

## User experience assessment of a COVID-19 tracking mobile application (AMAN) in Jordan

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### ABSTRACT

This study assesses the user experience of a COVID-19 tracking application, as employed as a case study of AMAN mobile application based on user experience. This paper proposed an assessment of user experience (UX) for AMAN application (COVID-19 tracking mobile application in Jordan) by implementing a user experience questionnaire tool. The study aims to get feedback and identify UX based on user interaction and usage with the tracking application. The data are taken from 1208 participants who have experience using the application; an online questionnaire was implemented and distributed through social media groups. The research method that was adopted used the instrument from user experience questionnaire (UEQ) of Arabic and English versions. The results from the UX assessment using UEQ showed that there are four scales which are categorized as excellent; they are Attractiveness (Mean=1.9), Efficiency (Mean=2.4), Dependability (Mean=2.1), Stimulation (Mean=1.8), while the two scales on the benchmark of good are Perspicuity (Mean=2.0) and Novelty (Mean=1.6). From the scores, above < 0.8 show a positive evaluation. All scores are above >0,08 indicating that the evaluation of UX has a positive impression. It can be concluded that the AMAN application is very good – satisfying users to track infected cases of COVID 19.

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## 1. INTRODUCTION

COVID-19 is an epidemic disease that emerged between late 2019 and early 2020 in China [1]. At the time of writing, it has infected more than 89 million people and caused over a million and a half deaths worldwide [2]. This new outbreak has forced governments to take measures to contain the epidemic, such as social distancing and quarantining [3], [4]. Among these measures, isolation and contact identification, (contact tracing) are of prime importance, as they can help to contain or control an outbreak for a longer period of time [5]. In the early days of an outbreak, with few cases, contacts could be tracked manually, while case growth made it more difficult [6]. For these reasons, several proposals have been made to automate contact tracing [7], [8], using mobile Bluetooth connectivity or GPS location history for tracking.

Mobile technology has been leveraged in a number of ways to control the spread of COVID-19. In order to contain the steady increase in the number of infected people, the Jordanian government invited people to install the (AMAN) mobile application, which uses geo-location services to track people who have been in contact with infected people. The goal of the AMAN application is to help health services authorities

predict the spread map of COVID-19 supporting the overall goal of flattening the curve, slowing and preventing the spread of COVID-19. However, according to the Health Minister [9], lack of awareness and difficult application interaction design are the main reasons preventing citizens from using AMAN. Contact tracing applications are self-service products. There is no instruction manual to read ahead of time, no training seminar to join, and no user service representative to assist the user in using the application [10]. There is only the user, who is alone on the application, relying solely on his wits and personal experience to guide him when people have difficulty using complicated technology; they blame themselves [11]. They believe they must have done something incorrectly and not pay enough attention. They feel stupid. If you intend to drive people away from your application, make them feel stupid when they use it. Hence, bad user experience leads to abandonment [11]. Thus, assessing user experience is a key part of developing a successful application and can be leveraged to improve adoption and usage over time. The existence of technology without a good user's impression will discourage others from using or adopting this technology. Therefore, the purpose of this study was to investigate the user experience of the COVID 19 tracking application (AMAN as a case study) amongst the general public and to identify any potential issues, areas for improvement and further design considerations.

UX can be assessed by questionnaire method. There are a number of such questionnaires [11]. For example, in [12], [13], questionnaires relating to pure usability aspects are defined. In their research [14], [15], questionnaires covering the broader aspect of UX are described. There are different scales in every questionnaire to cover and measure UX aspects groups. Therefore, choosing the best fitted questionnaire depends on the goal of the research study and the UX aspects needed to be measured. This study, contributes to UX field by introducing UX measurement as a first proposed work that investigates the UX of AMAN application in Jordan. We adopted UEQ [13] and its extensions [14] to quantify UX measurement for alerting and tracking mobile application notifying users who have been exposed to any diagnosed patient with COVID-19 (AMAN application) as a case study.

## 2. RESEARCH METHOD

### 2.1. AMAN mobile application

After the formal declaration that SARS-CoV-2 is a global pandemic, tremendous effort by countries has been made to control its fast-paced spreading. Thus, a wide range of contact tracing projects, approaches and applications have been suggested by government and the private sector such as TraceTogether [15], CoroTrac [16], Pandoa [17], AMAN [18] and many more that can be found in the global report [19]-[21]. These apps alert previously exposed individuals and authorities automatically after an infected person is identified in order to safeguard the humans' health. In order to assess user experience using COVID tracker apps in Ireland, [21] have conducted a mixed qualitative approach that relies on cognitive interviews, and focus groups besides questionnaires. Some issues have been raised such as the logo needing to be distinctive and the necessity of symptom check-in reminders. Yet, the main concern was the Bluetooth contact tracing function.

