STATE OF TRANSPORTATION PLANNING

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NEW TRENDS

Using Gamification to Provide Transport Behavior Incentives

By Scott O. Kuznicki, P.E.

INTRODUCTION

Imagine you've been asked to sort a stack of paper forms. As you wade through the dozens of variously-colored sheets, your mind wanders. Boredom sets in. Eventually, you just can't handle it any longer and so you grab your mobile phone and start playing Candy Crush.

Then it hits you: Isn't this the same thing as sorting a stack of papers? It's simply moving them around so they are all next to each other? Turning this process into a game with animation, ease of use, and immediate rewards transformed the mundane experience into something exciting, engaging, and, certainly, far more desirable.

Population growth and the growth of urban megacenters have placed enormous burdens on transportation infrastructure, particularly the freeway systems that function as the backbone of the trans-portation networks in many cities around the globe. Transportation planners have sought to mitigate the congestion on freeways by providing options such as transit and carpooling, limiting the supply of parking leading to increased cost, and increasing the price of using the freeway through various taxes, fees, and tolls. Some transport agencies work to reduce peak-period commute trips through various programs that provide for flexible employee schedules and work locations. While none of these actions address a structural deficit in capacity that exists, they are widely seen as partial mitigation to the problem of congestion, often by providing options that did not previously exist.

These actions encourage a change in mode, route, and/or time of travel. In general, they act on users' perception of known costs. Users recognize that they will save money on fuel and parking by choosing a different mode or working

from home. They see that they will save time by traveling earlier or later. In cities with reliable and freQuent public transit, workers find intangible benefits, as well, such as working or relaxing en route. What these forces often do not accomplish, however, is helping users understand all of the hidden costs associated with various choices. Furthermore, the result of each individual vector, that is encouragement or force to shift behavior in a particular direction, is limited by price elasticity, user preferences, and other factors. In fact, vectors can often cancel a user trend in any given direction.

Exploring the intercept of transportation system performance and the human desire for social interaction and

competition led Transpo Group to recommend a "gamification approach for improving transport system performance to a large transport authority in the Middle East. Our approach came about not after sorting papers, but in recognition the region's high data-connected mobile cellular device penetration. Using this asset to drive behavior would capitalize on a distributed non-infrastructure solution that was already accepted in the region for the purposes of transport information, navigation, fare payment, and even fines and fee management and payment.

GAMIFICATION

Gamification of regular tasks can be an innovative approach to influence human behavior and encourage compliance with rules and improve efficiency. Providing aspects of a typical mobile device gaming environment such as goals, incentive, animation, and reward can motivate people, increase brand and product loyalty, and bring a sense of accomplishment.

The purpose of gamification in the transport environment is to help users recognize and act on costs that they do not typically consider in making a transportation choice. It also provides the ability for users
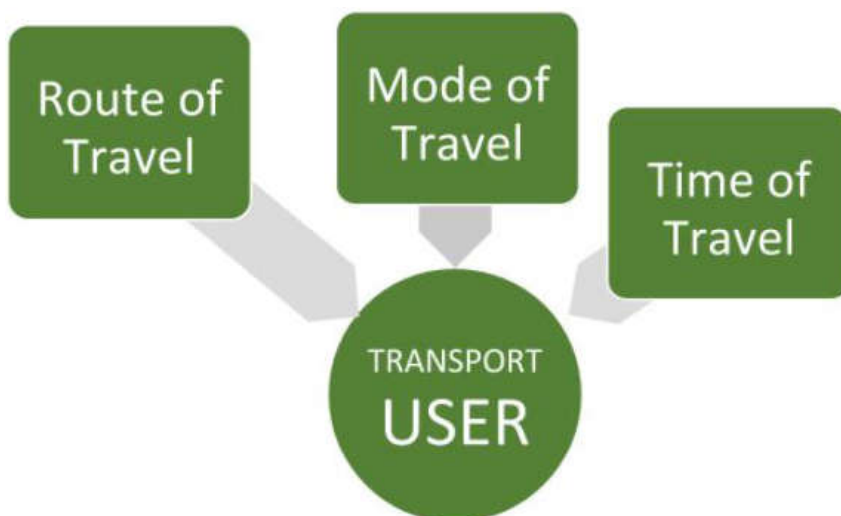

Figure 2. Gamification can be used to enhance a particular vector and drive user choice. It can reduce the effect of other vectors that are likely to have undesirable outcomes if not managed, such as a shift to a routing with limited capacity and greater propensity for social impacts. (Transpo Group, 201)

to accrue rewards that provide incentives for considering future travel choices. Costs that are not typically considered or directly known include point-source carbon emissions, impacts to other users and network performance, personal and public health, impacts to maintenance and operations, and even the user's own emissions profile. Avoiding stop-and-go traffic on a motorway, for example, and using an arterial roadway with a coordinated traffic signal system and a more constant travel speed may result in marginally-improved fuel economy but much less in the way of emissions.

