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Research paper

Measuring the Design of Online Meeting Application Using Golden Ratio and Silver Ratio

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Abstract

Several studies have attempted to create online meeting application, but the existing online meeting applications have not yet paid attention to User Interface and User Experience (UI and UX). To improve the UI and UX of online meeting applications, the existing design methods are implemented. The used methods are Golden Ratio and Silver Ratio. Those methods were tested empirically related to the effect of design methods on online meeting applications. The testing was done by collecting data in the field using User Experience Questionnaire (UEQ). The testing results of the UEQ showed that the attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty of the Golden Ratio Method appear to be better than the Silver Ratio Method. To ensure the correctness, the test was continued with testing the significance of UEQ data by using T-Test.

Keywords: *User Experience (UX), User Interface (UI), Golden Ratio, Silver Ratio*

1. Introduction

The development of mobile-based application is rapidly increasing in 2017 according to the world market analysis website stonetemple.com [1]. The increasing use of mobile application cannot be apart from smartphone as a driver of the mobile application. Smartphone is owned by almost everyone in the world. According to data from idntimes.com, the population in Indonesia with 261 million people in 2018, using smartphones as much as 236 million units. This number is expected to continue growing, given the absence of age restrictions or regulation for number of ownership and usage of smartphone in Indonesia [2].

In Indonesia, meeting activity is one of familiar activities in this era and becomes an activity that often carried out by many people. Some people apply conventional method to invite meeting participants both through social media and group chat, hence they are not well organized. Therefore, several studies have attempted to create online meeting application. An online meeting application was developed by Sitorus et al. in 2017 but has not paid attention yet to UI and UX [3].

By paying attention to UI and UX, user interest in online meeting application will increase. User interest can be seen from various sides, such as easy to use and convenient to operate. This will improve service and competitiveness in the market, which in the end will add sales value of the application [4].

Design methods are often found in structure modeling, one of which is the Golden Ratio method (which is used to build the Eiffel tower in Paris) and the Silver Ratio method (which is used to build Pagoda in Japan). The Golden Ratio method and Silver Ratio method are mathematical rules that have a significant impact on an architectural design. Along with the development of times and technology, the Golden Ratio began to be implemented to solve new issues, like research of Kausar et al. in 2017 which explained that the Golden Ratio is used as a medical tool to help doctors for displaying data visualization [5]. While the Silver Ratio Method is used as an International Standard, one of which is standard paper size series [6]. By paying attention to these two design methods, hence this study aims to test Golden Ratio and Silver Ratio on online meeting application from the UI and UX side.

2. Theoretical

2.1. Golden Ratio

Golden Ratio is a mathematical rule for the sequence of Fibonacci numbers. This rule of mathematics is in the form of a comparison of values between small value and large value. The larger value is denoted with the letter a and the smaller value is denoted with the letter b [7]. The comparison of these two values is the golden value of the Golden Ratio, which is symbolized by Greek letter phi φ. Algebraically, comparison of a and b values can be seen in Figure 1.

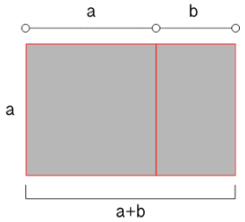


Fig. 1: Golden Rectangle

Figure 1 is a square with a long side a+b and a short side a. When placed coincide with a square with a side length a, then the square

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will be referred to as golden square if its sides follow a mathematical formula as follows (1):

$$\frac{a+b}{a} = \frac{a}{b} \equiv \varphi \tag{1}$$

Once solved, the mathematical equation above produces (2):

$$\varphi = \frac{1+\sqrt{5}}{2} = 1.6180339887 \ldots \tag{2}$$

To see a comparison of the golden value, the equation can be described as follows (3):

1	$\frac{(1+\sqrt{5})}{2}$

1 : 1.6180
b : a

(3)

2.2. Golden Ratio

Silver Ratio is a mathematical rule for the sequence of Pell numbers. This rule of mathematics is in the form of a comparison of values between small values and large values. The larger value is denoted with the letter a and the smaller value is denoted with the letter b. The value of Silver Ratio is denoted by δ_S [8]. Silver Ratio can be depicted with silver rectangle, which is shown in Figure 2.

