

# Gamification and Social Dynamics: Insights from a Corporate Cycling Campaign

Matthias Wunsch<sup>1,3</sup>, Agnis Stibe<sup>2</sup>, Alexandra Millonig<sup>1</sup>, Stefan Seer<sup>1</sup>,  
Ryan C.C. Chin<sup>2</sup>, and Katja Schechtner<sup>2</sup>✉

<sup>1</sup> Austrian Institute of Technology, Vienna, Austria  
{Matthias.Wunsch.fl, Alexandra.Millonig,  
Stefan.Seer}@ait.ac.at

<sup>2</sup> MIT Media Lab, Cambridge, MA, USA  
{agnis, rchin, katjas}@mit.edu

<sup>3</sup> Human Computer Interaction,  
Vienna University of Technology, Vienna, Austria

**Abstract.** Cycling is an essential transport mode in a well-balanced urban transportation system. While most approaches for achieving an increase from today's usually low levels of biking are focusing mainly on infrastructure measures and policies, this study presents the effects of the Biking Tourney, a bike commuting challenge between 14 companies aiming at motivating employees to commute by bike. This six-week study involved 239 participants using a socially influencing system for reporting commutes and watching the rankings. The frequency of bike commuting increased for 15 % of overall participants due to their participation. Within the subgroup of occasional bike commuters an even higher share of 30 % commuted by bike more frequently. Further analysis discusses multiple factors contributing to the engagement of employees in the tourney. As the results show the persuasiveness of the intervention, implications for a large-scale implementation are discussed.

**Keywords:** Low-energy mobility · Cycling · Behavior change · Transportation · Sustainability · Socially influencing systems

## 1 Introduction

Cycling is an essential transport mode in a well-balanced urban transportation system. The benefits of cycling comprise ecological, economic, social as well as individual advantages, e.g.

- Cycling is a carbon neutral form of transportation and requires only 1/30 of resources as compared to private motorized vehicles during its life cycle [1]
- Cycling provides major health and financial benefits both for the individual (low costs) and the economy as a whole
- Cycling requires less space than private motorized transport (about 10 % for parked vehicles and 60 % for moving vehicles [2]).

However, despite the documented advantages of cycling, in many cities there is still a very small share of cyclists. A range of different barriers to cycling are responsible for

the fact that cycling is not perceived as a legitimate form of transport. As many of these barriers are based on individual perceptions and emotional aspects such as fear of the feeling of insecurity, the provision of cycling infrastructure and access to bikes is not sufficient to convince a large number of people to start biking. Thus, there are several initiatives to promote biking through e.g. gamification and socially engaging approaches in order to motivate citizens to voluntarily switch to more sustainable modes of transport [3]. Examples of campaigns applying game elements like competition or cooperation show promising effects [4]: e.g. the annual Austrian cycling campaign “Bike to Work” engages thousands of bikers each year. Part of this success is believed to be related to the boosting effect of having small teams in the campaign, which mutually encourage themselves to take as many bike trips as possible. In comparison, prizes that are provided as part of the campaign are playing a less important role for motivating participants to bike more. The actual social dynamics and processes leading to behavior changes [5] are still barely examined. Particularly the effectiveness of initiatives aiming at creating/stimulating behavior change in the absence of any tangible incentives needs to be studied further.

A pilot study as part of the research project “Persuasive Urban Mobility” showed that the gamification of cycling, when cycling becomes part of a wider competitive challenge against the self and others, gives promising results regarding the increase of bike trips among participants [6]. Previous research from McCall et al. [7] and Jylhä et al. [8] support these results.

In this paper, we present the outcomes of an approach providing organizations with a socially influencing system for engaging their employees in a biking competition. We chose this approach to investigate how social dynamics evolve in organizations through gamified biking campaigns, which enable better scalability compared to reaching out to individuals themselves. In particular, the following research questions have been addressed:

- Are group dynamics and the elements introduced with the competition sufficient for increasing specific bike use?
- What overall effect on the level of biking can be observed for different types of bikers?
- To what extent can socially influencing systems designed for competition engage employees in commuting by bike?

The next section outlines the design of the study, followed by a description of the methodological setting. The main section provides the detailed evaluation results for the study, and the concluding discussion highlights the learning of this approach in relation to previous findings and the implications to be considered for similar future interventions.

