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Developing an Effective Targeted Mobile Application to Enhance Transportation Safety and Use of Active Transportation Modes in Fresno County: The Role of Application Design & Content

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MTI MINETA TRANSPORTATION INSTITUTE

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Samer Sarofim, PhD

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Samer Sarofim, PhD

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16. Abstract Do pedestrians and cyclists need their own app? Pedestrians and cyclists in Fresno county think so, and this research examined this need and how it relates to the importance of app design. Survey participants (all who regularly use active transportation modes) along with a variety of transportation stakeholders, including the Fresno Council of Government, the California Department of Transportation (Caltrans) District 6, and the City of Fresno — Public Works Department, indicated the importance of designing effective communication tools to enhance the utilization of active transportation modes and to ensure the safety of vulnerable road users. In this study, over 70% of the 180 survey participants expressed that having a mobile app specifically for active transportation (walking or biking) is at least moderately important to them. This research explored app users' engagement, enjoyment, and likelihood to purchase and recommend the app. Results indicated that safety information, weather conditions, a guide to trails, events for walkers and bikers, and promotional offers were the most important features for the targeted audience, who indicated a significant likelihood to use each of these features. With users indicating they would pay US$2.38 to purchase the app, this research suggests that there is a need to develop an application for active road users in Fresno County and, likely, in other areas as well.			
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1. Introduction

Multiple interactions with a variety of transportation stakeholders, including Fresno Council of Government, The California Department of Transportation (Caltrans) District 6, and the City of Fresno – Public Works Department, indicated The importance of designing effective communication tools to enhance the utilization of active transportation modes (walking and biking) and to ensure the safety of vulnerable road users (pedestrians and cyclists).

Current media vehicles that are used to target vulnerable road users seem to be lacking effectiveness. Perhaps this is because these media vehicles do not utilize the vast academic research available on media platform design, content, and their effects on altering motivations and behaviors. This research is aimed at identifying the most appealing mobile application design and content to target active transportation mode users. The mobile application aims to enhance the use of active transportation modes as well as promoting transportation safety practices.

Design aesthetics in the mobile landscape have been increasingly attracting the attention of both scholars' and practitioners' due to its influences on various behaviors.[1] For instance, mobile platform design has been found to affect consumer's enjoyment, as well as perceptions of both ease of use and usefulness.[2] This research quantitatively investigates the design and content needed in a mobile application that is aimed at enhancing safety and increasing the use of active transportation modes in Fresno County. The design of the mobile application, including the aesthetics, appearance, colors, flow of information, relevance of information, ease of navigation, and adoption intentions, would significantly affect the perceptions and credibility of content and messaging among the many targeted vulnerable road users (pedestrians and cyclists). This research empirically studies the differential effects of mobile application design and content on advancing traffic safety among vulnerable road users—an endeavor that shall benefit the public, city administrators, transportation authorities, and policymakers.

This research is aligned with SB1, Objective 4 as it will provide evidence-based and theory-driven strategies that contribute to creating safer communities and greater opportunities for use of active transportation modes (i.e., biking and walking). It will achieve this through inducing positive behavioral changes to enhance traffic safety via developing an effective design and content for a mobile application. Further, this research lends itself to SB1, Objective 1 as it will leverage the use of mobile technologies and shall align with the overall objective of developing and investing in "smart city" endeavors. Importantly, the proposed research is aligned with SB1, Objective 7 as it will inform and improve decision-making on transportation-related issues, namely traffic safety. Decision makers will be able to use the results of the proposed research to effectively design a mobile application to foster their communication efforts and spending to induce attitudinal and behavioral change that shall impact the safety of active transportation modes.

2. Methodology

2.1 Design

This research employed a survey design to quantitively assess the appeal of various mobile app designs and proposed content among the Fresno County pedestrians and cyclists. This research examined coherence, perceptions about various app names and colors, the importance of app features, perceived enjoyment, intentions to adopt the app, the willingness to recommend the app, the willingness to pay for the app, and the visual appeal and imagery of the app.

2.2 Sample

Sampling was designed to ensure that participants either use active transportation modes (walking or biking) as their main mode of transportation or participants walk or bike for 30 minutes or longer for recreational/exercising purposes at least 2–3 times per week. The sample was composed of 180 respondents from Fresno County who were recruited via a marketing research firm to complete the study. Detailed Sample characteristics are shown in Table 1.