There are two interrelated levels in which AMAN works. Firstly, it functions by exclusively tracking the user's location data saved on their dedicated device, while also examining and comparing movements of those who have been recognized by the Ministry of Health as COVID infected individuals. Once the location of any user overlaps with the location of those infected, AMAN signals its users informing them of a possible exposure as well as displaying instructions on self-isolation and notifying authorities. Secondly, once a user has been diagnosed with the virus, AMAN provides the ability to retrace the user's movements in the past two weeks before their diagnosis. This adds accessibility to crucial information such as the places in which the diagnosed patient previously visited, as well as the precise dates and times in which the visits occurred; notifying all other users that overlapped within the same location. This feature provides authorities with a more efficient and effective manner of controlling the spread of the virus.

This study focuses on UX assessment and, specifically on the evaluation of the AMAN mobile application. The application is based on a geo-reference technology which provides the ability to retrace the movement of all users' (contacts of infected cases) in the past 14 days before their diagnosis, allowing easy accessibility to information such as time and location. AMAN app is an exposure detection app that notifies users if they have been in contact with any infectious user carrying COVID-19, increasing awareness and preventing the spread of the disease in a more effective manner by instantly informing all exposed contacts of the possibility of being infected once their location overlaps with any infected individual, giving users the opportunity to take all the right precautions in a timely manner. A large portion of COVID 19 cases have been caused through face-to-face interactions due to the droplets that travel through the air in a proximity of 2 meters. Thus, "contacts" are individuals who have been exposed to COVID 19 through a physical interaction of approximately 2 meters. AMAN application informs users about their contact with COVID-19 infected people. Thus, it is widely used in Jordan with more than 2 million of downloads [18].

## 2.1. User experience

In this section, it is explained the results of research and at the same time is given the comprehensive discussion. Results can be presented in figures, graphs, tables and others that make the reader understand easily [11]-[15]. The discussion can be made in several sub-chapters. User experience includes all aspects of user interaction with a software product or service [22], [23]. UX has a subjective nature since it deals with the individual's perception and thoughts [6]. Introducing a good UX is critical to the success and acceptance of an application, taking into account that a user may be interested in reusing the application frequently. Generally, users may have good awareness of an application's capability to meet their demands and expectations based on a first impression [24], but UX will surely adjust any current perceptions of application usefulness and impact the affirmation of their first expectations [25], [26]. Thus, the positive evaluation result towards the UX of AMAN application will directly encourage people to adopt and use the application and this will contribute indirectly in disease quarantine.

User experience can be influenced by two main concepts: the pragmatic quality, concerned with specific task execution and the hedonic quality, concerned with the substantial values of each user and their personal perceptions [27]. Based on the perceptions of these qualities during the user interaction, users can form their impression. The combination of these qualities leads to positive or negative impression and consequently leads to the acceptance of an application [28].

All UX aspects can act as mediators to excite user's sensation about software product. User contentment is subjective and relies on user's needs and experiences. [15], [16] proposed a user experience questionnaire (UEQ) which resulted in the construction of a 26 item questionnaire including six factors: attractiveness, classical usability aspects (efficiency, perspicuity, dependability) and user experience aspects (novelty, stimulation). [26] in their systematic literature review, found that UX assessments are linked to three factors; user, task of interaction with software, and the context of use. These three factors help to empower and enhance the relationship between user and software[27], [28]. They also mentioned some other factors in their review: privacy, emotional attitude, functionality, service time, and design attractiveness.

## 3. METHODOLOGY AND MATERIALS

UX assessment test in this study involved the use of a user experience questionnaire (UEQ) disseminated online to participants via social media groups, professional networks platforms and students groups the questionnaire is available in both Arabic and English evaluated versions.