## 2 Study Design

Within the presented study, a six week lasting intervention: the “Biking Tourney 2015”, we designed as a socially influencing system [5] to drive competition [9] between organizations. In this approach, companies serve as communities, thus provide

a shared identity for their employees. By that, social interactions and mutual encouragement for biking are facilitated. Apart from the competition and related information (website, emails), no extra incentives were provided to the companies or participants.

The design of the tourney included four different categories related to bike usage in which the participating companies were ranked. Actual mobility data was gathered using a self-reporting web application. The categories aimed to reflect the goals of the tourney of encouraging citizens to bike instead of using high-energy means of transportation. Three of the rankings were introduced at the beginning of the tourney: (1) “Bikers”, reflected the share of biking employees and should encourage for participation as well as for motivating others to join the tourney. (2) “Average distance”, reflected the effort a company’s employees invested in the tourney while not being influenced by the actual employee count of a participating company. (3) “Total distance”, honored the total contribution of the biking employees which, however, clearly favored bigger companies. After the initial three weeks, the fourth ranking called “enthusiasm” was introduced, which showed a score of the change in the share of bikers over time. Thereby companies with low drop-outs and employees joining even after the official start were higher ranked. Figure 1 illustrates the graphical representations of three categories which were provided to the participants during the tourney.

The different ranking schemes were designed in a way that they also compensate for potentially demotivating settings for participants, for instance being in the lower ranks, or having a disadvantage because of the company size. This was based on the assumption that when providing several rankings a low standing in one of them is not as demotivating as in a single category design. The hypothesis is that a competition among organizations would provoke cooperation among employees in each organization. Furthermore, the use of publicly displayed rankings in common areas of the companies – as shown in Fig. 2 – should raise awareness of the tourney and facilitate [10] commuting by bike.

### 3 Methods

**Intervention Context.** After contacting 227 companies, a total of 14 companies took part in the Biking Tourney, with employee counts from 17 up to about 10,000. All companies or their respective local offices were located in the Greater Boston Area (MA, USA). The companies did not receive any incentives for taking part in the study. The Biking Tourney took place in September and October 2015 and lasted for six weeks. The weather during the intervention period was generally described by the participants as good biking weather except for one week with several rainy days.

**Sample.** The Biking Tourney had overall 239 registered users, with a mean age of 39 years (SD: 11 years), consisting of 18.6 % (44) female, 81.0 % (192) male and 0.4 % (1) non gender specific participant. The domination of males can be partly explained by the fact that the company with the most participants has a male-dominated workforce (about 70 %). Furthermore, the overall share of male bikers is higher in the US, similar to many other countries. [11] The mean commuting distance - home to work - was 7.7 km (4.8 miles) with a standard deviation of 6.1 km (3.8 miles). Based on a survey