2.3 Procedure

First, participants agreed to provide their thoughtful and honest answers to the questions in this survey. Next, participants indicated their agreement to the importance of having a Mobile App for biking and walking for Fresno (1–5 scale; anchored on 1 = "Not at all Important" and 5 = "Extremely Important"). Subsequently, they indicated the importance of the proposed five app features (Safety Information, Weather Conditions, Guide to Trails, Events for Walkers and Bikers, and Promotional Offers on equipment, services, and merchandise) (1–7 scale; anchored on 1 = "Not at all Important" and 5 = "Very Much").

Participants were then provided with three potential names for the app (Walk Bike Fresno, Active Fresno, On-The-Go Fresno) that were presented in a random order, and participants completed a three item (appealing, attractive, memorable) scale (1–7; anchored on 1 = "Strongly Disagree" and 7 = "Strongly Agree"), following Kim and Stoel[3] and Al-Qeisi et al., adapted from Aladwani,[4] and Rosen and Purinton,[5] respectively. Participants were then presented with the front layout of the app in three different colors (orange, blue, and green; in a randomized order) and participants indicated their perceptions about the appropriateness of each color[6] and how much they liked it on 7-point scales.[7]

To examine the visual appeal of the drop-down menu, the relevance of the menu options, and the likelihood to use the various menu options in the app, participants were presented with a screenshot of the potential design of the drop-down menu and its functions and then they answered questions related to the design's appeal,[8] relevance,[9] attractiveness, ease of navigation,

usefulness of functions, and personalization and customization,[10] as well as the likelihood to use each of the functions the drop-down menu provided (all on 7-point scales).

Following Kumar et al.,[11] imagery aesthetics (3 items), coherence and organization (4 items), and memorability and distinction of app features (2 items), adapted from Rosen et al.[12] and Kumar et al.,[13] and perceived enjoyment (3 items), adapted from Cyr et al.,[14] were measured. Following Al-Qeisi et al.,[15] the overall design of the app was then examined via a set of scales rated to perception regarding design quality (3 items), adapted from Aladwani.[16]

Intention for app adoption was measured using a 6-item (α = .92) (1–7; anchored on 1 = "strongly disagree" and 7 = "strongly agree"), adapted from Ahn et al., Davis et al., Harris et al., and Shen.[17] The scale included item such as "Using the app is an appealing idea," "I will consider downloading the app," and "I would use the app on a regular basis." The intentions to recommend the app to others (1–7; anchored on 1 = "Strongly disagree" and 7 = "Strongly agree") and the willingness to pay (sliding scale from 0 to 5 USD) were measured. Finally, demographics were collected and participants were thanked.

3. Findings

The need to have a mobile app for pedestrians and cyclists in Fresno County was justified, with almost 40 percent of the sample indicated that having the mobile app is either very important or extremely important to and another 30 percent indicated that it is moderately important to them.

The means for the importance of each the proposed main five features of the mobile app (Safety Information, Weather Conditions, Guide to Trails, Events for Walkers and Bikers, and Promotional Offers on equipment, services, and merchandise) were all significantly higher than the midpoint of the scale (One Sample T Test). This indicates that the proposed features are deemed important for the targeted audience of the mobile app. See Figure 1 and Table 2.

As for the proposed names for the mobile app, both On-The-Go Fresno and Active Fresno showed similar levels of memorability, attractiveness, and appeal that were significantly higher than the midpoint of the scale. The third proposed name (WalkBike Fresno) was perceived as inferior on memorability, attractiveness, and appeal when compared to On-The-Go Fresno and Active Fresno, and it did not show a significant positive result when compared to the midpoint of the scale. See Figure 2 and Table 2. For colors, the appropriateness and likeability of each of the three colors was positively and significantly correlated and, hence, combined in one item. The three proposed colors were found similarly appealing with the means significantly higher than the midpoint of the scale. See Table 2.

For the design and the content of the main drop-down menu of the mobile app, the design appeal, attractiveness, relevance of information, ease of navigation, content importance, usefulness of functions, concision, and personalization and customization were all positively perceived as indicated by means significantly higher than the midpoint of the scale. Relatedly, the likelihood to use each of the functions in the drop-down menu was significantly higher than the midpoint of the scale and, therefore, supports the importance of the proposed content of the app. See Table 2.

As for the overall design of the app, the scales for perception regarding design quality (α = .78), imagery aesthetics (α = .80), coherence and organization (α = .87), memorability and distinction of app features (r = .60, P < 0.01), and perceived enjoyment (α = .82) were reliable and hence combined into a single item for each category. Perception regrading design quality, imagery aesthetics, coherence and organization, memorability and distinction of app features, and perceived enjoyment were rated positively with means significantly higher than the midpoint of the scale. See Table 2.