In our research with leading global consultants on gamification, transport demand management, and human factors in user behavior, we determined that gamification has not been deployed on a network-level scale to address user choices in transport. We believe there is a high degree of applicability and, more importantly, we see gamification's key role in providing another means of vectoring user behavior. The gamification platform can amplify incentives for mode choice, for example, to overcome other influences that cannot be altered without dramatic and undesirable social and economic impacts.

SYSTEM DESIGN AND USER INTERFACE

The architecture of the system envisions integration with all transport agency data collection and dissemination functions, including ties with major navigation service providers. The core of the system is a deep learning platform that can accommodate millions of users, collecting data from the transport system monitoring and control functions in addition to collecting data from users themselves. This deep learning system relies on a massive data collection to understand system performance on how various choices can be manipulated to achieve certain outcomes—in this case, the likelihood of altered choices is also learned by the system based on user behavior and various feedback mechanisms. The primary interface for the public is the mobile application, which will provide security and authentication for each user. The mobile application will allow users to view commute choices and choose their route based on time of travel, cost of travel (including external costs previously not easily known), and earn points for various choices.
The application will provide contests and campaigns that are aimed at various commuters, based on usage statistics and transport system per-

formance needs. Complex games will be avoided, as will game interface during vehicle operation. The points users earn will be credited to a user account and may redeemed for tokens, social media engagement opportunities, and products and services provided by the transport agency or other government agencies. The app will be similar in appearance to and likely integrate with many ma□or navigation apps available today. Branding and packaging would be done in a fashion that engages people from a wide variety of cultural, economic, and social backgrounds. The experience will be customized to users who meet specific profiles, at the users' choice, in order to best serve users with a values system that appeal to their specific desires and likely patterns of behavior.

Any applications, games, competitions or campaigns put in place as part of the gamification scheme must be kept current and novel. Goals and rewards should be relatively easy to achieve in order to trigger more interest and use. Users will complete the end goal or status level of a game or an application relatively □uickly and be prepared for new games and rewards. The introduction of continuous new gamification strategies and applications is important to maintain the momentum and a very high level of engagement.

USER ENGAGEMENT

Two kinds of user engagement are envisioned. The □spot□ user engagement is what occurs as the user chooses to use the app and relies on it for directions, feedback, and motivation. The long-term user engagement is the overall system of incentives that retain user interest and encourage complete saturation of the user's trip planning and execution efforts.
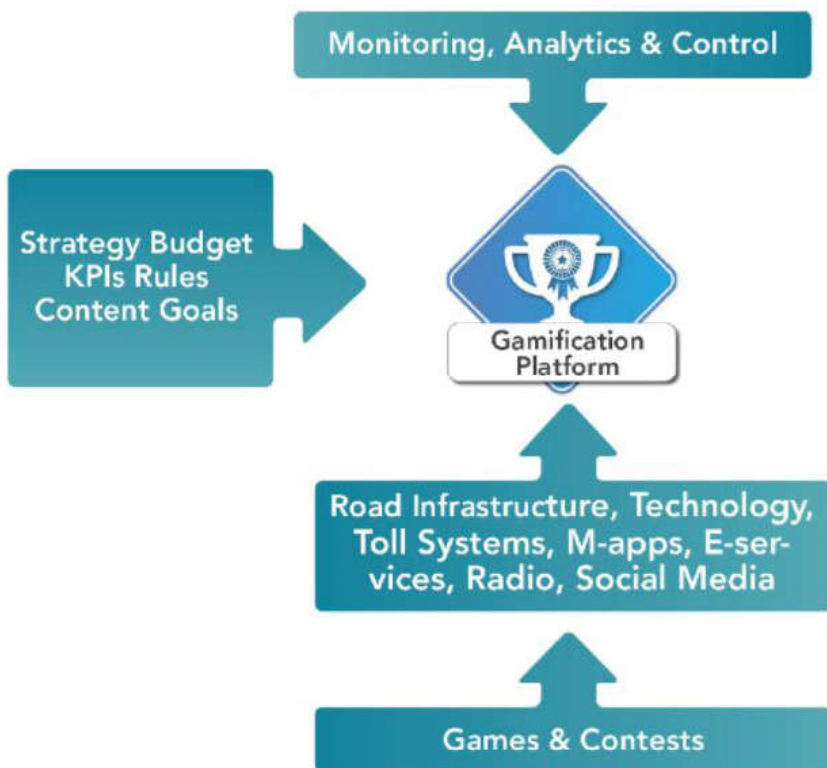
Figure 3. The gamification platform is complex but the user interface is one single app. A systems engineering process is essential for constructing a platform management architecture that ensures data inputs are managed at the appropriate level and key performance indicators (KPI's) are appropriately selected and aggregated. (Transpo Group, 201□)

No technique or system deployment will allow or instruct the driver to look at or use the mobile devices gamification functions while driving. In fact, it is even possible to deny rewards to game users who pick up the mobile device while operating a vehicle. Visual cues can easily be replaced with auditory cues and even in-vehicle telematics integration with heads-up displays and other vehicle communications systems.

