A Shikake as an Embodied Trigger for Behavior Change

Naohiro Matsumura

Graduate School of Economics, Osaka University

1-7 Machikaneyama, Toyonaka, Osaka, 560-0043 Japan

Abstract

A shikake is an embodied trigger for behavior change to solve social or personal issues. In this paper, we give a general statement regarding the concept of Shikakeology as the science of shikake. The mechanism behind a shikake covers a wide range of physical and psychological triggers. From a shikake point of view, physical triggers are used to ignite psychological triggers, and psychological triggers work as a driving force for changing behavior. We will describe four simple shikake cases to explain the concept of shikake as well as the mechanisms of triggers. We choose to use case studies to make readers understand the mechanism of shikake as a starting point. We also present the idea of a Shikakeology ecosystem, which is a feedback loop between citizen science, academia, and education.

Introduction

"*Shikake*" is a Japanese word with various meanings interpreted depending on the context. According to Shogakukan's Progressive Japanese-English Dictionary, shikake means a device, mechanism, contrivance, and system as a noun, and to start, set up, prepare, and challenge as a verb. In this paper, we use "shikake" to describe a complex merging of these definitions to develop an approach to change, induce, nudge, and trick attitudinal and actional behavior to solve social or personal issues.

The social or personal issues that we are targeting range from personal topics such as dietary habits, exercise, and education to public topics such as crime prevention, traffic safety, and ecological preservation. As these issues are results of our own behavior, changing behavior is a straightforward approach to solve them. This is really what a shikake is aiming to realize.

In contrast to the shikake-driven approach, we might consider a superb high-tech device that automatically solves issues without people's help. However, such a high-tech driven approach is feasible if and only if the device can be created. Practically, this is not a realistic choice in most cases since it requires much effort in terms of fabrication cost, expertise, and technology. Ordinary people cannot af-
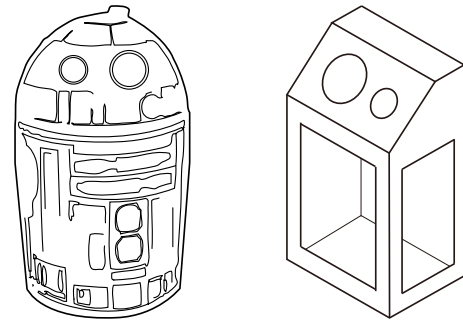
Figure 1: High-tech trash bin and transparent trash bin.

ford to spend such effort to solve their personal issues, and of course, people rarely make such devices by themselves.

Let us consider a simple example of garbage separation. Figure 1 shows a trash bin with a built-in high-tech device that can automatically separate plastic bottles and cans and shows a trash bin with a transparent structure. The transparent trash bin does not seem particularly special, but it encourages people to separate bottles and cans more than a normal, nontransparent trash bin (IPROS 2004). In the case of the transparent trash bin, what people throw in is visible to others, and that elicits prosocial behavior because people do not want to lose face and thus their self-esteem. Also, the garbage in the transparent trash bin becomes a social norm that many people separated correctly. Deviation from the social norm needs a special reason. In this way, the transparency of a trash bin becomes an effective shikake to make people aware of their behavior. Getting back to the original topic, it is obvious which trash bin is a more realistic approach to garbage separation. The main problem is the cost. Ordinary trash bins could not all be replaced with high-tech trash bins because of the initial deployment cost and maintenance cost, whereas transparent trash bins are much cheaper than high-tech ones and could replace all ordinary ones. In fact, the Central Japan Railway Company replaced about 1,600 ordinary trash bins with transparent trash bins. Thus, the shikake-driven approach is a much more feasible and realistic choice in our daily lives.

Cost is not the only advantage; human behavior is superior to high-tech devices in term of functionality, since

human beings are much more functional than high-tech devices. In terms of vision, operation, and mobility, our eyes, feet, and hands are superior to computer vision, robot hands, and wheels at recognizing objects, moving to a destination, and interacting with objects under various environments. For these advantages of both cost and functionality, most social or personal issues can be solved by our behavior.

As we already explained above, the fundamental mechanism underlying a shikake is simple. This merit of a shikake is it enables ordinary people as well as experts to make their own shikakes to solve their own issues with their best efforts. Those who have enough money and/or skill can make an advanced shikake, whereas ordinary person can create a simple shikake. From a pervasive point of view, giving ordinary people the opportunity to make a shikake is quite important since there are many more ordinary people than experts.