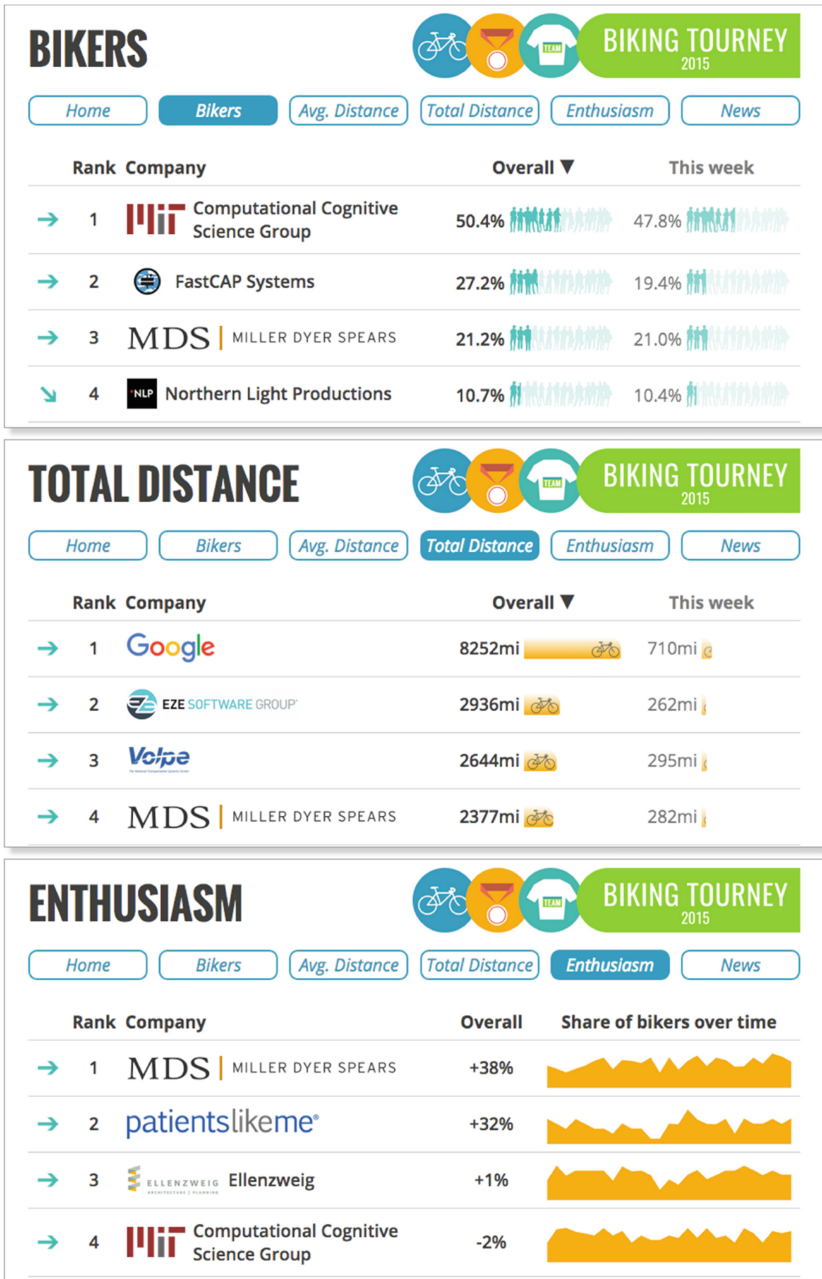
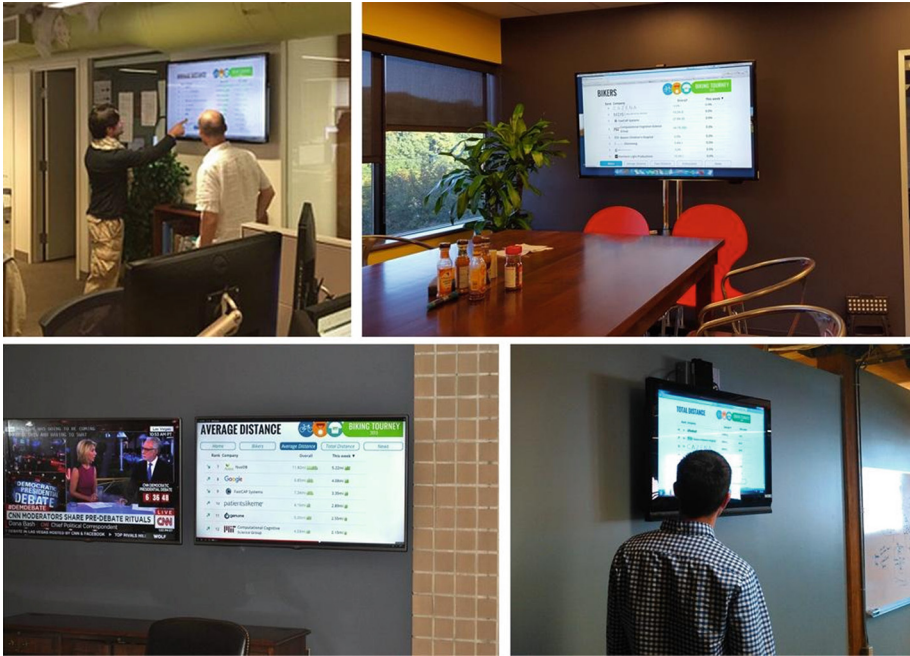


Fig. 1. Screenshots showing the rankings for bikers, total distance and enthusiasm



**Fig. 2.** Public displays with the tourney rankings in the participating companies

the participants took during the sign-up, 60 % were usually bike commuting on an almost daily basis, 24 % were usually commuting by bike up to several times a week, and 16 % were using their bike less often than that. All of the participants had been commuting by bike before the tourney. Out of all study participants, 127 filled out the ex post survey. For them, the mean age was 39 years, with 17 % (22) female and 83 % (104) male participants.

**Data Generation.** Quantitative data was gathered by pre- and post-intervention online surveys, where all participants had to fill out the pre-intervention survey during the sign-up for the tourney whereas participation in the post-intervention survey was done voluntarily. The surveys contained standardized questionnaire items for descriptive statistics and cross-tabulation. The post-intervention survey also contained a set of open questions regarding the overall effect of the tourney on one's commuting routines. Furthermore, nine qualitative interviews with the company representatives, i.e. our contact persons for each company, were conducted during the Biking Tourney.