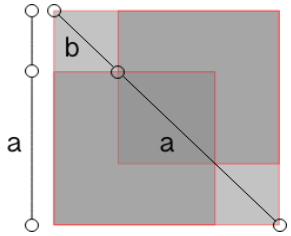


Fig. 2: Silver Rectangle

Figure 2 is a square with a long side 2a+b and a short side a. When it is placed coincide with a square with a side length a, then the square will be referred as silver square if its sides follow the mathematical formula as follows (4):

$$\frac{2a+b}{a} = \frac{a}{b} \equiv \delta_S \tag{4}$$

Once solved, the mathematical equation above produces (5):

$$\delta_S = 1+\sqrt{2} = 2.4142 \ldots \tag{5}$$

To see the comparison of the silver value, the equation can be described as follows (7):

1	1+√2

1 : 2.4142
b : a

(6)

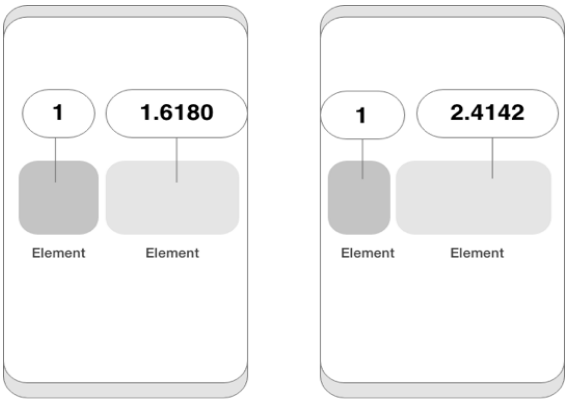
2.2. User Experience Questionnaire

User Experience Questionnaire (UEQ) is a data retrieval technique in the field by using a questionnaire that is fast and reliable and useful for measuring user experience in using interactive products. Putu et al. measured the effect of website complexity, task complexity, and design complexity of web-based learning media by using UEQ [9]. Therefore, Yulianandra et al.'s research used UEQ to evaluate interfaces of English learning by using UEQ to compare 3 (three) types of design at once and display the quality of each design individually [10].

3. Experimental Design

3.1. Application Design

The designing of application design focuses on space and layout. Space and layout are places to put each element of the online meeting application. The elements are separated by the ratio of the Golden Ratio or Silver Ratio, as shown in Figure 3. It appears that the elements in Figure 3a have an upper side ratio of 1 : 1.6180. While Figure 3b shows that the elements have an upper side ratio of 1 : 2.4142.



(a) Golden Ratio Element (b) Silver Ratio Element

Fig. 3: Element Position

Designed application is in the form of a prototype with Golden Ratio and Silver Ratio methods. The design refers to the function and purpose of the online meeting application. The designing of prototype was developed with a screen resolution of 1125x2436. This resolution is the resolution of smartphone that used during the testing.

3.4.1. Golden Ratio

UI/UX design modeling using Golden Ratio method is shown in Figure 4.