This paper aims to give a general statement regarding the concept of *Shikakeology* as a science of shikake in order to understand the underlying mechanisms. In the following sections, we first define the meaning of shikake in the study of Shikakeology. We then introduce the mechanisms of behavior change from precedence studies, followed by concrete shikake cases. We then explain the concept of the Shikakeology ecosystem and conclude this paper by describing future work.

Shikake Definition

The original meaning of shikake is ambiguous as a technical term. In the context of Shikakeology, we define a shikake as the following three factors to clarify the meaning.

1. A shikake is an *embodied trigger* for behavior change.

2. The trigger is designed to induce a *specific behavior*.

3. The behavior solves a *social or personal issue*.

A shikake should be practical rather than academic or theoretical. That is why we emphasize "embodied trigger" to distinguish it from the ambiguous usage of "trigger" in factor 1. Here, we consider an embodied trigger as an artifact that is perceivable and desirable. Also, a shikake is not a trap to force or trick people, but a way to encourage people to change their behavior by presenting them with possible alternative behaviors explicitly or implicitly. The alternative behavior needs to be carefully designed because the induced behavior becomes an approach to the issue to be solved. That is why we emphasize "specific behavior" in factor 2 and "social or personal issue" in factor 3.

One important point is that the objectives of target people and shikake designers do not necessarily match. In the trash box example mentioned in the previous section, the objective of target people is not to lose face by deviating from social proof (i.e., copying the actions of others in order to behave in socially acceptable way). On the other hand, the objective of the designer is to improve the accuracy of garbage separation. These objectives do not match, but the shikake works to solve the issue.

Psychological and Physical Triggers

A shikake has two aspects: a psychological trigger and a physical trigger. A fine combination of these triggers becomes a superb shikake to change people's behavior.

Psychological Triggers

Psychological triggers affect our psychological preference. The power of social influence has been investigated mostly in experimental settings for decades. Solomon Asch conducted experiments in visual judgment and revealed that social forces easily alter people's opinions (Asch 1955). Stanley Milgram also investigated that conformity increases as a function of group size through experimental results that showed the more people in a crowd were looking up at a building, the more passersby joined the crowd (Milgram, Bickman, and Berkowitz 1969). Robert Cialdini described in his book how people are influenced and persuaded as a result (Cialdini 2006). He categorized various cases regarding behavior change into six main factors: reciprocity, authority, social proof, commitment & consistency, liking, and scarcity. Richard Thaler and Cass Sunstein described in their book "Nudge" how people can be nudged to make the world better especially in terms of health, wealth, and happiness (Thaler and Sunstein 2009). They explained various cases in accordance with six principles of good choice architecture: incentives, understanding mappings, defaults, give feedback, expect error, and structure complex choices. B.J. Fogg's behavior model explained that three elements (motivation, ability, and trigger) must converge at the same moment for a behavior to occur (Fogg 2009). In his model, a trigger that is a reminder of a habitually associated action should be designed first. If the trigger does not work, six ability factors should be tackled next: time, money, physical effort, brain cycles, social deviance, and non-routine. If these factors do not work, the final approach is motivation. B. J. Fogg also proposed an approach for persuasion by using a computer and revealed persuasive techniques in the domain of software applications and mobile devices (Fogg 2002). Gabe Zichermann described game mechanics as a technique to encourage people to become involved in activities (Zichermann 2011). Game mechanics stimulates human desires such as reward, status, achievement, self-expression, competition, and altruism by designing a system that controls points, badges, levels, challenges, leaderboards, goods, quests etc.

Physical Triggers

Physical triggers work directly and indirectly. As a direct effect, a physical trigger is realized by good visibility of function that enables people to understand intuitively the usage and expected results. For example, a door with good visibility of function tells people 1) opened or closed, 2) locked or unlocked, and 3) push or pull or slide right/left/up/down. If these functions are obscure, the visibility is inadequate and needs to be improved. A shikake should have good visibility because it has to induce appropriate behavior. Such a perceived function, which enables people to perform an action, is named "affordance" by Donald Norman (Norman

2002). He later coined the term "signifier" instead of "affordance" to make the vocabulary more precise; a signifier is some signal in the physical and social world that can be interpreted meaningfully (Norman 2010). Louis Sullivan proposed a principle known as "form follows function", where the shape of an object shows the purpose of the object (Sullivan 1896). The concept was first applied to architecture and then spread to other design fields, such as product design, automobile design, and enterprise business architecture. The principle is also considered as a direct physical trigger.

