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Understanding the people's willingness to change their intentions towards bicycle

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ABSTRACT

Bicycles are the easiest and cheapest form of mode of transport which can be used to reduce pollution and other environmental negative externalities. Recently, with the awareness of its benefits, many cities around the world have successfully adopted bicycles in form of sharing scheme and inspired by this, Gandhinagar, the administrative capital of Gujarat also took initiatives to introduce Bike share Program. The planned city of Gandhinagar, compared to the other cities are endowed with a better bicycle-friendly environment with wide congestion free roads and surplus tree coverage, but yet saw a decline in the use of bicycles from the stands. Hence it becomes necessary to know the factors that stimulate individual to use (or not to use) the bicycles. As to modify the travel patterns, it is necessary to understand in detail the behavior of individuals and the reasons why they choose (or do not chose) a particular mode of transport. The aim of the present study was to understand the difference in the factors which determines people's willingness to adopt bicycling in Gandhinagar. In order to recognize these factors, use of Theory of Reasoned Action (TRA) components and the concept of transtheoretical model of change (TTM) were used. The study included a sample of 147 people drawn from the general public who already knew how to bicycle, traveled frequently every day and lived in the precincts of Gandhinagar. The results to an extent confirmed that the constructs, as measured by the TRA, only distinguished difference between Precontemplation, Contemplation, and Maintainers successfully, with exception of Active group which overall failed to form a linear relationship between all the stages. But in overall, the aggregate values of attitude are very low in all the stages with very small variations between them. Especially in case of their perceived benefits and the barriers, Majority of people agreed that cycling is good for their health and that it is an environmentally sound way to commute and similarly was observed in there perceived barriers especially the climatic related barriers. What differentiated them were the aspects of their personal and social norms, flexibility and their intentions which became more positive with advancing stages except the group who were already using bicycles in their daily basis (Active). The study also discussed about the short-term benefits of flexibility, which showed a very strong relationship with the process of change, and how the negative barriers has to be addressed and taken seriously if we wanted to persist a change in their decision to change. Implications of the current findings about the description of different characteristics which evolved out from the constructs were discussed in detail and ending the paper with plausible recommendation.

Keywords— Bicycles, Theory of Reasoned Action (TRA), transtheoretical model of change (TTM)

1. INTRODUCTION

Bicycles are the easiest, cheapest and most sustainable form of mode, which today has lost its importance and since has been neglected, despite meeting the mobility needs of millions of Indians. Many academic research has been conducted which predicted the benefits of encouraging bicycles in cities with its vast array of positive externalities on societies: such as healthy replacement to travel short distances, affordability, environmental friendly, congestion free etc., (Lu-Yi Qiu, 2018); (Akash Krishna Srivastavaa, 2017) were identified, which promised to lead the cities towards a healthy and a sustainable path. And since last few decades, the trend in the west slowly started to catch up by encouraging policies and executing designs more towards a cycle friendly approach to enable people to use bicycles as a utility mode. Today more than 700 cities have adapted the bicycle share scheme successfully with evident change in the behavior among people using it and the various other problems tend to be reducing as the usability increased. Though

After imprinting its influence on major cities of the world, now in recent years cycle sharing system has its wheels on Indian roads. To reintroduce the bicycle in the modal share, attempts have been made to introduce the sharing model to the metro cities including Delhi (Planet Green Bikes), Ahmedabad (MYBYK), Bangalore (ATCAG), Mumbai (Cycle Chalao) and many. The policy makers and the private entrepreneurs collaborating with the local governments have shown their initiative on making use of this model. But to a large extent the scale of these projects has been compromised due to the uncertainty in the demand of the services and lack of

adaptability, risking the private entities to readily undertake such intervention in future (Gauquelin, 2017) (Iderlina Mateo-Babiano, 2016). In a Similar way, Gandhinagar, which is the capital of Gujarat, also took an initiative of Introducing a G-Bike sharing scheme. The City with its bicycle friendly environment with wide congestion free roads, optimal tree coverage of 54%, and a dominance of younger population under 30 sharing a 55% of total population and living in a densely populated area with closed geographic boundary of 57Sqkm, over all hypothesis to have a perfect condition for an evolving bicycle culture in the city. A pilot project introduced by the Gandhinagar Urban Development Authority (GUDA) with a PPP model with 11 Stands along the Important Junctions and tourist spots with 200+ Bicycles.

Initially acclaimed for its success with hiked trips of bicycles counting up to 7.2 trips per cycle, further sanctioned 50 Crores funding for 400+ bikes and 30 more stands in upcoming years. But at the time of survey the average bicycles active per day has come down to 2.4 and since has been stagnant. When asked for the reason for such a drastic decrease, GUDA claimed the Initial free charge of distribution of the cycles as a champagning strategy being the reason of the hike during the initial stages, but as they started to charge, the trips started to reduce and since been stagnant.

This lack of demand could be objectively reasoned due to many factors such as the socioeconomic and demographic factors (e.g., age, gender, income, education), station locations, harsh climatic conditions, fear of accidents, etc., could be hypothesized as possible factors effecting the choice to cycle. In fact several studies have demonstrated positive correlation between these factors and decision to cycle e.g., (Allen, 1997) (Carr, 2003). Yet few studies also showed that quick solution of solving the aspects of built environment, would not necessarily increase the frequency of riders (Chris Rissel, 2015) (Angela Hull, 2014).. Hence it becomes necessary to know the factors that stimulates individual to use (or not to use) the bicycles. As to modify the travel patterns, it is necessary to understand in detail the behavior of individuals and the reasons why they choose (or do not chose) a particular mode of transport. Because If the groups of people would like to cycle are identified, individuals with similar characteristics could be more effectively encouraged by means of specific policies and strategies.

In this context, the aim of the paper is to understand how different the behavioral factors differ in each group which has been divided according to their willingness of cycling and there perceived goals to change. In which in the first stage (Precontemplation), at which individuals are not intending to take action in the foreseeable future. In the second stage (Contemplation) they develop the awareness that a change may be necessary. In the third stage (Active but could Relapse) they are active but could soon be relapsed, and the fourth stage is (Maintenance) where the individual already bicycles and are motivated enough to continue being active in his motive. These individual intensions and there perceived future goals alone which does not describes the details of psychological factors but only contributes a staged progression (Bamberg, 2013). Hence to explore the psycho-social factors with the limited secondary variables collected for the previous study a reference of TRA (Theory of Reasoned action) model is considered in this study.