### 3.1. Experiment tool

Questionnaires are a widely used instrument for user-driven evaluation of the consistency and usability of software quality. They allow for an efficient assessment of product characteristics in quantitative terms. A very powerful way to get useful feedback from end-users is to allow them to evaluate what worries them most instantly: How did engagement with the product feel, how was the overall usage experience? This study adopted the user experience questionnaire (UEQ) constructed for user experience evaluation and developed by [13] and its extensions [14]. The UEQ questionnaire is available in English, Arabic and other languages [29]; the UEQ contains the scales attractiveness (six items), perspicuity, dependability, efficiency, novelty and stimulation (four items each) needed to fill out a survey consisting of 26 contrarian adjective pairs. All the participants were familiar in activating the application and its related requirements such as location via global positioning system (GPS) to efficiently track the user and record the locations that users visited or moved around.

The UEQ consist of 26 items distributed among 6 scales, the scales are the following; attractiveness indicating overall impression of the product. Do users like the product or hate it? Perspicuity: Is it easy to get acquainted with the product? Is it easy to learn how to make use of the product? Efficiency: can users solve their tasks without any excessive effort? Dependability: does the user feel in control of the interaction? Stimulation: Is the product exciting and motivating to use? Novelty: Is the product innovative and creative? Is the product in the interest of users? Figure 1 depicts the presumed scale structure of the UEQ and shows the items per scale.

The UEQ's items have the form of a semantic differential; every item is represented by two contradictory terms. Terms are randomly ordered per item, half of the items of the scale begin with the positive term and the other half begin with the negative term. UEQ uses a seven-stage scale to decrease the central tendency bias for the types of items. The items are scaled from -3 to +3. Accordingly, -3 denotes the most negative answer, 0 a neutral answer, and +3 the most positive answer as referred to Data Transformation in UEQ [29].

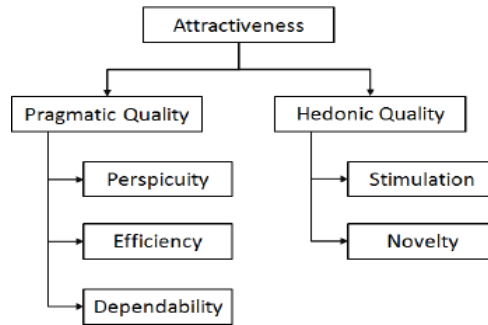


Figure 1. UEQ scale structure [29]

**3.2. Sample and sampling process**

A representative number of users have been hired to perform certain representative tasks on the application. The questionnaire was sent to AMAN page users on Facebook to be filled out online. Before filling the questionnaire, the participants have been asked to make sure they have downloaded the app and activated it. All the participants, must make sure they are connected to the internet and to walk through the app while evaluating it. Thus, 1208 AMAN users (703 males and 505 females) who came from different backgrounds participated in filling out the questionnaire. The participants are working in the public sector, private sector, housewives and citizens in general. All users had experienced with the application. The study was facilitated because the Jordanian government enforces all employees of the public sector to download the application, as well as citizens who visits governmental institutions, hospitals, and other governmental directorates must download the application according to DEFENSE LAWS. The sample also included students in universities and colleges. In general, the Defense Ministry encouraged downloading the application to all citizens. Thus, this compulsory dissemination eased the task of collecting data from citizens.

**4. RESULTS AND DISCUSSION**

The outcome of the usability assessment is as follows: Demographics, where gender distribution is shown in Table 1 and age distribution is demonstrated in Table 2. Table 1 result demonstrates that 58%, in other words 703 out of 1208 of the respondents were males, 42% were females. Among participant, Table 2 shows that (42.3%) had an age range between 20-30 which represents the highest majority since workers in public sectors and students fall within this group and it is mandatory for them to install AMAN app by their institutions. 324 (26.8%) had an age range between 31-40, 284 (25.5%) had an age range between 41-50 and 88 (7.4%) had an age range >51. With respect to participant’s occupation, 48.2% of them worked in the public sector, while 31.8% of the participants worked in the private sector and the remainder were housewives (11.7%) and others were unemployed (8.3%). In terms of education and qualifications background, 71% had a college degrees or higher level of education, and 26 % had high school certificates, while 3% had primary school certificates.

Table 1. Gender distribution

Gender	N=1205	Percentage
Male	703	58%
Female	505	42%
Total	1208	100%

Table 2. Age distribution

Age	20-30	31-40	41-50	>51
Subtotal	512	324	284	88
Percentage	42.3%	26.8%	23.5%	7.4%

**4.1. AMAN UX assessment**

The UX assessment of AMAN application includes 26 items categorized under six scales as shown in the Table 3. The Table 3 contains the scaled items against each structure clarifying the standard deviation, variance, and mean for each item. It is apparent that no item has a negative mean and that all items in this scale have a high positive mean. This shows that in this sense, there is no problem with this item in this context. Table 4 shows the mean for the three groups of UEQ category.