A physical trigger as an indirect effect works as an ignition of a psychological trigger. For example, the transparent design of the transparent trash bin works as a physical trigger to cause the senses of social proof and self-esteem. In this case, these senses considered as psychological triggers are ignited by the physical trigger. We previously proposed the concept of Field Mining as a methodology to reconstruct relations between human, objects, and the environment for the purpose of growing "imagiability" of the field by accumulating the findings of attractive features in the field (Matsumura 2007). The approach of Field Mining is to use artifacts to help people discover attractive features in a field. In fact, Shikakeology evolved from Field Mining by expanding the purpose from growing imagiablity to solving social/personal issues. These purposes seem to have nothing in common, but growing imagiability is relevant to social issues such as education for children or quality of life. In other words, Field Mining is a subset of Shikakeology.

Psychological and Physical Triggers

In terms of both physical and psychological triggers, Kim Vicente proposed human factor engineering to tailor the design of technology to people (Vicente 2004). He characterized the human-tech relationship with five key human factors (physical, psychological, team, organization, and political) and corresponding hard and soft technologies. The approach begins by understanding a human or societal need – a problem worth solving –, and then human factors and technologies that govern our behavior are considered. Daniel Kahneman described biases of intuition as System 1 and System 2 in our mind (Kahneman 2011). System 1 processes automatic and quick mental operations with little effort, whereas System 2 processes effortful and slow mental operations. System 1 intuitively attracts people's attention as a psychological trigger, and System 2 keeps attention and encourages people to change behavior by physical and psychological triggers. In that sense, a shikake is a trigger that includes both aspects of Systems 1 and 2 if we consider a shikake as a process of behavior change.

Challenges for Shikakeology

As described above, psychological triggers are categorized differently in accordance with people's points of view, such as persuasion, engagement, nudges, human factors, and biases, in order to best describe the fundamental mechanism. Physical triggers are also considered in various ways such as signifiers, feedback, and technologies, to specify the component of a trigger. A physical trigger is also associated with

Figure 2: Cylinder.

a psychological trigger, and that is what a shikake especially focuses on because the combination works strongly for behavior change. From a shikake point of view, categories of psychological and physical triggers should be optimized to describe the fundamental mechanism. However, the criteria have not been studied yet. One of the biggest challenges to establish Shikakeology is to uncover the criteria for categories best tailored for describing shikake specifications. These categories are useful not only for understanding the mechanism of shikake specifications but also for designing new shikakes. Currently, we are collecting hundreds of shikake cases and trying to construct these categories. The preliminary shikake categories extracted from 120 shikake cases will be presented in our paper (Matsumura and Fruchter 2013).

Shikake Cases and Mechanisms

The mechanism behind shikake cases covers a wide range of physical and psychological triggers. From a shikake point of view, a physical trigger is used to ignite a psychological trigger, and the psychological trigger works as a driving force for changing behavior. In this section, we will show four simple shikake cases to clarify the concept of Shikae as well as the mechanisms of triggers.

Cylinder

Figure 2 is a cylinder installed at Tennouji Zoo in Japan. There is no explanation board around it, so people are not told what this artifact is, but they can guess how to use it because this artifact has some triggers. First, the cylinder looks like a telescope, so people can imagine that one looks through it. Second, there is a hole in the cylinder. When people find the hole, they instinctively look inside it out of curiosity. Third, the cylinder is placed about one meter off the ground. The position is good for children to look inside the hole. Because of these triggers, children are interested in the cylinder, approach the cylinder, look inside the cylinder, discover something over the cylinder, and finally enjoy the discovery. In this case, children can find a replica of an elephant's excrement and are surprised to notice the size and color. When people observe a child's behavior for a while,

Figure 3: Tiny shrine gate.

Figure 4: Urinal fly. (Broennimann 2010)

they might notice that once s/he looks inside the cylinder, the behavior attracts other children's attention and makes them gather around the cylinder. This phenomenon is called as snowball effect, where a small action becomes a trigger that leads to a big effect. As a result, the cylinder succeeds in attracting children.

The cylinders are installed along the pathway connecting animals' exhibition areas. If there were no cylinders there, no children would stop walking or enjoy the discoveries. Also, the cylinder is easy to make but hard to break due to its simple structure. All things considered, the cylinder works as a superb shikake for behavior change.

In the case of the cylinder, the telescope-like shape and the height of installation work as physical triggers for inferring the usage and attracting target people, and a hole in the cylinder works as a physical trigger for inducing specific behavior as well as a psychological trigger for exciting curiosity. Also, people looking into the cylinder could be a psychological trigger for a snowball effect. In this case, the telescope metaphor, signifier of a hole, curiosity, and social effect are considered as the underlying mechanisms of the cylinder.