The intention for app adoption among participants scored positively and significantly higher than the midpoint of the scale, which indicates not only the previously denoted importance of having the app, but also the target audience's willingness to use the app. The intentions to recommend

the app to others was positive and significantly higher than the midpoint of the scale. See Table 2. The average amount participants were willing to pay to download the app was US$2.38.

Table 1. Sample Characteristics

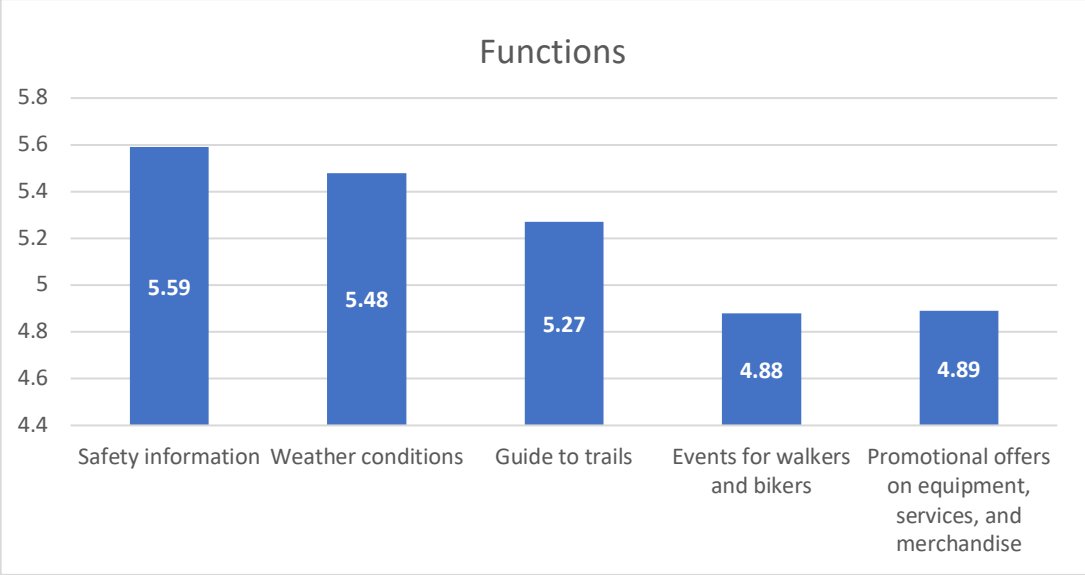
Sample Characteristics					
Characteristic	**Percentage**	**Characteristic**	**Percentage**	**Characteristic**	**Percentage**
Political Party		**Ethnicity**		**Education**	
Republican	16.7	American Indian or	2.8	Less than high school	7.2
Democrat	36.7	Alaska Native		High school graduate (or	30.0
Independent	22.2	Hispanic/Latino	33.3	GED)	
Other	4.4	Black or African	9.4	Vocational or technical	1.7
No preference	20.0	American	1.1	training	
		Native Hawaiian or		Some college (No degree)	20.6
		other Pacific Islander	40.6	Two-year college degree	13.3
		White or Caucasian	3.3	(Associate's, etc.)	
		Asian	3.3	Bachelor's degree	13.3
		Multiracial	1.7	Master's degree	8.9
		Other	4.4	Doctoral degree (PhD, JD,	5.0
		Prefer not to answer		MD, etc.)	
Age		**Total Annual Household**		**Employment Status**	
18 to 24	35.0	**Income**		Working full-time	34.4
25 to 34	30.0	Less than $30,000	35.6	Working part-time	14.4
35 to 44	17.8	$30,000 to $49,999	20.0	Self-employed	9.4
45 to 54	8.3	$50,000 to $74,999	17.2	Homemaker or stay-at-	6.1
55 to 64	6.1	$75,000 to $99,999	7.2	home parent	
65 or older	2.8	$100,000 to $124,999	4.4	Student	11.7
		$125,000 to $149,999	3.9	Out of work, but looking	14.4
		$150,000 to $199,999	3.3	for work	
		$200,000 to $249,999	4.4	Out of work, but not	4.4
		$250,000 or more	3.9	looking for work	
				Unable to work (e.g.,	3.3
				disability)	
				Military	0.0
				Retired	6.1
Marriage Status		**Main Mode of**		**Frequency of Walks**	
Married	35.0	**Transportation**		Daily	43.9
Single (Never	51.7	Motorists	67.2	4-6 times a week	32.8
married)		Pedestrians and Cyclists	27.8	2-3 times a week	17.8
Divorced	10.0	Other	5.0	Once a week	3.3
Separated	1.7			Never	2.2
Widowed	1.7				
Children		**Homeowner**		**Frequency of Bike Rides**	
Yes	44.4	Yes	44.4	Daily	29.4
No	55.6	No	55.6	4-6 times a week	22.2
				2-3 times a week	34.4
				Once a week	3.3
				Never	10.6

