detail. The corresponding data are presented in Table 5.

Table 5: UTAUT Mean values by age groups (Q-II)

Block	20-39 years	40-59 years	60-80 years
A: PE total	3,00	3,15	3,67
B: EE total	4,00	3,56	3,27
C: SI total	3,33	2,18	2,15
D: FC total	5,00	4,42	4,13
E: BI total	5,00	3,79	4,27

Certain peculiarities within the individual age groups emerge in the analysis: The perceived performance enhancement through VR is rated higher with increasing age. Conversely, it is observed that the age group of 20-39 years rates the effort or the difficulty of learning VR as easier than the other two groups. This can be partly attributed to the fact that this age group is more accustomed to new digital technologies, having grown up with them, compared to older cohorts (Tilvawala et al., 2013). This is also consistent with the use and recommendations of family and friends of the participants, which are almost equally low in the 40-59- and 60-80-year age groups. Additionally, it is noted that the 20–39-year-olds were more satisfied with the technical conditions than the other two groups, although the values for all groups are in a very positive range (>4). The fulfillment of expectations is rated positively by the 40–59-year-olds with a value of 3.79. However, this value is significantly lower than for the other two age groups. It must be mentioned that this group also constitutes the highest proportion of participants, and a large part of them participated using laptops rather than VR headsets.

4.4 Comparison of Laptop vs. VR-Headset

Half of the feedback from the free-text part of the Questionnaire was positive feedback and curiosity about similar upcoming events. At the same time, six out of the 12 answers repeatedly indicated that citizens who entered the virtual space via laptop experienced more technical problems, particularly with the audio connection. These participants could not follow the event at times, as they could neither understand the speakers nor exchange with other citizens. Additionally, it was technically not possible at the time of the event to offer spatial audio for laptop users, as the project manager at Arthur Technologies GmbH explained. Thus, VR headset users heard people standing further away more quietly and those standing closer louder. Laptop users, however, heard all voices at the same volume, which led to additional significant background noise. Furthermore, the operation of the technology for laptop participants differs from that for VR headset users, as avatars are moved via keyboard rather than joysticks. Due to these differences, Table 6 compares the UTAUT responses to Q-II of participants with and without VR headsets.

Table 6: UTAUT Results group by device

Block	ID	Laptop n=12	Headset n=6	Delta Headset to Laptop
Block A *Performance Expectancy*	PE1	2,82	3,67	0,85
	PE2	3,45	4,17	0,71
	PE3	2,73	3,33	0,61
	PE total	**3,00**	**3,72**	**0,72**
Block B *Effort Expectancy*	EE1	3,64	3,67	0,03
	EE2	3,64	3,33	-0,30
	EE3	3,42	3,33	-0,08
	EE total	**3,56**	**3,44**	**-0,12**
Block C *Social Influence*	SI1	2,36	1,83	*irr.*
	SI2	2,18	1,33	*irr.*
	SI3	3,09	2,67	*irr.*
	SI total	**2,55**	**1,94**	***irr.***
Block D *Facilitating Conditions*	FC1	4,64	4,33	-0,30
	FC2	4,73	3,50	-1,23
	FC3	4,11	4,67	0,56
	FC total	**4,49**	**4,17**	**-0,32**
Block E *Behavioural Intention*	BI1	3,27	4,33	1,06
	BI2	3,82	4,67	0,85
	BI3	4,00	4,67	0,67
	BI total	**3,70**	**4,56**	**0,86**

The following differences are noticeable:

A) Laptop participants perceived VR as neither an improvement nor a deterioration. In contrast, headset participants noted a significant improvement (+0.72) in understanding and especially active participation in local political events.

B) There are no fundamental differences in the ease of learning and interacting with VR; however, headset participants rated the effort level of using VR as worse (-0.3) than laptop users, thus making the use of VR with a headset more strenuous.

C) The social influence of friends and acquaintances is irrelevant in this comparison and is therefore not further interpreted.