Tiny Shrine Gate

Littering is an everyday issue that all societies have in common, and its mechanism has been studied. There is the Broken Windows Theory, which hypothesizes that a small trigger causes a big result, like a snowball effect (Wilson and Kelling). If there is a broken window in a building, the window becomes a sign of disorder and leads to more broken windows. The same is true for littering (Keizer, Lindenberg, and Steg 2008). If someone drops one piece of litter, the litter becomes a trigger to induce more littering. Complete cleanliness could be a good trigger to stop littering, but it is not a realistic approach because it will cost a great deal.

Figure 3 shows a tiny replica of a gate to a Shinto shrine. The tiny shrine gate reminds people of a holy place, and this prevents them from littering. This shikake also prevents bad behavior such as dog-walkers not picking up excrement. In this case, the shikake works if and only if people associate the tiny shrine gate with a Shinto shrine.

There could be other approaches like putting up anti-littering signs or installing high-tech devices like security cameras, but these approaches give neighbors a descriptive norm of caution and spoil the trusting atmosphere. However, the tiny shrine gate is a much more elegant approach and does not negatively affect the atmosphere. Also, a tiny shrine gate is easy to make and possibly to DIY, so the cost is not expensive. The tiny shrine gate in Figure 3 is available for about $18 dollars.

The shrine gate is a physical object, but it works as a psychological trigger for causing positive behavior by giving the impression of a holy place. In this case, the metaphor of a shrine gate and the associated social norm are considered as the underlying mechanisms. In other words, this shikake might not work in places where nobody associates these things with shrine gates. Therefore, this shikake is culturally dependent. Culture could be a strong trigger when considering the use of social norms, but we have to take into account the availability carefully in order not to provoke people's antipathy. Careful investigation would be necessary if we were to consider using a small sacred object instead of the tiny shrine gate.

Urinal Fly

Figure 4 shows a fake fly pained on a urinal. Once people (men in this case) see the fly, they instinctively aim at it. The location and type of target are designed to determine the "sweet spot" and to minimize splash back (Smets 1995). As a result, spillage is expected to reduce and the facility to become cleaner. We do not need any reason to aim at the fly other than it is fun. We do not have to aim at it, but there is no reason we should not.

Followed by the success of the fly target, various repertoires of witty stickers, such as a dartboard, soccer goal, and fire, have been produced by various companies. Today, target stickers are widely used in men's restrooms because the target stickers are inexpensive and easy to install; just put the sticker at an appropriate position, and it will contribute to making the floor cleaner.

A urinal fly has the physical shape of a fly and causes a psychological trigger to aim at it by instinct. In this case, the

Figure 5: Speed camera.

fly metaphor for the target and playful challenge of hitting the target are considered as the underlying mechanisms.

Speed Camera

Cars are convenient for transport, but every year lots of people are injured or killed in traffic accidents. Various shikake have been considered to make traffic safer. Figure 5 shows a speed camera that feeds back the speed of a car with a speed limit sign. This system is not connected to a police office, so there is no force compelling drivers to slow down. However, this system works well in practice. The feedback of cars' speed to the drivers becomes a good trigger to change from mindless to mindful driving.

In addition to feeding back the speed, one more shikake element could be added. The Speed Camera Lottery is a campaign in which the speed of passing cars is monitored, and lotteries is randomly mailed to the houses of random drivers who kept under the speed limit (Volkswagen 2009). The reward comes from speeding fines. As a result, it is reported that the average speed was reduced 22% when the Speed Camera Lottery was tested in Sweden.

A physical speed camera produces the feedback, and it ignites a psychological trigger to control the speed. In addition, the lottery system works well as a psychological trigger for driving to obtain a reward. Also, when a goal is clearly provided, it becomes a challenge. In this case, feedback of car speed, reward, and the challenge to keep under the speed limit worked as the underlying mechanisms.

Unlike the other cases, this case uses electronic technology. A shikake does not necessarily depend on technology because it heightens the hurdle to make it from viewpoint of cost and expertise. However, when it becomes possible to use technology and it generates a synergistic effect, a technology-based trigger becomes a powerful shikake to change behavior.

Shikake Ecosystem

A shikake is an implementation of multiple physical and psychological triggers. Each of these triggers has been studied thoroughly in various fields, such as psychology, design, engineering, and management. However, as far as we know, the methodology for making a shikake has not been studied enough. There could be a number of combinations among categories although most of them do not work. To extract a carefully selected number of "rules of thumb" as reusable patterns of triggers is a worthwhile research topic because it will help us make shikakes to solve our own issues.