2. CONCEPTUAL MODEL AND LITERATURE REVIEW

Most of the studies which specifically dealt on understanding the psycho-social nature towards bicycle choice have largely used (TPB) Theory of Planned behaviour model successfully (Ajzen, 1991) to evaluate the effect of attitude, social norms and planned behavioural control (PBC) on the intentions. (Gulsah Akar, 2009) (De Bourdeaudhuij, 2007) (Andrés Monzón, 2010). It's an extension of Theory of Reasoned Action (TRA) with an addition of PBC factors which indicate how hard people are willing to try (Self-efficacy), how much effort they are planning to exert in order to perform the behaviour was added (Ajzen, 1991). But due to the nature of our secondary data collection, variables of PBC were absent and due to the close relation with the TPB, TPA model was taken to reference.

TRA has been applied to explain the behaviour by including behavioural attitudes, subjective norms and intention to use (Martin S. Hagger, 2002). It argues that individuals evaluate the consequences of a particular behaviour and create intentions to act that are consistent with their evaluations. A particularly helpful aspect of TRA is its assertion that any other factor that influences behaviour does so only indirectly by influencing attitude and subjective norms (Martin Fishbein, 2010).

Attitude is an important concept within the theory and is the function since it meets the individual's certain needs (Katz, 1960). In Initial stage, the formation of new attitude is a conscious process but later when attitude has become more established, the behaviour will then be persistent until something changes the motive behind the given action (Forward, 2014) also shows the consequences which are negative and positive attitude towards adopting this behaviour. Because having the positive attitude towards the bicycles in our case increases the likelihood of using this mode of transport for commuting.

Subjective Norms are based on normative beliefs which are the social pressure. It is the judgement that people make about what the individual should do and his motivation to agree with the people (Parents, friends, etc) (Adriana A. de Souzaa, 2014). Although, belief and the perceived attitude of an individual are separate from social norm, but they are very closely linked: often, social norm would influence a behaviour, in turn, the behaviour of many people can influence the perpetuation or changing of an existing social norm. The major difference between attitude and behaviour could be mostly found at the individual level, but whereas social norms are collective in nature or in other

words interdependent actions of a collective (Oxfam, 2016). As it is known that Indian population to an extent believe in very strong social ties and tends to behave according to accepted standards from the society hence representing a large network of relationship of the individual, the greater his needs for approval, not only from the family but also the other groups in society . And with an addition of *Personal Norms* which is an abstract social norm from which individuals perceive about an activity. In addition to use components from the above described TRA, which is a continuous model, the formation of a new behaviour could be added to further explain the behaviour using a staged model of behaviour change. Here, a stages can be defined as a set of categorically different in there intentions , which are similar internally in terms of cognitive, emotional and behaviour features, but could be psychologically

different from each other (Falko F Sniehotta, 2010) and within this field of research is the *Transtheoretical model*(TTM). According to TTM, behaviour change is not a result of a single event but it's a phenomenon, which occurs overtime (James O. Prochaska, 1983). These stages outline the individuals behaviour which goes through them before a new behaviour is firmly established (Forward, 2014). The change here is defined as an incremental, gradual, continues and dynamic process, involving progress through a series of stage (Suttons, 2001). The advantages with this approach are to match interventions to the different needs of the individuals. According to the theory TTM, the outlines are divided in 6 stages, *Precontemplation* - Have no intension to change; *Contemplation* - Start to become aware about the activity and its benefits; *Preparation* – Started to prepare themselves to change, *Action*- have changed but the risk is still high that they will return to their old behaviour. *Maintenance*- the behaviour has started to become a habit. *Termination* – the new behaviour is established and is not likely to return to their old behaviour (James O.Prochaska, 1983). In our study, we have only considered four of the following stages, as majority of the users did not possess the behaviour such as stated in *Maintenance* and *Termination*. But in our stage we have only used four stages, to evaluate the participants.

This theory could be very useful to evaluate the difference between the targets before a new behaviour is firmly established, but it is important to point out that it's only a small part of the rather complex model. In addition, to the various stage, the analysis includes a set of constructs that describes the process, Attitude differences, emotions and behaviour, taking place in the various stages.

3. METHOD

3.1. About Gandhinagar

The Planned capital city of Gandhinagar which came into existence around 1966, comprised of 57sq.km of land under the jurisdictions of GNA (Gandhinagar Notified Area) where 28sq.kms included the 30 sectors of the city and remaining area covered the cantonment, National Park, forest and Industrial Estates. With the population of 2,08,299(Census 2011) and density of 7,900 persons per sq/km in 28sq.kms, it is considerably densely populated area where much of the city is organized in 1.0km by 0.7km grid (Dhwani Shah, 2016). Roads followed a grid pattern mainly to curb the urban congestion and wide pathways separated from the main roads (ranging from 45m – 100m) are sufficiently covered with trees which is about 54% of the land use (APCCF & IFS, 2015).

The government buildings are placed in the heart of the city, while distributing the surrounding sectors with residential in terms of land use. Each sector is planned to accommodate all the basic residential facilities such as schools, shopping, gardens, etc which were placed in the center of each sector for easy access. Also, since the last decade, major education and Research institutions, IT companies have marked their presence in the southern part of Gandhinagar, which lead to increase in the flow of young population into the city, where now we have about 50% of the population under 30 years of age. Fairly a young populated city, compared to its previous status of a quite retirement city.

But since most of the commercial activities and institutional land use are concentrated in specific area and given the lack of connectivity to the users, the city sees a high level of dependency on personal motor vehicles even for short trips. According to a household study (Keval Mistry, 2016) conducted in Gandhinagar, shows that the trips are more often within the city with maximum travel time of 10 to 20minns due to its small geographical boundary. Even with such small distances to travel, they has been rise in ownership of cars and 2 wheelers. The main reason specified by (Keval Mistry, 2016), they is no adequate public transportation connection between the sectors, in fact the locals found difficult to even reach the nearest bus stand where instead tinkle hey had to be dropped off with the help of others. Hence the proposal of Bicycle share could help addressing the connectivity gap and also could compliment public transportation services. But when the built environment of the city is all seems favourable towards bicycling, the proposed bicycle share has not risen up accordingly.