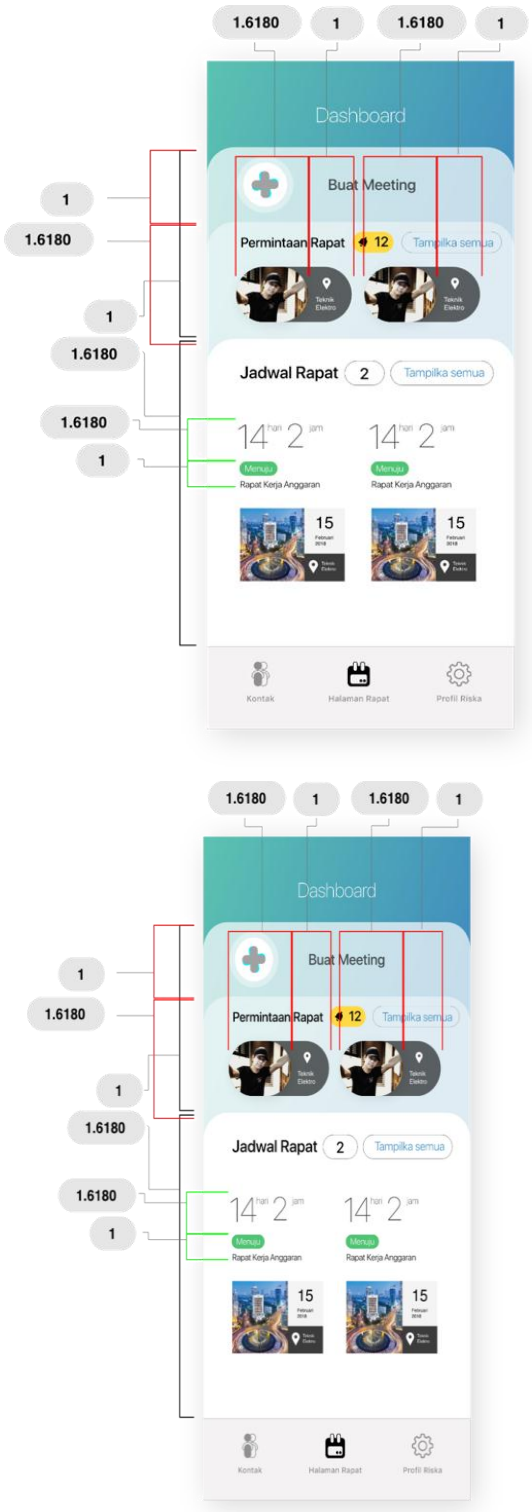


Fig. 4: Golden Ratio Design

Figure 4 is a display from Meeting Page of the online meeting application. Function of this page is that users can add new meetings, confirm meeting requests and arrange meeting schedule in one menu page.

3.4.1. Silver Ratio

UI/UX design modeling using Silver Ratio method is shown in Figure 5.