Table 3. UEQ scale structure

Item	Scale	Right	Left	No.	Std.	Variance	Mean
1	Attractiveness	Enjoyable	Annoying	1208	1.3	1.6	2.0
2	Perspiciuity	Understandable	Not understandable	1208	1.3	1.8	1.8
3	Novelty	Dull	Creative	1208	1.6	2.5	2.1
4	Perspiciuity	Difficult to learn	Easy to learn	1208	1.7	2.9	2.2
5	Stimulation	Inferior	Valuable	1208	1.5	2.1	2.4
6	Stimulation	Exciting	Boring	1208	1.3	1.7	1.6
7	Stimulation	Interesting	Not interesting	1208	1.4	1.9	1.5
8	Dependability	Predictable	Unpredictable	1208	1.3	1.8	2.3
9	Efficiency	Slow	Fast	1208	1.4	1.9	2.6
10	Novelty	Conventional	Inventive	1208	1.6	2.4	1.3
11	Dependability	Supportive	Obstructive	1208	1.4	1.9	2.1
12	Attractiveness	Bad	Good	1208	1.4	2.0	1.9
13	Perspiciuity	Easy	Complicated	1208	1.4	2.0	1.8
14	Attractiveness	Pleasing	Unlikable	1208	1.4	2.0	2.1
15	Novelty	Leading edge	Usual	1208	1.5	2.1	1.5
16	Attractiveness	Pleasant	Unpleasant	1208	1.4	1.9	1.7
17	Dependability	Not secure	Secure	1208	2.0	3.9	2.0
18	Stimulation	Demotivating	Motivating	1208	1.3	1.7	1.8
19	Dependability	Does not meet expectations	Meets expectations	1208	1.3	1.7	1.9
20	Efficiency	Efficient	Inefficient	1208	1.4	1.9	2.2
21	Perspiciuity	Confusing	Clear	1208	1.4	2.0	2.3
22	Efficiency	Practical	Impractical	1208	1.2	1.4	2.4
23	Efficiency	Cluttered	Organized	1208	1.6	2.5	2.3
24	Attractiveness	Unattractive	Attractive	1208	1.4	1.9	1.8
25	Attractiveness	Unfriendly	Friendly	1208	1.3	1.7	1.9
26	Novelty	Innovative	Conservative	1208	1.4	2.1	1.6

Table 4. AMAN UEQ quality dimensions

UEQ scale category	Mean
Attractiveness	1.9
Pragmatic Quality	2.1
Hedonic Quality	1.7

Seen from the table, each category of the scale has a mean, which is then makes known the scale category of the answer result for each item. Table 5 shows the 5% confidence intervals for the scale means. The confidence interval is a measure for the precision of the estimation of the scale mean which indicates for high score for relevant scales of UX. The smaller the confidence interval is, the higher the precision of the estimation and this, in turn, indicates the reliability of the results. Table 5 shows that 80% of participants to some extent agreed that the AMAN application was efficient to use whereas 53.3% of them to some extent agreed with the novelty of application. Participants agreed with the dependability (70%), perspicuity (66.6%) and stimulation (60%). UEQ scale was grouped into pragmatic quality dimension to involve perspicuity, efficiency and dependability. The hedonic quality dimension was grouped to include stimulation and novelty. Consequently, the attractiveness is identified as individual parity dimension.

Table 5. Confidence intervals for UX scales means

Scale	Mean	Confidence intervals (p=0.05) per scale			
		Std. Dev.	Percentage	Confidence	Confidence interval
Attractiveness	1.9	1.143	63.3%	0.064	1.836 1.964
Perspiciuity	2	1.138	66.6%	0.064	1.936 2.064
Efficiency	2.4	1.048	80.0%	0.059	2.341 2.459
Dependability	2.1	0.908	70.0%	0.051	2.049 2.151
Stimulation	1.8	1.061	60.0%	0.060	1.740 1.860
Novelty	1.6	1.079	53.3%	0.061	1.539 1.661

#### 4.2. AMAN UX comparison to benchmark

Schrepp [29] constructed UEQ benchmark data sets to includes data on 452 software product assessments using UEQ to calculate the score range of the AMAN application against software available in benchmark. Next, to calculate the score range of each scale, the benchmark was inserted on UEQ. A benchmark that already existed for UEQ determined the practical score range for the factors of UEQ from the evaluation result of UX of AMAN, thus it could be better estimated.