Table 2. One Sample T Test – Comparing the Means to Mid-Point of the Scale

One Sample T Test – Comparing the Means to Mid-Point of the Scale						
The Importance of Proposed App Features						
		Mean	Std. Deviation	Mean Difference	T	Sig.
Safety Information		5.59	1.697	1.589	12.561	.000
Weather Conditions		5.48	1.696	1.478	11.690	.000
Guide to Trails		5.27	1.717	1.272	9.941	.000
Events for Walkers and Bikers		4.88	1.819	.883	6.514	.000
Promotional Offers		4.89	1.898	.894	6.322	.000
The Appeal of Proposed Names						
		Mean	Std. Deviation	Mean Difference	T	Sig.
WalkBike Fresno	Appealing	4.15	1.916	.150	1.050	.295
	Attractive	4.16	1.877	.161	1.152	.251
	Memorable	4.19	1.920	.194	1.358	.176
Active Fresno	Appealing	4.42	1.822	.422	3.110	.002
	Attractive	4.56	1.659	.556	4.494	.000
	Memorable	4.68	1.697	.678	5.359	.000
On-The-Go Fresno	Appealing	4.53	1.748	.533	4.094	.000
	Attractive	4.61	1.562	.611	5.249	.000
	Memorable	4.72	1.666	.717	5.773	.000
The Appeal of Proposed Colors						
		Mean	Std. Deviation	Mean Difference	T	Sig.
Orange		4.7056	1.57653	.70556	6.004	.000
Blue		4.8500	1.60298	.85000	7.114	.000
Green		4.7972	1.54151	.79722	6.939	.000
Design & Content of the Main Drop-Down Menu						
		Mean	Std. Deviation	Mean Difference	T	Sig.
The Design Appeal		4.93	1.617	.928	7.698	.000
Attractiveness		5.02	1.561	1.022	8.788	.000
Relevance of Information		5.27	1.459	1.267	11.645	.000
Easy to Navigate		5.26	1.529	1.261	11.062	.000
Content Importance		5.37	1.517	1.372	12.134	.000
Usefulness of Functions		5.44	1.473	1.444	13.155	.000
Concision		5.27	1.542	1.272	11.069	.000
Personalization and Customization		5.01	1.594	1.006	8.462	.000
Likelihood to use Each Function						
		Mean	Std. Deviation	Mean Difference	T	Sig.
Safety Information		5.36	1.353	1.361	13.500	.000
Weather Conditions		5.19	1.532	1.194	10.459	.000
Events for Walkers and Bikers		5.21	1.480	1.211	10.980	.000
Promotional Offers		4.99	1.559	.994	8.559	.000
Guide to Trails		5.12	1.602	1.122	9.399	.000
Design Features of the App						
		Mean	Std. Deviation	Mean Difference	T	Sig.
Design Quality		5.4889	1.18253	1.48889	16.892	.000
Imagery Aesthetics		5.1815	1.29762	1.18148	12.216	.000