3.2 Participants

This study is a secondary analysis from the previous research thesis work “Assessment of the Perceptions and Behaviours of Public towards Bicycling in Gandhinagar City” which was a descriptive understanding between cyclist and non-cyclist. Initially, the participants consisted of 180 people with the age ranging between 15 – 75 years old with males (68%, n=123) and females(32%, n=57). In accordance with this analysis, to avoid biasness among the sample, few assumptions were taken into consideration: *i) Who knew how to ride a bicycle*: As it was seen that people who did not know to ride a bicycle, have shown no traits of motivation to ever change and possibly nothing could be done to change their behaviour towards pro-cycling.(n=12) *ii) Resident of Gandhinagar*: About 18 participants who worked in Gandhinagar were resident of the neighbouring city of Ahmedabad, who commuted by their respective cars and two wheelers, Exception of 3 participants who largely were dependent on public transportation and were included because of their positive intentions to use bicycle when necessary. *iii) Considering only working, School and College students*: As the remining participants were outlying the data due to the large age differences in participants (n=3).

Table 1: Summary of perceptual questions and cycling indicators.

Attitudes(A) towards bicycle commuting characteristics

Considering your (possible) trip by bicycle to work/college/School, to what extent do you agree with the following statements

- I would/can commute quickly to the destination
- I would/can save money compared to other transport modes I would/can get some physical exercise
- I would/can pollute the environment less by cycling
- The present tree canopy (cover) is enough for me to use bicycle The climate is comfortable for me to ride bicycle
- I would be/am stressed when I arrive at my destination
- It would/is be very comfortable riding bicycle in Gandhinagar roads I would/do Enjoy riding a bicycle
- Personally, Its actually cool riding a bicycle
- I would/am (be) comfortable to ride in the present traffic
- I would/am be at risk of having an accident on Gandhinagar roads

Subjective Norms (SN) towards bicycle commuting characteristics

My Parents/Family Encourage me use bicycles to Work/College/School My Parents/Family Encourage me use bicycles to Recreation

Personal Norms (PN) towards bicycle commuting characteristics

Bicycle is generally used by poor Bicycle is generally used by Kids

Perceived Behaviour Control (PBC)

If separate paths are laid down specially for bicycling, I would use the bicycle in the future If Bikeshare stations are placed near me, I would use the bicycles in the future

Intention of Changing

Considering your intention for Bicycling, chose (only one) the statement which represents you

I have never thought about commuting by bicycle, and I am not interested (Precontemplation)(P) I have never commuted by bicycle, but I might use bicycle in the future (Contemplation)(C)

I bicycle occasionally, but I prefer other modes over bicycling (Action)(A)

I bicycle occasionally, and I am seriously thinking about doing more regularly (Maintenance)(M)

After the segregation of the data, the total participants consisted of 147 people aged between 15 – 58 years (M = 25, SD = 10.3) where female participants came down to 26% (n = 38) and males to 74%(n = 108) which approximately represented 65% of the population.

3.3. Instruments

The questionnaire selected for this study comprises of three thematic areas: First Section comprises of demographics section where questions were asked about their age, gender, their occupation, Income, Family status and the frequent mode of transportation used to commute. Second section, the components of TRA were measured with a total of 17 items. In these questions, participants had to estimate their agreement for each item on the Likert scale (1 strong disagree to 5 strong agree). The TPB components used in this study are the direct measures of Attitude, Subjective Norms, and Personal Norms and Intentions. But instead of following the recommendations of (Ajzen, 1991) of using separate questions for the Intentions in the same format as above, a multiple choice item was used to understand the Intentions of change. These Intentions are divided according to the Theory of Change (TTM) for the further analysis. Further to comprehend the attitude questions in the analysis, the eleven questions were divided into 6 sub groups:

3.4. Analysis

Initially, to check the predictability of the intentions from the latent variables which were based on the TRA theory, Pearson correlation was first conducted to see if the components used have any relation with the Intentions and then to predict the intentions a linear regression was evaluated. To Analyze the variables, Initially the factors were compared by the means and standard deviation to check the difference between all the four stages. To find a statistical difference between the variables one way ANOVA test is generally used. It checks the homogeneity of variance by testing the following hypotheses; H_0 = There is no difference between the variance in all four group and H_1 = There are difference between two or more variances. But when the variables were tested for normality and homogeneity, it violated the presumed assumptions needed for ANOVA test and hence Welch t-test is used instead. It is a modification of the t-test of Independent samples for assumption of unequal population variances, which allows heterogeneous variances to be tested with ANNOVA. To further understand where the differences are among the four stages a Non- parametric Games-Howell Post-hoc test are used, as the latent variables violate the normality distribution in the groups.

4. RESULTS

In Table 2, means, standard deviations and intercorrelation between all the sub groups of attitude, subjective norms, personal norms and Intentions to use the bicycle are displayed. The result shows that about 63% of the participants were willing to use bicycles if the bike share stations are placed near to their houses and also 80% agreed to use bicycle if separate lanes are built. However, their attitudes towards cycling are not overall positive with only 42% indicating a positive attitude. Though the participants are well aware of the Intrinsic benefits ($78\% \geq 4$) of bicycling which are the health benefits, environmental friendly and Economical, yet turns out to be these benefits outpost the disadvantaged they perceive ($86\% \geq 4$) to change the mode to bicycling.

According to the Pearson's correlation coefficient, all the TPB variables are significantly associated with the Intentions, although the strongest relation is between intentions and Enjoy riding ($r = .72, p < .01$), Its Cool riding (roughly describing to be amazing and uniquely interesting) ($r = .72, p < .01$), which explains that respondents who felt its cool and either felt they enjoyed riding have more positive intention to ride bicycles. And it's also observed that participants who considered bicycling being a quick commute to their destinations also have a higher intentions to take up bicycle in the future($r = .72, p < .01$). A simple linear regression was calculated to check the predictability of intentions towards cycling with the TRA latent variables, the explained variance came up to be $R^2 = .675$ and is statistically significant at $F(3, 143) = 65.6, p < .05$, where attitude largely explains 91% of the variance. Hence proving that the model is a good fit for the further analysis.

The respondents were then divided according to the different stages specified by the TTM. The total respondents who responded to this question were 147 and of those 16% could be described as precontemplators(P), 16% contemplators(C), 21% Actors(A) and 46% Maintainers(M). Table 2 presents the characteristics of the respondents across the different stages of change. As we compare the gender distribution in the stages, female participants are unevenly distributed with 42%(n = 16) in Action stage and 34% (n = 13) in maintenance stage.