Figure 2 shows the chart of the mean values for UX scales. According to the diagram of benchmark result of UEQ, there are four scales that were categorized as excellent; the scales of Attractiveness

(Mean=1.9), Efficiency (Mean=2.4), Dependability (Mean=2.1), Stimulation (Mean=1.8), while two scales on the benchmark of good are Perspicuity (Mean=2.0) and Novelty (Mean=1.6). The impression mean score between -0.8 and 0.8 is consider as normal evaluation score, score > 0.8 is a positive evaluation and the scores <-0.8 are a negative evaluation. Then it can be concluded that the AMAN application is likely to have a positive impression (the score is in the direction of 1 and above) decreasing successively in the groups of efficiency, dependability, perspicuity, attractiveness, stimulation and novelty.

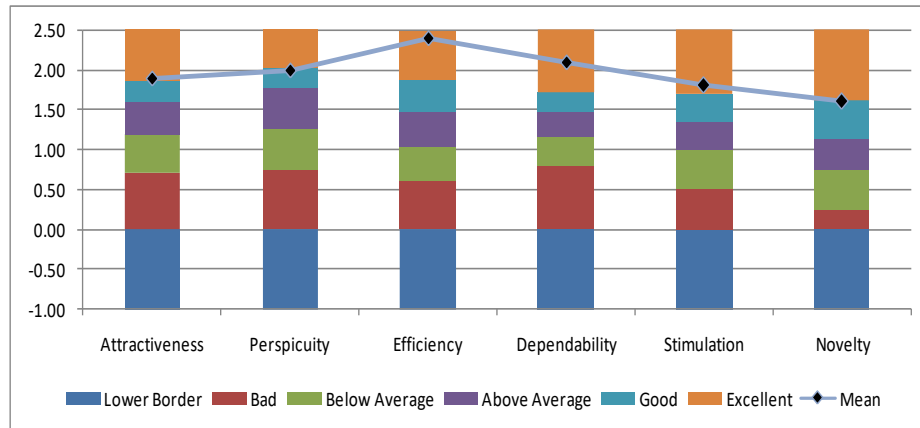


Figure 2. AMAN UX quality (3 dimensions)

The evaluation of AMAN shown in Figure 2, it shows excellent score value in benchmark comparison and highest mean score (M=2.4), as well. While there are excellent score values for dependability, perspicuity and attractiveness, those have a lower mean value than efficiency. In other words, AMAN application has a higher positive impression toward those scales than stimulation and novelty. Generally, all the UX scales have encouraging values and positive user impression. The UEQ benchmark comparison is a main indicator of whether AMAN provides an acceptable level of UX to perceived impression. Comparing AMAN application to such a benchmark data set is considered adequate to measure UX by a wide representative sample of users. Comparing the different scale results to the applications in the benchmark make it possible to draw general impression of the evaluated application [26], [30], [31].

**5. CONCLUSION**

This study assessed the UX of the mobile AMAN application in Jordan with 1208 study participants from different backgrounds. The results showed that the majority of participants were satisfied with the attractiveness, efficiency and perspicuity of the AMAN mobile application. On the other hand, the results of dependability, stimulation and novelty are not really encouraging. Analyzing the results, it is clear that, the users rated the AMAN application as a medium range experience (attractiveness, perspicuity, and efficiency) on all three items, and rated the application poorly against (dependability, stimulation, and novelty). The study recommends some area of improvement should be considered respectfully by the AMAN development team. The area of improvement might be taken on more than one option such as scale item (26 item rating), scale dimension (six scales) or scale grouping (attractiveness, hedonic and pragmatics). In this study, UEQ provides the ability not only to measure the current version of AMAN application, but also to establish computation measurement for hedonic and pragmatic qualities.

The benchmark previously described, provides an additional opportunity to check whether the current state of the user experience of an application is sufficient by comparing it to a large range of different available applications. Definitely, the benchmark only provides a high-level impression on the status of an adopted application by health authorities and organizations and therefore should preferably be extended by comparison with direct competitors in order to obtain a clearer picture. Based on the assessment of UX scale in this study, the UI/UX designers of AMAN application could improve the UX design effectively, which leads to better interaction. In the future, we will try to discuss security and privacy for alerting and tracing user movements. However, this requires adopting a specific framework to measure said security and privacy.

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