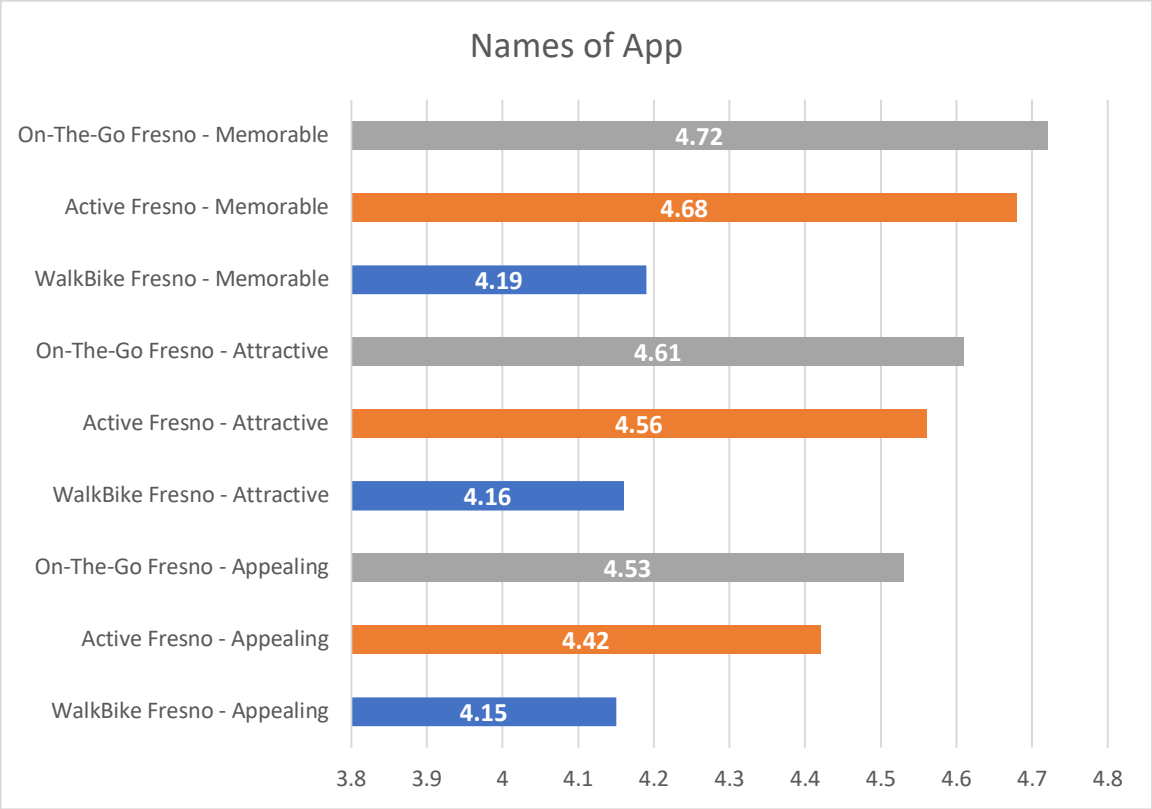
Design Features of the App					
Coherence and Organization	5.2611	1.21467	1.26111	13.929	.000
Memorability and Distinction of App Features	5.1972	1.29081	1.19722	12.444	.000
Perceived Enjoyment	5.2815	1.22503	1.28148	14.035	.000
Intentions for App Adoption					
	Mean	Std. Deviation	Mean Difference	T	Sig.
App Adoption	5.4222	1.19075	1.42222	16.024	.000
Likelihood to Recommend to Others					
	Mean	Std. Deviation	Mean Difference	T	Sig.
Likelihood to Recommend	5.33	1.465	1.333	12.213	.000

Figure 1. The Perceived Importance of the Mobile Application Functions



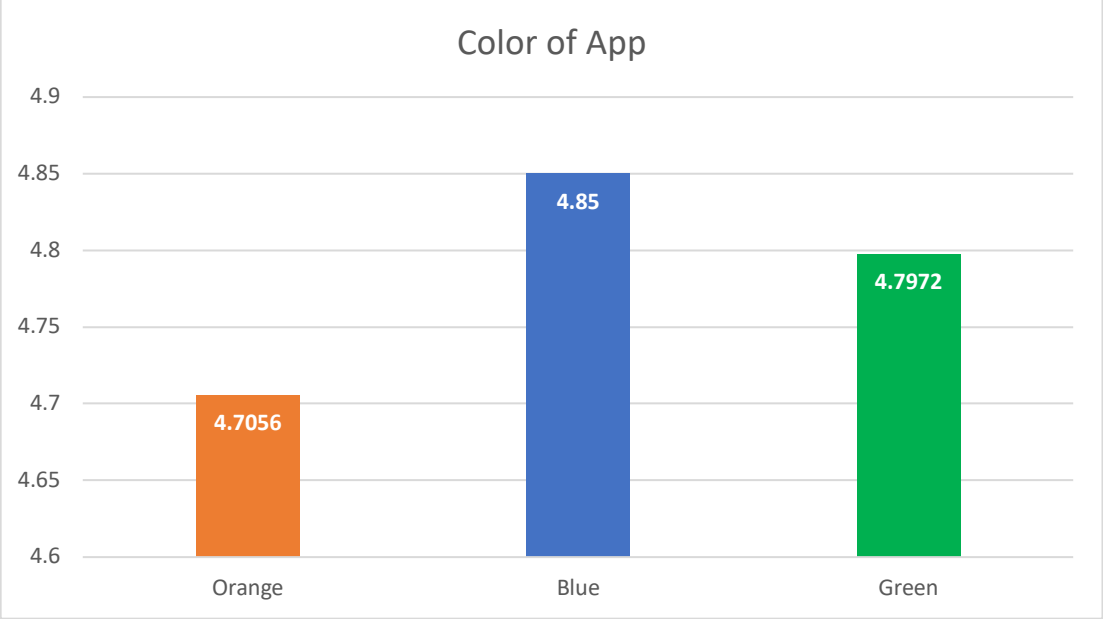
One Sample T-test: Means are significantly higher compared to the mid-point of the scale (P < .01)