	M	SD	Extrinsic benefits	Intrinsic Benefits	Enjoy Riding	It's cool riding	Climate Disadvantages	Traffic and safety disadvantages	Social Norm	Personal Norm	PBC
Extrinsic benefits †	2.80	1.33									
Intrinsic Benefits †	4.28	0.62	.53*								
Enjoy riding †	3.80	1.20	.67*	.36*							
It's cool riding †	3.32	1.15	.60*	.33*	.59*						
Climate related disadvantages †	2.02	0.68	.40*	.25*	.35*	.34*					
Traffic and safety disadvantage †	2.17	0.79	.56*	.29*	.51*	.43*	.43*				
Social Norm	3.85	0.97	.55*	.40*	.57*	.62*	.30*	.32*			
Personal Norm	3.25	0.85	.45*	.35*	.40*	.69*	.39*	.29*	.48*	.55*	

** Correlation is significant at the 0.01 level (2-tailed).

† Sub divided groups of Attitude.

Table 3: Distribution of the sample according to the intention to change.

	PC(N=24)	C(N=24)	A(N=31)	M(N=68)	Total(N=147)
Gender					
Male	66.7	95.8	51.6	80.9	74.2
Female	33.3	4.2	48.4	19.1	25.8
Age M(SD)	30.67(12.0)	25.45(10.15)	19.4(4.82)	26.2(10.5)	25.4(10.3)
15-25(%)	41.7	66.7	90.3	66.2	67.35
26-35(%)	25.0	25.0	9.7	17.6	18.37
36-45(%)	20.8	4.2	0.0	7.4	6.80
45+ (%)	12.5	8.3	0.0	8.8	7.48
Occupation (%)					
Student	37.5	50	74.2	52.9	54.42
Employed	45.8	45.8	22.6	32.4	34.69
Self Employed	16.7	4.2	3.2	14.7	10.88
Income (%)					
Don't make any	29.2	33.3	64.5	45.6	44.9
< 10K	8.3	4.2	16.1	5.9	8.2
10K-30K	8.3	16.7	9.7	14.7	12.9
30K-50K	12.5	20.8	9.7	14.7	14.3
50K-75K	8.3	8.3	0	4.4	4.8
75K-1Lakh	12.5	4.2	0	7.4	6.1
> 1Lakh	20.8	12.5	0	7.4	8.8
Family status (%)					
Living with Family	66.6	56.5	93.54	66.17	70.74
Without Family ties	33.3	43.5	6.45	22.82	29.25
Ownership (%)					
2 Wheelers	55.7	47.9	44.1	54	51.2
Cars	29.1	26	23.7	21.7	24.2
Bicycle	15.2	26	32.3	24.2	24.6
Frequent Mode used (%)					
On foot (Walk)	19	13.3	30.9	15.5	12.4
Bicycle	2.4	6.7	16.4	18.2	9.2
Dependent	4.8	8.9	12.7	4.1	4.3
Public Bus	11.9	13.3	10.9	19.6	10.5
Auto	4.8	8.9	10.9	7.4	5.3
2 wheelers	28.6	22.2	16.4	20.9	14.2
Car	16.7	13.3	1.8	12.8	7.6
Cab (Uber/Ola)	11.9	13.3	0	1.4	3

The stage P tends to have more older respondents (M = 30.67, SD = 12) ranging from 15 – 55 years and the concentration of younger population are predominantly seen in Stage A (M = 19.4, SD = 4.82) with all the respondents being under 23 years and about 75% of them under 18 years comprising of school children. This also reflects the income status of the group with 64.5% of them do not earn anything and are largely dependent on their family (93% living with their family) and also comparatively highest ownership of bicycles (32%).

In stage P, the respondents comparatively earn more than the other groups where about 53.3% of group earn more than 30K per month, which reflects the highest ownership of cars and two wheelers (29% & 55.7% respectively) among all the groups and the frequent mode used is highly motorised dependency. Stage C and M have comparatively shown similarity in their characteristic: age (M, M = 26.2, SD = 10.5)(C, M = 25.45, SD = 10.15), occupation with students 50% students in stage C and 52% in stage M, employed participants higher in stage C (45%) than in stage M (32%). It is observed that ownership of cars (r = 0.207) and 2 Wheelers (r = 0.247) are correlated with age which means with increase in age there is a rise in ownership of motorized vehicles, In

fact many studies have similar findings (Prateek Bansal, 2016). Unfortunately ownership of bicycles were insignificant due to the fact that we couldn't ask if the bicycles belonged to the respondents or their children but a negative correlated ($r = -.140$) with age.

Table 4 shows the mean, standard deviation, ANOVA-F values for all the TRA components and Games-Howell post hoc test for comparisons between groups. As attitude in our model largely explained 91% of the variance, it is clear that intentions to change the behaviour for opting the bicycles is largely influenced by the attitude they perceive. But from the results, it was evident that the average mean of the attitude is aggregately low in all the four stages. Though the maintenance stage who have been the pro-cycling cohort, marginally showed a positive attitude in comparison, the average is still less than the accepted threshold of being positive in nature. With regards to perceived barriers and benefits towards cycling, the trend of values remained almost same with very little difference among the groups, which clearly infers that even though there is a strong intentions to use bicycles, there perceived dangers and benefits were observed to be closely equivalent to the individual who had no intentions to change.

In instance, the sub-attitude of intrinsic benefits among all the groups are perceived highly positive with very small variance at $F(3, 60) = 5.26, p < .003$, which indicated the awareness of the internal satisfying benefits of cycling, especially the underlying factors of physically exercise and the environmental benefits. But in case of bicycle being economically viable option, precontemplation group did not comply positively ($M = 3.33, SD = 1.1$). This would presumably reflect there intentions of not changing their behaviour towards cycling and in turn would be a waste of investing in purchasing bicycles if not intended.

The extrinsic benefits which explains the outcome of using bicycling which in our case is commuting quickly to the destination, over all is the highest predicted factor explaining 63% of the variance of the intentions. Which clearly explains that the time flexibility for commuting to their respective destinations places a greater importance on their decision to choose bicycling, where the maintenance group showed more positive attitude towards it ($M = 3.6, SD = 1.19$) but with lower threshold considering to be positive. The reasons could be the Gandhinagar's wide and uncongested roads, where motorised vehicles easily sieve through the traffic with maximum delay of 31 seconds in average (P.K.Sartkar, 2016), giving a comparative advantage over the bicycles which in contrast in many studies (Álvaro Fernández-Heredia, 2014) have been one of the influential factors to choose bicycles.