It was a major goal to ensure that participation of companies and employees would be as effortless as possible. Therefore, the reporting of trip data for a time period before the tourney was not mandatory. Self-reported data on daily choices of mode of transportation were hence used to calculate the standings in the tourney but was not analyzed for gauging the intervention effect due to the lack of pre-study- or control-group data.

**Analysis.** Cross tabulation is used to highlight the effects within the intervention for different types of participants. Qualitative data from the interviews and from the open-question pre- and post-questionnaires was structured and analyzed according to a thematic analysis [12].

## 4 Results and Discussion

Participants of the Biking Tourney have been very positive about the intervention design. The question: “Overall, how did you like the Biking Tourney?” on a scale ranging from 1 “Not at all” to 50 “Very good” the mean rating was 35.5 [SD = 9.8]. Regarding mode shifts due to participation, a reduction of car use was reported by 11 % of the respondents and 17 % stated to have reduced their use of public transportation. Furthermore, out of all participants answering the post-intervention survey, 19 % planned to commute by bike more often or continue to do so and 78.6 % planned to continue to do their commute as they did before joining the tourney. As for these results one has to keep in mind that a self-selection bias has been likely introduced through the selection of participants and the voluntary nature of the post-study questionnaire.

### 4.1 Motivation for and During Participation

Cooperation among employees of each organization was a driving factor for participation, with 45.7 % of participants crediting “team spirit /participating together as a team” and 41.7 % saying that their colleagues were motivating to them. A total of 29.9 % agreed with “joining as a way to motivate others to bike”, highlighting the cooperative effect within the companies. *“I bike most every day anyway. I do appreciate the encouragement for others.” (#205).*

Personal health benefits were a relevant motivator for 40.9 % of participants, the available statistics did motivate 34.6 % of participants and competition with other companies has been a motivator for 34.6 %. Although often mentioned in relation to biking, environmental benefits were the lowest ranked motivating factor with a share of only 27.6 %. Of course, for most participants a mix of motivators was present: *“The tourney gave me more incentive to bike during the week as the exercise is good, faster than transit, and more reliable.” (#48).*

**Colleagues as Persuaders.** The level of engagement and activities of the company representatives varied to a large degree. All of them sent out informational emails to their colleagues, but some were more eager and actively engaged their colleagues to participate regardless of their otherwise used mode of transportation. In order to support this, some companies used specific mailing lists, handed out flyers or set up social media groups. This shows that the Biking Tourney did provide a framework for persuading their colleagues within a company to regularly commute by bike or try out doing so. Because of that, having companies as a proxy for such an intervention appears to be an effective way for increasing scalability.

**Advocacy.** Another motivator for participating was advocacy for improved bike policies. Company representatives and decision makers as well as individual tourney participants stated that they want to signal to the city that there is demand for better infrastructure for utilitarian biking. *“Hoping that the statistics will improve safety for cycling and bring attention to improved urban planning for commuting on bike in Greater Boston.” (#76).*

#### 4.2 Change in Frequency of Bike Commuting

Users of the Biking Tourney reported their preexisting frequency of bike commuting at the sign-up process for the tourney. Based on this, three groups of participants can be identified: (1) Occasional bikers, commuting by bike monthly to weekly, (2) regular bike commuters are those commuting several times per week by bike and (3) daily bike commuters. Notably, the latter two groups represent 84 % of the tourney participants and are slightly overrepresented in the ex-post survey with a share of 90 %. Furthermore, all Biking Tourney participants stated that they commuted by bike before, implying that the tourney did not encourage non-biking employees to try to commute by bike. By that the intervention did mostly “preach to the converted”. This could have been caused by the overall approach of a competition oriented design which might be more attractive to existing bikers.