Figure 2. The Appeal, Memorability, and Attractiveness of Tested Names of the Mobile Application



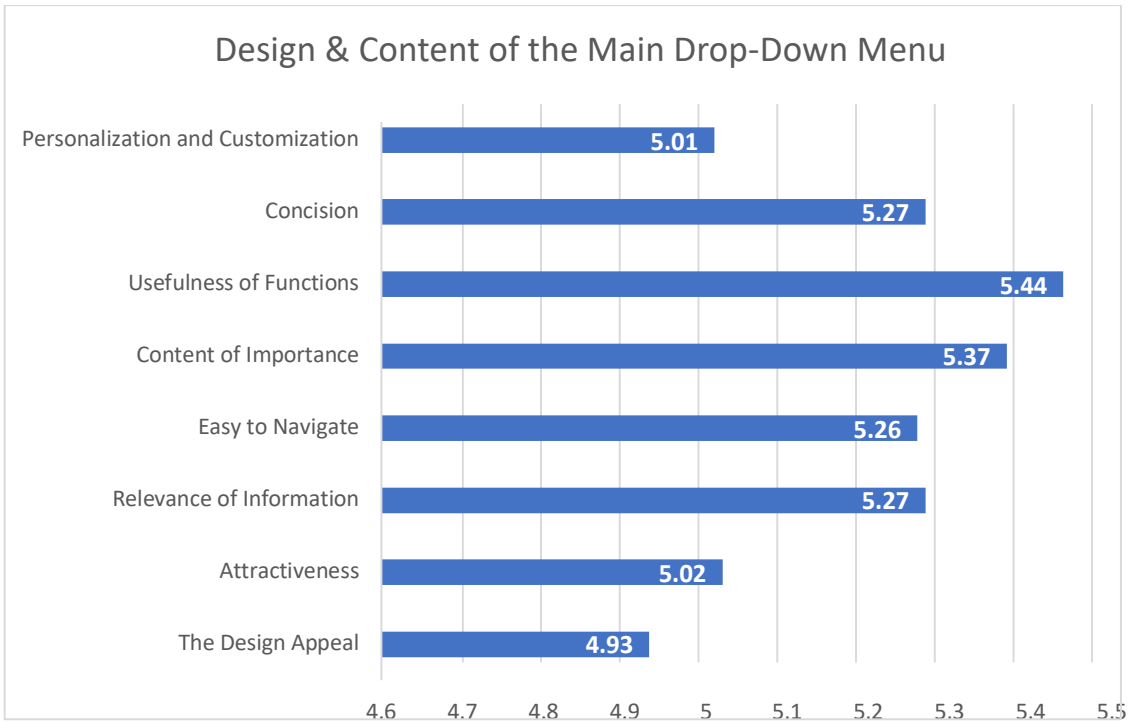
One Sample T-test: Means are significantly higher compared to the mid-point of the scale (P < .01)

Figure 3. The Acceptance of Proposed Mobile Application Colors



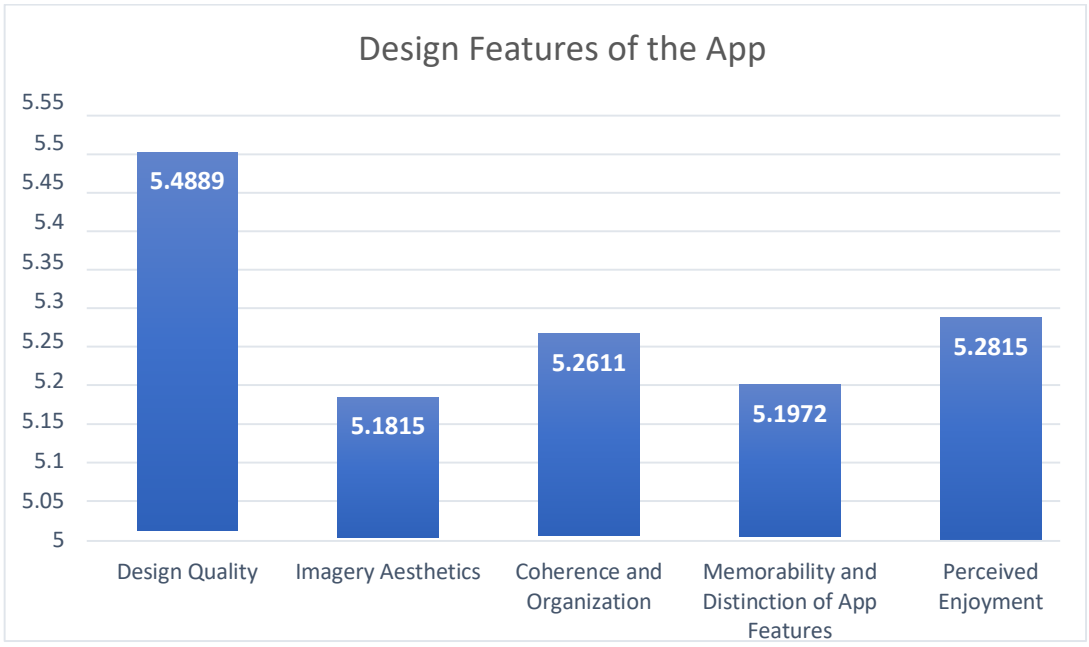
One Sample T-test: Means are significantly higher the mid-point of the scale (P < .01)