The Symbolic and affective advantages, which in our study is about how they enjoyed cycling and if they personally felt it to be a cool option to ride, predicted 36% of the total variance. The results shows a staggering contrast between the pre-contemplators and maintainers, especially when asked about enjoying the rides. $PC(M = 4.7, SD = .94), M(M = 2.3, SD = .91)$. It was also observed that the active group which majority of them being school kids have a negative outlook towards cycling being a cool option or an enjoyable mode, which clearly explains there disinterest in pursuing bicycles in long term.

Though they have been a mixed agreement among all the stages about the benefits, they all conformed with the fact that cycling could be risky and most uncomfortable mode to use. As it was observed, that there is a very small

Table 3: Mean and standard deviation of social cognitive constructs regarding biking across stage of change.

Variables	PC. M(SD)	C M(SD)	A M(SD)	M. M(SD)	Total M(SD)	F	Post hoc
Attitude (aggregate)	2.29(.47)	2.94(.35)	2.78(.38)	3.39(.49)	3.01(.6)	34.7*	PC < C = A < M
Intrinsic Benefits	3.82(.77)	4.50(.41)	4.24(.51)	4.38(.58)	4.28(.61)	5.2*	PC < C = A < M PC = A, C = M
Save money	3.33(1.1)	4.33(.64)	3.97(.66)	3.6(1.19)	3.76(1.05)	7.04*	
physical exercise	4.1(1.9)	4.54(.51)	4.32(.6)	4.81(.4)	4.53(.6)	9.70*	
Pollute less by cycling	4.0(0.8)	4.62(.65)	4.42(.76)	4.72(.77)	4.53(.8)	4.59*	
Extrinsic benefits:							
Commute quickly	1.5(.83)	2.67(1.05)	2.16(.93)	3.60(1.19)	2.80(1.33)	31.7*	PC < C = A = M
Enjoy riding	2.3(.91)	3.46(.72)	3.29(1.04)	4.7(.94)	3.8(1.2)	61.2*	PC < C = A < M
It's cool riding	2.21(0.66)	3.08(.88)	2.71(.9)	4.07(.63)	3.32(1.20)	40.1*	PC < C = A < M
Climate related disadvantages	1.64(.53)	2.01(.54)	1.86(.57)	2.23(.81)	2.02(.68)	6.11*	PC = C = A < M
tree canopy	2.5(1.47)	3.38(1.21)	2.55(1.26)	3.22(1.34)	2.99(1.36)	3.55*	
climate to hot	1.17(0.38)	1.50(.72)	1.65(.75)	1.74(.79)	1.60(.75)	8.54*	
Stressed and tired	1.25(0.44)	1.17(.38)	1.39(.8)	1.7(.8)	1.47(.72)	6.30*	
Traffic & safety disadvantage	1.44(.54)	1.83(.5)	2.11(.6)	2.58(.78)	2.17(.79)	22.10*	PC = C = A < M
Risk of accident	1.08(.28)	1.04(.2)	1.32(.54)	1.78(.81)	1.45(.69)	17.19*	
I can ride through the traffic	1.79(1.06)	2.63(.92)	2.90(.91)	3.38(1.11)	2.9(1.17)	13.38*	
Subjective Norms	3.0(.9)	3.65(.93)	3.44(.9)	4.41(.67)	3.85(.97)	23.04*	PC = C = A < M, PC = A
Parents/Family Encourage me use bicycles to Work/College/School	2.71(1)	3.42(1.10)	3.16(1.07)	4.25(.94)	3.63(1.17)	18.42*	
Parents/Family Encourage me use bicycles to Recreation	3.29(0.95)	3.88(.9)	3.71(.9)	4.41(.67)	4.07(.93)	19.11*	
Personal Norms	2.98(.93)	3.79(.75)	2.77(1)	3.3(.95)	3.22(.97)	13.36*	PC < C > A < M, PC = A, C = M.
Used by poor	3.58(1.34)	4.3(0.95)	3.19(1.40)	3.47(1.11)	3.85(.97)	5.19*	
Used by Kids	2.37(1)	3.29(.81)	2.35(.98)	3.13(1.08)	3.56(1.23)	8.07*	
Intentions	2.50(.92)	3.85(.62)	3.06(.6)	4.62(.6)	3.82(1.07)	68.86*	PC < C = A < M, A = PC
If separate paths are laid down specially for bicycling, I would use the bicycle in the future	2.25(.74)	3.79(.72)	3.32(.83)	4.71(.55)	3.86(1.13)	29.35*	
If Bikeshare stations are placed near me, I would use the bicycles in the future	2.75(1.29)	3.92(.78)	2.81(1.01)	4.53(.87)	3.78(1.25)	86.36*	

PC: precontemplation; C: contemplation; A: action; M: maintenance, Asymptotically F distributed is significant * $p < .05$ significant difference between the values. When asked about the climatic conditions and there consequences of stressed and tiered commute, the responses were similar with very small variances [$F(3,63) = 6.1, p < .001$]. In fact, the tree canopy coverage which is considered to be an enabler for a comfortable ride, responses stood in contrast with an average of $M = 2.99$ $SD = 1.36$ which is way to less to be considering Gandhinagar’s advertised tree coverage to be any benefit to the commuters. Over all the respondents tend to judge the risks higher in comparison to the befits of cycling, which could aggregately explain in our case that participant’s attitude towards bicycling is fairly very negative, even the pro-bicyclist tend to carry the same attitude as the other groups who are yet to begin cycling. This signs to the fact that people in Gandhinagar are not motivated enough to take up cycle without any external help.

in comparison to the befits of cycling, which could aggregately explain in our case that participant’s attitude towards bicycling is fairly very negative, even the pro-bicyclist tend to carry the same attitude as the other groups who are yet to begin cycling. This signs to the fact that people in Gandhinagar are not motivated enough to take up cycle without any external help. As the attitude was seen to be very weak among the responders towards bicycling, it equally complimented there normative morals towards bicycle. The belief that bicycles are generally used by poor and kids stayed very strong among all the groups except the contemplators ($M = 3.8, SD = .95$) which was a very unusual, as it was expected the maintainers to be more positive about their personal norms. The active group in contrast strongly believe that the bicycles are only for kids and poor.