D) The VR headset group rated the technical resources, especially the pre-event testing, lower. This is mainly because the VR headsets were loaned devices and distributed to participants only shortly before the event.

E) Expectations were met in both groups, but VR headset users perceived the immersive experience much more positively (+1.06) than laptop users. This is similarly reflected in a higher degree in BI2 and BI3.

In summary, compared to laptop users, the potential for acceptance and positive notation are significantly higher among users who participated via VR headset despite a slightly increased level of effort.

4.5 Comparison of Q-I and Q-II Answers

Both events, the information session, and the main event, took place in a real-world setting, and thus, the participants of both response groups for Q-I and Q-II were not identical. Nevertheless, it is still possible to make general statements about the expectations towards the VR application for local political events compared to the actual experience. This discussion only pertains to blocks A-D, as block E was solely part of Q-II. This section does not provide absolute comparative values but rather trends to avoid statistical misstatements. "Performance Expectancy" and "Effort Expectancy" were lower among the main event participants than expected/predicted by the information session participants. The influence of friends and acquaintances was similarly rated in both groups, thus showing a minor (positive) influence on the intention to use VR. Surprisingly, despite technical issues experienced by laptop users, the "Facilitating Conditions" were rated more positively at the main event than expected during the information session.

5. Discussion

As explained in Section 3.1, the time between the availability of responses to questionnaire Q-II and the submission of this paper was very limited. For this reason, only descriptive analysis is presented. The first inferential statistical analyses show a strong positive correlational effect of performance expectancy, while the other predictors only show minor dependencies.

Referring to the descriptive analysis, a unique contribution is made as solid indications have been

found to answer the research questions posed in Section 1, based on data from a field experiment involving citizens discussing actual political topics with municipality officials in a virtual environment.

In summary, the results show that only a few participants had regular contact with VR before the events. Therefore, the UTAUT feedback can be considered unbiased, which is particularly relevant regarding the positive assessment of "Effort Expectancy." Differences were identified between age groups. Notably, the positive perception of the experience by the 60-80-year-old group stood out. The results of the laptop user group compared to the VR headset user group differ greatly, especially in "Performance Expectancy" and "Behavioral Intention." A higher potential for acceptance of VR in local political events is evident among the VR headset group. Finally, the following insights regarding the research questions have been gained:

RQ1: It can be confirmed that VR technology is accepted in citizen dialogues or similar event formats.

RQ2: It can also be said, based on the underlying dataset, that VR application has a positive influence on citizens' motivation to participate in municipal political events.

Thus, the application of VR in citizen participation has a high potential for success in cities that wish to address local political issues with technological innovation.

This study is based on a field experiment in a real-world setting. As such, it was influenced by many uncontrollable factors, such as the individual device equipment or internet connectivity of participants, general technology affinity, or the unpredictability of participation itself. The free-text feedback from the questionnaire repeatedly pointed out technical problems, particularly among laptop users. Future events should, therefore, pay more attention to the reliability of technical solutions, as technical issues, as described in the analysis, have a substantial impact on the acceptance of VR by the respective user group. Furthermore, due to the experimental setup, individual employees of the involved partners might have answered questionnaires, too. This might have an influence, too, which should be avoided in future experimental setups. It would be reasonable to encourage more event participants to complete the questionnaires to increase the sample size. This could be accomplished through more vigorous appeals and direct contact with participants, for example. Offering only an online questionnaire version is also beneficial, as it simplifies data analysis. Looking forward to the inferential statistical analyses, a pretest of the questionnaire is highly recommended prior to the main event to adjust the items if needed.

Despite these limitations, this study is useful and valuable in measuring the acceptance of VR in a local political context. It indicates that applying the Metaverse in a citizen participation context is practical and beneficial. It provides valuable insights for practitioners and researchers but also requires further adjustment in the methodology and more advanced investigation. Future studies should examine applications in adjacent political environments, such as participatory events on state or national levels and with larger groups of participants.

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