USER REWARD AND SOCIAL INTERACTION

Agencies need a fourth vector that can act on incentives for mode, route, and time choices. Active engagement with inverse pricing by means of the point system is the key vector that can drive choices where elasticity of price is insufficient. Because the users earn more points for more positive behaviors that best assure the public good, personalized interaction will deliver innovative and exciting rewards.
For example, in some urbanized areas, travel is restricted based on cordon zones or license plate number schemes. However, users who forego their assigned travel days could store up points and use those to buy into the system for personal automobile travel on another day when a penalty

would be assessed, ensuring access to medical care or other appointments that cannot be kept with transit. Users will receive a personalized service that is tailored to their preferences, travel choices, and travel patterns.

The gamification platform is a tool for exponential leverage of the existing means of achieving desired user behavior. For example, if users receive points for choosing an alternate route but too many users begin to choose that route, it might affect toll revenue on the favored motorway. Lowering the incentive value (the points offered) may drive traffic back to the motorway, in particular, traffic that is willing to accept the price of travel on the corridor. The use of these multi-source incentive vectors allows for much greater influence over user behavior and enables fine-tuning of available incentives and disincentives to increase revenues and further optimize the use of transportation network.

The social media revolution has made competition with friends and society extremely compelling to users of various online games. Beyond travel choices, using social movements and even social stigma can be an effective means of changing behavior, including driving behaviors such

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IMPACTS

Increase awareness concerning impacts of choices

INCENTIVIZE

Incentivize specific and explicit social behaviors

SOCIAL PARTICATION

Drive participation in high-value social campaigns

Figure 4. Three main outcomes of gamification are integrated as goals of the gamification platform. In fact, the outcome of social participation is often seen as a driver for social behavior. For example, campaigns intended to address impaired driving often rely on social stigma generated from social participation in group activities. (Transpo Group, 2018)

as following too closely and lane discipline. Additionally, user behavior such as alcohol abuse coupled with driving has been altered significantly where traffic safety campaigns have included a social stigma element. The power of social media engagement and user behavior is a key component of the gamification of transport choices.

AGENCY CONSIDERATIONS

For the agency implementing the gamification system, a change in organizational mindset will often be necessary. Communications integration both inside and outside of the agency requires new ways of approaching data security, access, and licensing. Integration with the agency's enterprise command and control center or similar traffic management and operations facility is essential, if only to ensure that enterprise transportation management is availed of all applicable data. Data feed to other providers can also provide the impetus for the development of apps entirely around the gamification platform. Additionally, user sentiment and behavior can only be understood with a high degree of certainty when there is user trust. This points to the key consideration of user data security and total protection

of user information on route choice and travel patterns, in addition to a robust protection against GNSS "spoofing" and other compromise vectors. Users will also want to be able to liberate their data and, if they choose, provide that data to other providers in exchange for payment and/or services. The budget impact of implementing this system can be recovered with advertising, transit farebox recovery rate increases, and the offset of new infrastructure improvements. Because it generates the most efficient use of the infrastructure and builds support for increased funding, the optimization of user experience and infrastructure investment promise to lower the overall societal cost of providing transport.

The current models of travel demand management have failed to adequately inform users of the real-time external and unknown costs of transport-related decisions. Primarily, using user avoidance of these costs to structure a reward system provides for positive reinforcement and flexibility in allowing the transport user to decide based on information that can be readily understood by means of the value assigned by points. Heavy-handed restrictions, onerous pricing schemes, and deliberate capacity restriction

frustrate users and lead to dissent concerning the funding of transport improvements, particularly for competing modes. Building user appreciation and excitement, on the other hand, by rewarding socially-responsible transport use with gamification systems, promises true transportation choices and incentives for the choices that benefit the overall system in any situation.

Scott O. Kuznicki, P.E., is the Director of Safety and Mobility Technology Solutions at the Transpo Group. In his global role of project management and business development, he primarily works with public agencies and private clients to prepare organizations for automated vehicles integration and mobility-as-a-service. He has led autonomous vehicle and transportation system management projects in the Middle East and in the United States. His extensive experience in traffic operations aids his work on integration of data management and learning technologies into transportation system performance analysis. He has earned a pilot's license with an instrument rating, is a certificated UAS operator, and holds a Bachelor's Degree in Civil Engineering from University of Wisconsin – Platteville.

Figure 5, Sample of how various rotes and mode choices result in points earnings in a given game campaign. (Transpo Group, 2018)

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