But in case of social norms, Maintenance group tend to have a very positive values ($M = 4.41, SD = .67$). When compared to other groups, there were very small significant difference observed between them. Which could indicate that acceptance of their social groups might play a key role in individual’s choice to cycle, but a biased acceptance more positive towards a recreational use of bilking than to use it as a utilitarian mode.

5. DISCUSSION

The aim of the present study was to understand the difference in the factors which determines people’s willingness to adopt bicycling in Gandhinagar. In order to recognize these factors, use of theory of Reasoned Action (TRA) components and the concept of transtheoretical model of change (TTM) were used. The integration of these theories have been tested previously by many medical studies which dealt with Health Belief Model with TPB(Theory of Planned behaviour) (Seth M.Noar, 2005) (K.Bledsoe, 2006) and one of the main purpose for the use has been to determine if these components could be used to discriminate difference between stages of change, which could help in providing an insight of what each group perceive over the same activity and what could be done to influence them to commit to change. With the proposed method, to understand if the evidence of our study is for or against a stage model, is to see the trend of each stage. These cognitive variables to an extent were able to explain the transition as the intentions grew positive towards bicycling but with an exception between contemplation and active groups (fig 1). These groups tend to show many similarities in their factors, hence failing to demonstrate a linear relationship, since it is suggested TTM is a linear “pseudo-stage model” (Alko F Sniehotta, 2010). This pattern, where the cognitive components did not always distinguish between the different stages, were consistent in many numbers of studies (Forward, 2014) (Armitage, 2010).

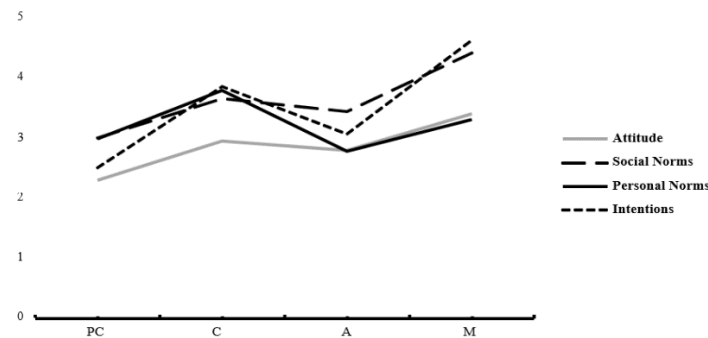


Fig. 1: TRA and their trend in different stages

Hence explaining the staged model to be more of a proxy measure to explain the intensions. Also, the Action group tend to show more negative responses compared to Contemplation but only with an exception in Traffic and safety barriers (Fig.1). But in overall, the aggregate values of attitude are very low in all the stages with very small variations. Especially in case of there perceived benefits and the barriers, Majority of people agreed that cycling is good for theirhealth and that it is environmentally sound way to commute.

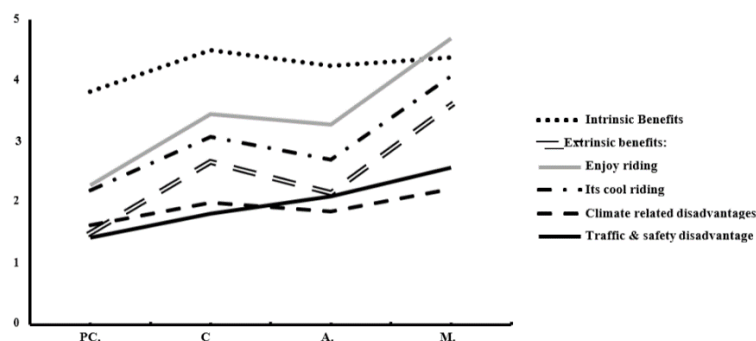


Fig. 2: Attitudes and there trend in different stages

This is also in line with other studies, which also demonstrated the pattern of similar behaviour e.g., (Katz, 1960), (Katherine M Appleton, 2007), (Andrés Monzón, 2010). Similarly, the Perceived barriers especially the climatic related barriers tend to show a flat response (Fig 2) with very small difference between the stages.

Based on the results of the study, people at the different stages could be described to have different characteristics: To start with the maintainers group: Their intentions of continuing bicycling were very much correlated with their positive responses in all the factors except that of affordability. This could be explained as most of the responders in this cohort use the G-bike program, and comparatively found it expensive to use the mode. Though the barriers perceived by them were almost valued the same as the other lower groups, they highly intended to enjoy cycling and felt it cool to ride the bicycles. But with the previous study (Annex Fig1) majority of the rides were specifically observed to be used for recreational and exercise purposes with very few using it as a utilitarian purpose. This is also reflected in their perceived subjective norms, where social circles largely encouraged recreational rides than to their respected work, school or to colleges, despite they lived in cyclable distance. One drawback which was also observed in maintainers are their personal norms. Considering their positive intentions, majority of this pro-cyclist groups still believed that cycles are generally meant to be used by kids and poor only, specially towards kids. This explains the taboo they still perceive by symbolizing bicycles only for poor and kids, which to an extent restricts their intentions to further use it for a utilitarian purpose interest.

The Active groups which already commute by bicycles at present could be considered as a representation of school kids. Shockingly they tend to have similar perception in many instances to the group who were least interested to change their intentions (Precontemplation), in fact their attitude and intentions are comparatively weaker than the respondents who have thoughts of changing their intentions towards cycling too. This clearly points out the fact, that kids are more influenced with the present trend of motorized vehicles, it has become a norm for them to considering bicycles to be not a favorable option in their future. This was clearly reflected in their personal norms, where they have the least value supporting the fact that bicycles are generally used by poor and kids only. Further reducing their motivations to use bicycles. With the current attitude and their perceived expectations, it is clearly evident that the younger population did not give much importance to cycling today. Though majority of them own bicycles today and also frequently used it, they seemed to be much inclined towards upgrading themselves to the motorized vehicles.

In case of Contemplation, who have not yet used bicycles but are soon considering to adopt it, comparatively have a positive response right after maintainers. In fact, the aggregate attitude showed a significantly similarities between each other and are also most positive in their personal norms compared to all the other stages. It's evident that this group had at least positive attitude towards cycling. According to the Prochaska's model of change, this cohort can be brought closer to action by increasing their general problem awareness. And in case of precontemplation, they were aware of the fact that cycling is good for their own health and also environmentally but other than that all other factors were disapproving towards the bicycling. In fact, the difference in attitude and intentions were very contrasting with the maintainers. This could be explained due to their age, dependency and subsequent affordability of motorized vehicles, as majority of them earned higher than the subsequent groups and preferred maintaining their status quo by continuing with their present ways. Their negative personal norms and the perceived lack of acceptance from their social circles, overall convinces them not to change their behaviour. Unfortunately, people in the pre-contemplation stage are usually very difficult to reach since they are not at all interested or would not even volunteer for programs or actively seek any information. However, it's found that it is possible to contact this group of people by proactively seeking them. Another strategy could be to introduce a number of "push" and "pull" measures which are the combination of rewards and disincentives to induce change in mobility behavior (Corjena Cheung, 2006).