Figure 4. The Perception of Various Factors of the Design & Content of the Main Drop-Down Menu



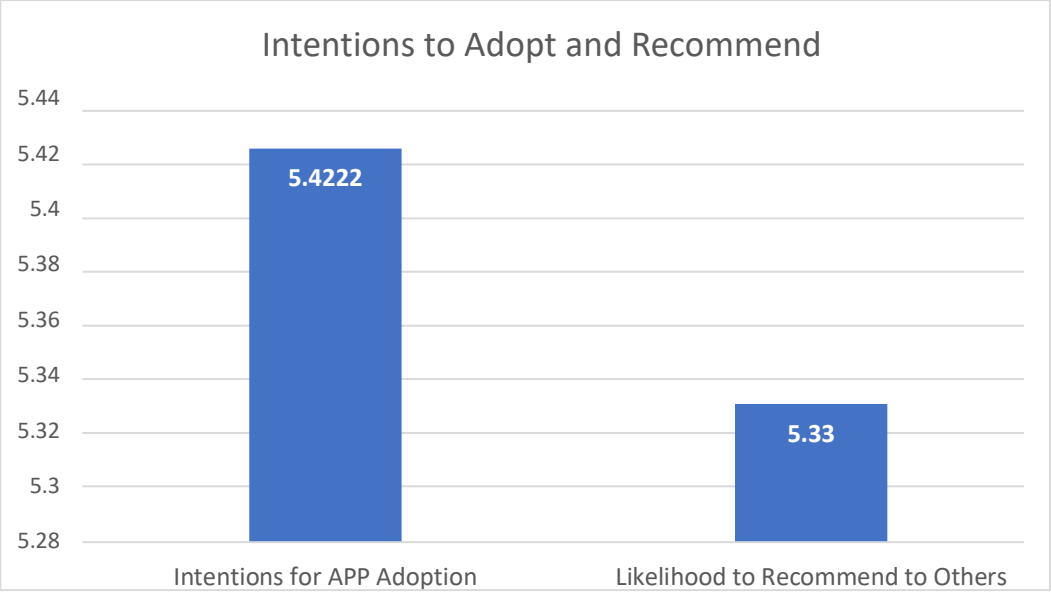
One Sample T-test: Means are significantly higher the mid-point of the scale (P < .01)

Figure 5. Opinions Regarding the Overall Design of the Mobile Application



One Sample T-test: Means are significantly higher the mid-point of the scale (P < .01)

Figure 6. Behavioral Intentions Towards the Proposed Mobile Application: Intentions to Adopt and Recommend



One Sample T-test: Means are significantly higher the mid-point of the scale ($P < .01$)

4. Summary & Conclusions

Findings indicate the need and acceptance among Fresno County pedestrians and cyclists to have a mobile application that is specifically designed for active transportation modes (walking and biking). Safety Information, Weather Conditions, Guide to Trails, Events for Walkers and Bikers, and Promotional Offers were deemed as important features for the targeted audience, who indicated a significant likelihood to use each of these features.