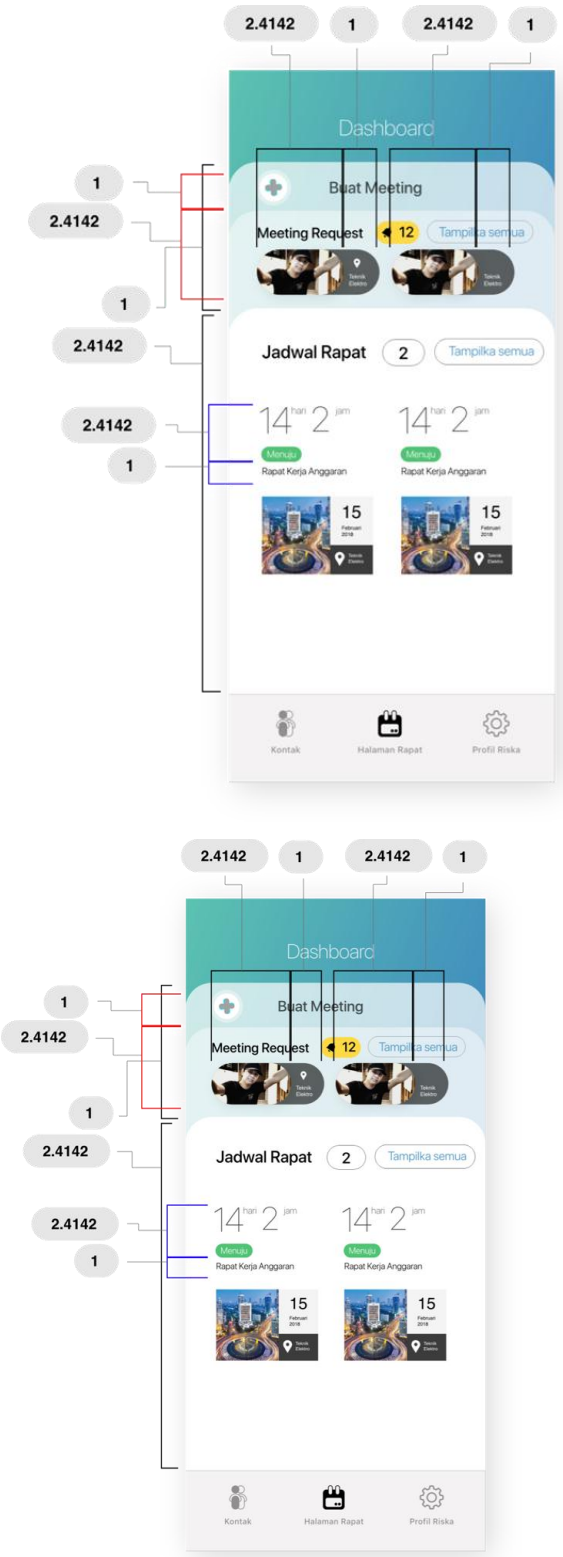


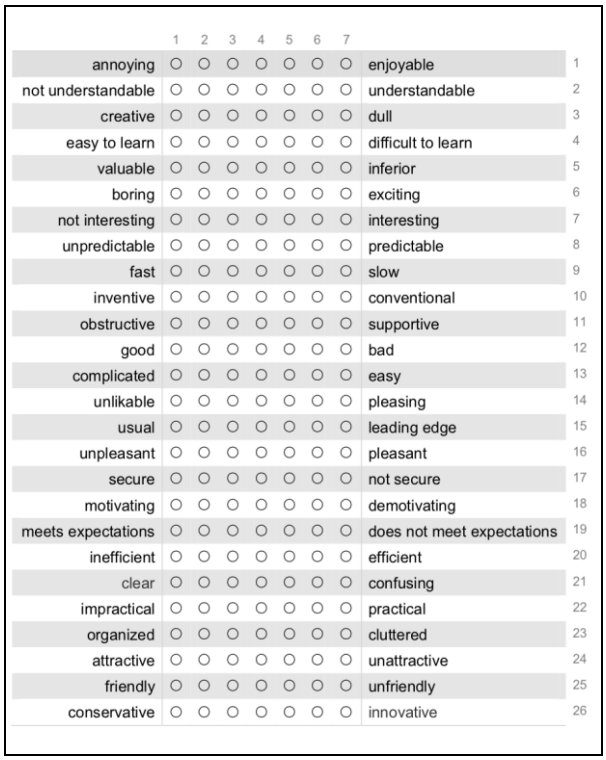
Fig. 5: Silver Ratio Design

Figure 5 is a display from Meeting Page of the online meeting application. Function of this page is that users can add new meetings, confirm meeting requests and arrange meeting schedule in one menu page.

3.2. Data Collection

UEQ used in this study consists of 27 question items and takes 5-8 minutes to fill all items. UEQ was prepared as many as 60 pieces with portion of 30 for filling the Golden Ratio method and 30 for

the Silver Ratio. The format of the UEQ questionnaire sheet is shown in Figure 6 [11].



	1	2	3	4	5	6	7		
annoying	○	○	○	○	○	○	○	enjoyable	1
not understandable	○	○	○	○	○	○	○	understandable	2
creative	○	○	○	○	○	○	○	dull	3
easy to learn	○	○	○	○	○	○	○	difficult to learn	4
valuable	○	○	○	○	○	○	○	inferior	5
boring	○	○	○	○	○	○	○	exciting	6
not interesting	○	○	○	○	○	○	○	interesting	7
unpredictable	○	○	○	○	○	○	○	predictable	8
fast	○	○	○	○	○	○	○	slow	9
inventive	○	○	○	○	○	○	○	conventional	10
obstructive	○	○	○	○	○	○	○	supportive	11
good	○	○	○	○	○	○	○	bad	12
complicated	○	○	○	○	○	○	○	easy	13
unlikable	○	○	○	○	○	○	○	pleasing	14
usual	○	○	○	○	○	○	○	leading edge	15
unpleasant	○	○	○	○	○	○	○	pleasant	16
secure	○	○	○	○	○	○	○	not secure	17
motivating	○	○	○	○	○	○	○	demotivating	18
meets expectations	○	○	○	○	○	○	○	does not meet expectations	19
inefficient	○	○	○	○	○	○	○	efficient	20
clear	○	○	○	○	○	○	○	confusing	21
impractical	○	○	○	○	○	○	○	practical	22
organized	○	○	○	○	○	○	○	cluttered	23
attractive	○	○	○	○	○	○	○	unattractive	24
friendly	○	○	○	○	○	○	○	unfriendly	25
conservative	○	○	○	○	○	○	○	innovative	26

Fig. 6: UEQ Sheet Format

3.3. Testing

Users who are the target of the testing work in event and restaurant environments with 15 (fifteen) people for each environments and 30 (thirty) people in total. These users often hold meetings every month and every year, what makes them the right target testing. The testing spent 2 (two) days on holidays and was done with 3 (three) stages. The first stage was introduction, the second stage was testing prototype, and the third stage was filling in the UEQ form data. During the testing phase, was found only few of the users recognized Golden Ratio method and Silver Ratio method was just recognized during the testing.

4. Results and Discussion

The results of data collection in the field can be seen in Table I for the Golden Ratio and Table II for the Silver Ratio.