6. CONCLUSIONS

This study showed a new insight which could help in persuading more people to cycle. Most importantly, it showed that neither all cyclists nor all non-cyclist are the same in their intentions, such as the contemplation group which fairly showed positive outlook towards bicycles than the action group who were already cycling. This way we can have important implications for targeting cycling policies.

To date, G-Bike campaigns tend to focus on the problems related to motorised transport such as the pollution and congestion problems, but mainly towards health and environmental benefits of cycling, which was clearly reflected in their responses of being beneficial in all the stages with very small variances. This study suggests that work also needs to be done to improve the image of the cycling. Because at the moment many of those participants who never cycled before strongly believed that cycling is something that the kids or the poor do, people unlike them. In order to change these views a cultural change is needed. In short, Images or the campaigning with familiar faces via the mass media could be introduced.

It is clear that the results are not a quick-fix but a slow process, in fact could take longer time for the population to normalize the mode. Hence care has to be taken that the authority keeps running the Bikes scheme and equally increase its stations corner to corner to connect all important location. For a long-term solution, it might be useful to promote cycling among children and young people. By encouraging this cohort to cycle, which should be a paramount and also an easiest task to take on. One might create a generation of confident cyclist who view cycling as the most common activity instead of detesting it.

Unfortunately, it was clear by the results that they had no intentions to continue cycling. It is not surprising that parents do not allow their children to go to school in an environment where cycling is uncommon, perceived to be dangerous and also the drivers are not used to dealing with the cyclist. Hence it is absolutely clear that a safe segregated cycle paths are needed, but in case of Gandhinagar, the present cycle tracks are more concentrated along the touristic areas, who's core purpose is to increase the tourist inflow. This to an extent might increase the inflow of recreational uses but not utilitarian way, which the city has more potential to be used that way

with its limited geographic boundary, mixed use land use, wide roads and congestion free roads. Another, perhaps easier group to target are the college student population. With concentration of many colleges and research institutes in city, the inflow of young population has drastically increased in the last decade. As the student's we could not afford a car or two wheelers and who highly rely on infrequent bus services, bicycles can provide an excellent form of flexible transport.

Respondents in the contemplation group in our study already seemed to be aware of the benefits of cycling. According to the results, it was clear that their perceived barriers which are out of their control like the traffic, lack of cycle lanes and weather were the reasons due to which they do not cycle. It was suggested that these people need to be motivated and encouraged to develop an action plan towards them (DiClemente, 1984). For instance, when there are no cycle lanes these people may need assistance in determining and testing a good cycle route initially. Also, few strategies could be adopted by encouraging and incentivizing bi-cycle plans in the office to the employers to persuade employees to cycle. May be by adding bonus points to whoever checks in to office by cycling or well-organized cycling to work events and support with borrowing and buying a bicycle could be fairly simple strategies that may help to increase cycling numbers.

Respondents in our study, who we termed them as Maintainers, not necessarily used bicycles on a regular basis but had very positive attitudes towards cycling compared to other groups. As suggested by (DiClemente, 1984) that these people can be persuaded to cycle more often by means of positive feed-back and more of social support. Feedback information on issues such as fitness improvements and environmental or financial savings might have already increased the number of cycling trips made by those who already cycle infrequently. In our study it however showed that at least for commuters' cyclist, a focus on the flexibility of a bicycle might be more important than health and environmental benefits. This actually makes sense as flexibility benefits could be experienced directly during every single journey whereas health and environmental benefits of cycling can only be detected in the longer term and also could not be directly seen or have a major impact on individual behavior, In fact in our study, flexibility is the highest predicted factor explaining about 63% of the variance in Intentions. But unlike other cities in India, Gandhinagar has uncongested roads but speeding vehicles to which the cycles are sidelined towards the road ends with many irregularities which in turn slows down their speed. The problem of flexibility could be specially affecting the present two-wheeler and car riders, if they opted bicycle for their work, as they space out their timings according to their previous modes and could discourage them to further opting it again. Hence solving the issue for the quick transit could be important to get in more riders.

There is no one simple solution to how this problem could be solved, and it is also considered that cycles are not for all people as an alternative mode. If a person continues to choose the same mode, it might be for his own explainable reason. But it is important to try and find out what motivates them to change to a different mode. At this moment, bicycles seem to be undervalued. But as to increase cycling, it is necessary to make infrastructure changes and also influence people by portraying a positive image of bicycling among the society. Because at least in India, cycling is never going to be taken seriously by individual users, but if it is not perceived to be taken seriously by the authorities and the planners today, an opportunity to create a healthy and safe atmosphere for the remaining intended riders will slowly diminish along with the quality of traveling. At the moment, NMT has been just a part of many vision statements in many development plans, accounting on only tackling the symptoms (e.g., providing cycle facilities) but failing to tackle the underlying problems of societal disapproval and their complexities. Unless cycling is taken more seriously at an individual, regional as well as national level, it is unlikely that more people will cycle on regular basis.