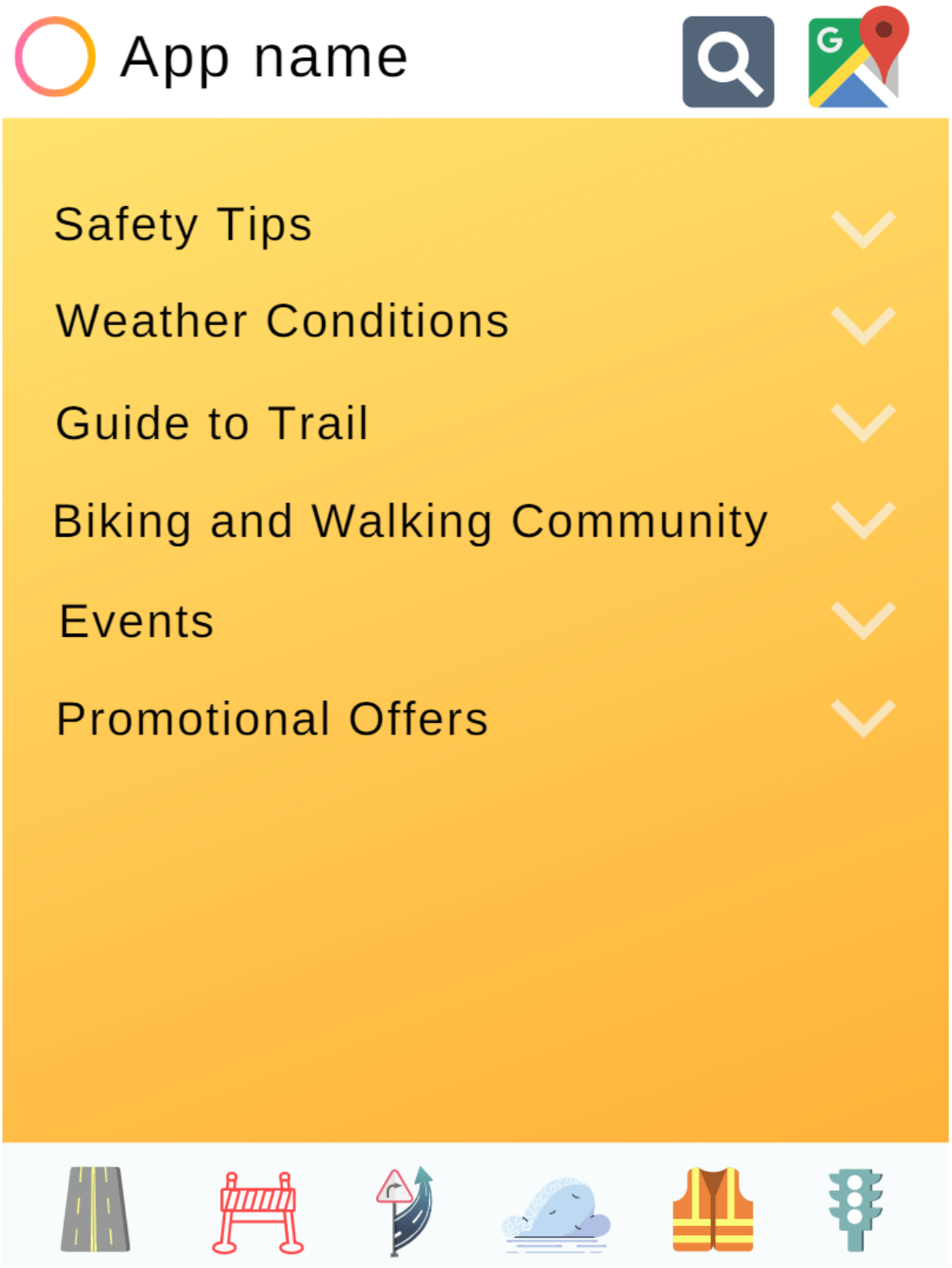
Two potential names for the mobile applications that were found appealing, attractive, and memorable among the targeted audience are On-The-Go Fresno and Active Fresno. Green, Blue, and Orange are potential dominant colors for the application as these colors were favorably perceived among the target audience.

The proposed design of the drop-down menu (appendix A) as well as the overall app design (appendix B) were perceived favorably on factors such as design appeal, attractiveness, relevance of information, ease of navigation, content importance, usefulness of functions, concision, personalization and customization, imagery aesthetics, coherence and organization, memorability and distinction of app features, and perceived enjoyment.

The targeted audience indicated a favorable likelihood to adopt the application and to recommend it to others. They were willing to pay an average of US$2.38 to purchase the application.

This research and its findings suggest that there is a need to develop an application for active road users in Fresno County. The findings indicate which features are important to include in the application, as well as providing insights for appealing design and content characteristics.

5. Appendix A: App Menu Screenshot



6. Appendix B: Homepage

Endnotes

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