Table 1: UEQ Scale Golden Ratio

Scale	Mean
Attractiveness	1.511
Perspicuity	1.492
Efficiency	1.508
Dependability	1.342
Stimulation	1.567
Novelty	1.242

Table 2: UEQ Scale Silver Ratio

Scale	Mean
Attractiveness	1.372
Perspicuity	1.392
Efficiency	1.258
Dependability	1.142
Stimulation	1.317
Novelty	1.033

To find out more clearly the significant level of Golden Ratio and Silver Ratio methods, a comparison was made using T-Test with a confidence scale of 5. The results of the comparison are shown in Table III for the Golden Ratio and Table 4 for the Silver Ratio.

Table 3: comparison of the Golden Ratio means scale

Scale	Data Set 2					
	Mean	STD	N	Confidence	Confidence Interval	
Attractiveness	1.51	0.89	30	0.32	1.19	1.83
Perspicuity	1.49	1.04	30	0.37	1.12	1.86
Efficiency	1.51	0.95	30	0.34	1.17	1.85
Dependability	1.34	0.97	30	0.35	0.99	1.69
Stimulation	1.57	0.86	30	0.31	1.26	1.88
Novelty	1.24	0.99	30	0.35	0.89	1.60

Table 4: comparison of the Silver Ratio means scale

Scale	Data Set 2					
	Mean	STD	N	Confidence	Confidence Interval	
Attractiveness	1.37	1.03	30	0.37	1.01	1.74
Perspicuity	1.39	0.90	30	0.32	1.07	1.71
Efficiency	1.26	0.96	30	0.34	0.91	1.60
Dependability	1.14	0.88	30	0.32	0.83	1.46
Stimulation	1.32	0.98	30	0.35	0.97	1.67
Novelty	1.03	1.04	30	0.37	0.66	1.41

Table III and Table IV can be represented in the graph as shown in Figure 7.

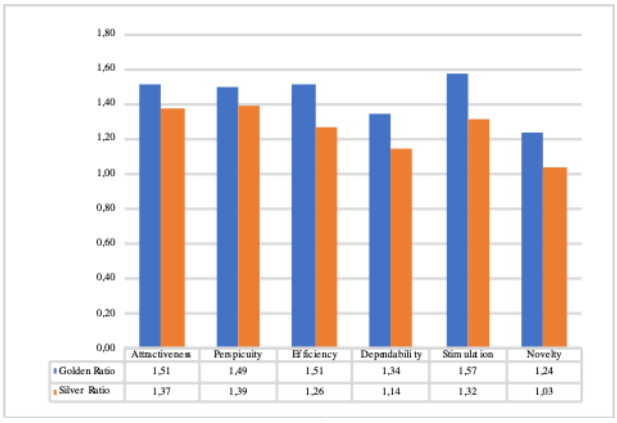


Fig. 7: Chart of the Means Scale

From Figure 7 can be seen that the Golden Ratio method looks better than the Silver Ratio method. To ensure the correctness, a significance test was carried out by using T-Test measurement with Alpha Level value of 0.05. The results of the T-Test significance measurement are shown in Table V.

Table 5: T-Test Compare

Attractiveness	0.5779	No Significant Difference
Perspicuity	0.6914	No Significant Difference
Efficiency	0.3147	No Significant Difference
Dependability	0.4077	No Significant Difference
Stimulation	0.2995	No Significant Difference
Novelty	0.4309	No Significant Difference

From Table V can be seen that attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty show no significant difference. The difference in the results of the T-Test gives information that the Golden Ratio and Silver Ratio methods are equally good to be applied on the Online Meeting Application.

5. Conclusion

The testing results of the Golden Ratio method and Silver Ratio method show that the attractiveness, perspicuity, efficiency, de-

pendability, stimulation, and novelty of the Golden Ratio method appear to be better than the Silver Ratio method. But after the significance test using T-Test was done, it can be concluded that the two methods are equally good.

The user experience that could be got from Golden Ratio method and Silver Ratio method is the user could understand the whole menus and submenus. That comprehension was got from the ratio's consistency that applied on every menu's element, with the result that in designing the design is not just with perception but with consistent ratio.

The use of ratio whether Golden Ratio method or Silver Ratio method are really recommended in designing user interface. The Silver Ratio method is just a comparison with Golden Ratio method, that with ratio's consistency on each element will achieve the better user experience.

Future Work

Considering the absence of significant differences from the Golden Ratio method and the Silver Ratio method, it is hoped that further research will not only considering the space and layout, but also takes color into account.

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