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ANNEXURE

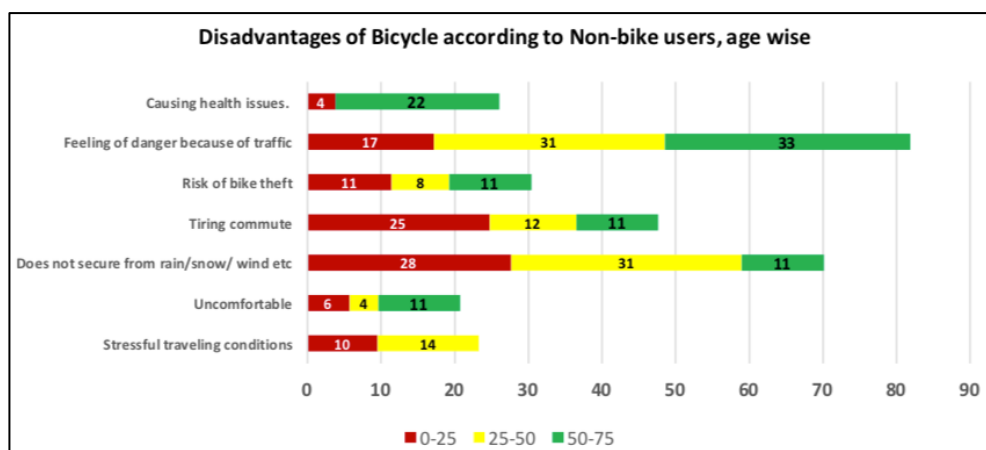


Figure: Disadvantages of Bicycle according to non-bike users, age wise

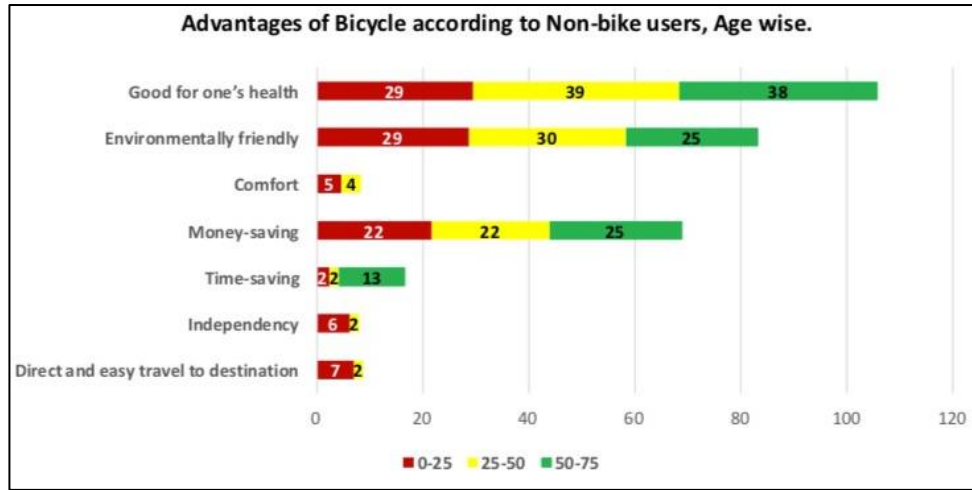


Figure: Advantages of Bicycle according to non-bike users, age wise

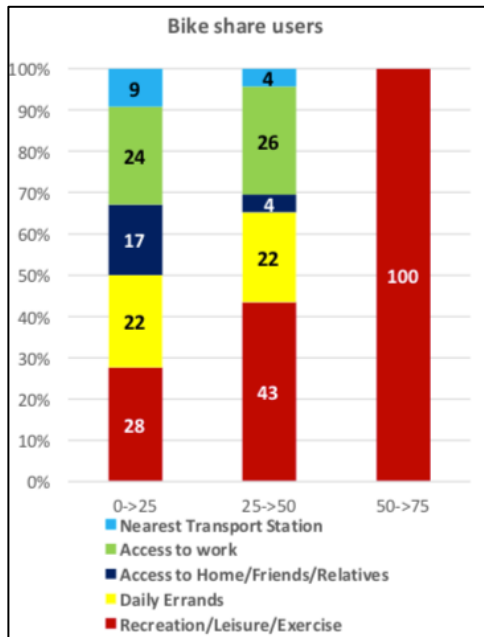


Figure: Bike share users about using the cycle

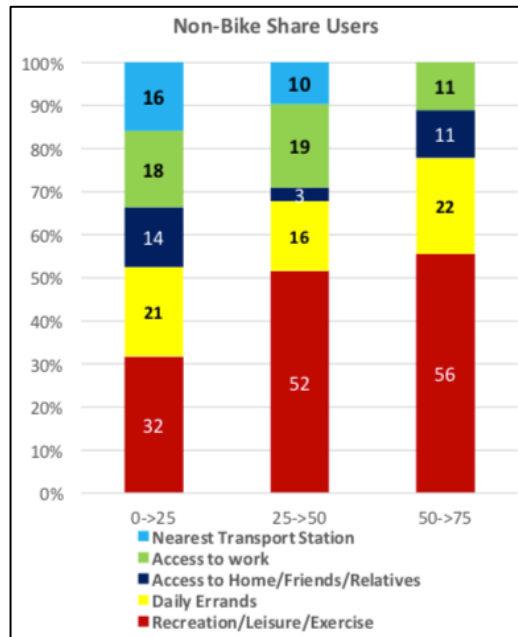


Figure: Anticipated use of the non-bike users

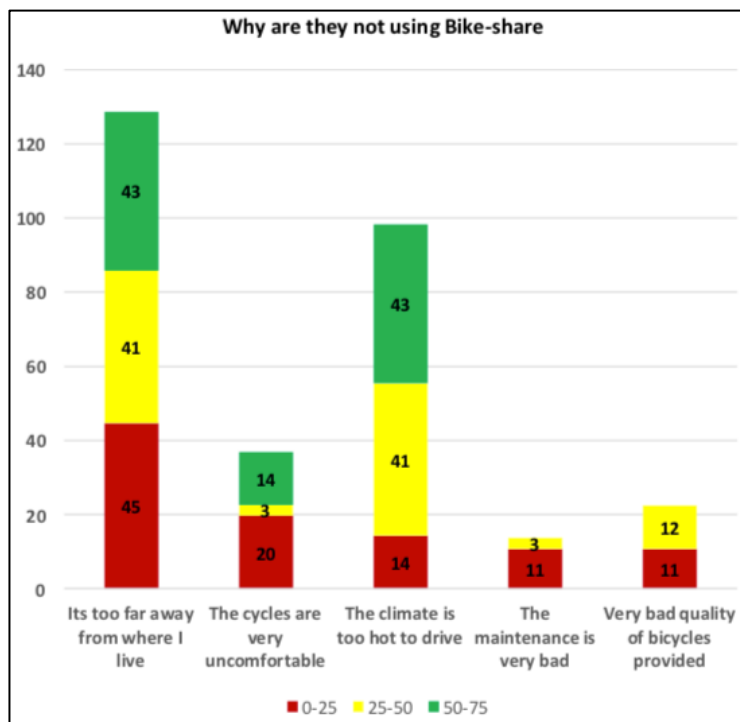


Figure: Replies on the reasons the non-users not using Bike-share