Table 1 represents the reported change during the Biking Tourney. These changes are based on survey data rather than self-reported trip data as no pre-intervention mobility data was collected. While 78.7 % of participants remained at their level of bike commuting, overall 15 % reported an increase in doing so. This compares to only 4.7 % reporting a decrease in bike commuting. By that, a persuasive effect shifting

**Table 1.** Reported change in frequency of bike commuting

	Occasional bikers	Regular bikers	Daily bikers	Full Sample
	Survey (total) 10 % (16 %)	Survey (total) 22 % (24 %)	Survey (total) 68 % (60 %)	100 % (100 %)
Usual frequency of bike commuting	Monthly to weekly	Several times a week	(Almost) daily	
Change during Biking Tourney				
Biked more often	30.8 %	25.0 %	9.3 %	15.0 %
Biked the same	61.5 %	57.1 %	88.4 %	78.7 %
Biked less often	0.0 %	14.3 %	2.3 %	4.7 %
Other	7.7 %	3.6 %	0.0 %	1.6 %
Total	100.0 %	100.0 %	100.0 %	100.0 %
Number of survey respondents	13	28	86	127

Survey question: “During the Biking Tourney...” (a) “I commuted by bike more often than usually.” (b) “I commuted by bike as often as before.”(c) “I commuted by bike less often than before.” (d) “Other”

daily transportation choices towards biking is indicated. A comparison by group shows that the increases in bike use were most present for the occasional (30.8 %) and regular bikers (25 %). This does not come as a surprise, as these were the participants with a higher potential for such increases.

**A Trigger for Commuting by Bike More Often.** The collected qualitative data supports these findings shown in Table 1, with some of the occasional bikers trying out to commute by bike: *“I took bus before but was pleasantly surprised how much faster taking bike was.”* (#276) But while this leads to an uptake of a new commuting habit for some, other came by bike to *“[...] try it out and support the regular bike commuters in my office”* (#286), but stopped doing so after the tourney. Regular bike commuters commented about the motivating effects on their colleagues as well: *“The Biking Tourney is a great boost for folks who were considering bike commuting and who needed a little push.”* (#93).

**Commitment for Commuting by Bike More Often.** For occasional bikers, the tourney acted as a mean for making bike commuting more of a habit. *“Last spring the Mass Bike Challenge helped me realize that I could bike the 12 miles each way. The MIT Media challenge helped make it more of a routine.”* (#86) *“Due to the tournament, I did seek out a safe route to cycle into work and will use it more often as a result.”* (#76) Furthermore, the tourney acted also as a commitment system for increasing ones bike commuting frequency: *“I have always wanted to bike in pretty much every day. Biking tourney got me moving towards that goal.”* (#176) *“It definitely helped as motivation to get on bike more often.”* (#36).

Another effect of the commitment to the tourney was that participants biked even on days with bad weather. *“Some of my office mates made a bigger effort to bike. [...] It was exciting to see so many of our fair-weather bike commuters take the plunge into cold and wet riding on the days that rained.”*(#50).

**Commuting as Always.** Most participants (78.7 %) continued commuting by bike at their usual level, indicating no change due to the tourney. *“I always bike to work, so it was the same as usual.”* (#50).

**Commuting by Bike Less Often.** A small amount of participants (4.7 %) reduced their amount of bike commuting, but this was mostly due to temporary external causes such as business travel to other places, illness or technical problems with one’s bike.

## 5 Conclusion

This study investigated the effects of competition and cooperation on overall engagement which adds to the knowledge about the social dynamics within initiatives as the Biking Tourney. The mutual encouragement present in most participating companies made employees join. While a large part of actual participants were already commuting by bike on a daily basis, the induced social processes did also motivate non-regular bikers to participate in the Biking Tourney. By that, the tourney was able to set the stage for triggering an increase in bike commuting for 15 % of overall participants, with almost a third of the subgroup of occasional bike commuters and for a



quarter of the subgroup of regular bike commuters increasing their bike use. Qualitative data showed the importance of the competition between companies and the cooperation within companies for the overall engagement in the tourney.

Future large scale implementations of the presented study design should consider that the share of occasional bikers, i.e. participants that usually bike once a week or less than that, has been lower and the behavior changing effects were smaller than in previous studies [6, 13]. A different framing of this intervention that is more inviting to non-regular-bikers or non-bikers might help to get more of them involved. Furthermore, companies as a social-group might not be as effective as small teams for producing mutual encouragement between participating employees.

As a behavioral intervention the Biking Tourney can be easily scaled-up, making it a viable option for communities or cities for promoting sustainable transportation. By that it has the potential to benefit organizations, communities, societies, individuals and research alike.

**Acknowledgments.** The authors gratefully acknowledge Kent Larson and Geraldine Fitzpatrick for their advice and support within this research project. Our special acknowledgement is due to Chengzen Dai, Felipe Lozano-Landinez and Francesco Pilla for their contributions to this research and their help in conducting the presented study.

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