The most important feature of a shikake is its practicability because a shikake is designed to solve social or personal issues. For academics, the most important thing is to investigate the reliability of the effect scientifically by experiments or observations. In that sense, not all shikake cases are scientifically investigated because practitioners of shikake are interested in practicality, and they do not care about the academic side. Also, a shikake is designed in accordance with the context where the shikake is installed, such as place, target people, or culture. Therefore, each shikake is nothing but a case, and the same shikake is not always applicable to different contexts. We choose a case study approach to understand the mechanism of shikake as a starting point.

We consider that the ecosystem of Shikakeology is constructed by creating a feedback loop between citizen science, academia, and education. The grass-roots activities of citizens become a driving force of producing shikake practices. Academia inspects the effectiveness and refines the rules of thumb of the shikake mechanism and feeds back the methodology of shikake design to those who are interested in making their own shikakes to solve their issues. By using this loop, the study of Shikakeology proceeds and more and more social or personal issues can be solved.

Conclusion

Although we only described four shikake cases here, we have collected more than 400 cases and are currently trying to construct hierarchical categories for understanding the mechanism of shikake cases. We assume that a shikake is composed of physical and psychological triggers and the physical trigger ignites the psychological trigger whereas the psychological trigger works as a driving force for changing behavior. We will continue to study Shikakeology to investigate this hypothesis further.

Readers might worry about the abuse of shikakes for bad purposes. As well as induce the mindset of desirable and engaged attitudes for a specific benefit, they might also be used to make people behave badly, like littering or speeding. The best way to avoid such risks is to understand the mechanism underlying of the behavior change. The point is that a superb shikake works well even if we understand the mechanism. Not only those who consider designing a shikake but also we as recipients should know the mechanism to reduce the risk of it being abused.

As the main targets of shikake users are ordinary people who are facing their own issues, the framework of making a shikake based on a shikake mechanism is necessary. Recently, personal fabrication has become a big trend, and the threshold for people to make original gadgets is lower (Gershenfeld 2007). 3D printers allow us to make an accurate stereoscopic artifact easily. Arduino – an open source electronics prototyping platform – enables us to make easy-to-use hardware and software artifacts less expensively. This

device could be a powerful approach for making a shikake with feedback functions. Due to these technologies, making and using shikakes will affect our daily lives.

Also, we are planning to teach the methodology of making shikakes to not only adults but also elementary school students to let them make their own shikakes to solve their own issues. The experience of solving their issues gives students small but precious confidence that they can change the world. We believe the experience would result in a positive motivation for learning and understanding various things. We will keep these things in mind as we proceed to study Shikakeology.

Acknowledgements

References

Asch, S. E. 1955. Opinions and social pressure. *Scientific American* 193(5):17–26.

Broennimann, G. 2010. Photo: Licensed under Creative Commons Attribution-Share Alike 3.0, http://de.wikipedia.org/wiki/Datei:Urinal_Fly.JPG.

Cialdini, R. B. 2006. *Influence: The Psychology of Persuasion*. HarperBusiness.

Fogg, B. 2002. *Persuasive Technology: Using Computers to Change What We Think and Do*. Morgan Kaufmann.

Fogg, B. 2009. A behavior model for persuasive design. In *Proc. The 4th International Conference on Persuasive Technology*, 26–29.

Gershenfeld, N. 2007. *Fab: The Coming Revolution on Your Desktop – from Personal Computers to Personal Fabrication*. Basic Books.

IPROS. 2004. Transparent eco-duster catalogue. IPROS CORPORATION.

Kahneman, D. 2011. *Thinkig, Fast and Slow*. Farrar, Straus and Giroux.

Keizer, K.; Lindenberg, S.; and Steg, L. 2008. The spreading of disorder. *Science* 322(5908):1681–1685.

Matsumura, N., and Fruchter, R. 2013. Shikake categories for shikake specifications. In *Technical Paper on AAAI2013 Spring Symposium on Shikakeology*.

Matsumura, N. 2007. Field mining: Reconstructing relations between human, objects, and environment. In *Proc. First International Symposium on Universal Communication*, 153–156.

Milgram, S.; Bickman, L.; and Berkowitz, L. 1969. Note on the drawing power of crowds of different size. *Journal of Personality and Social Psychology* 13(2):79–82.

Norman, D. A. 2002. *The Design of Everyday Things*. Basic Books.

Norman, D. A. 2010. *Living with Complexity*. The MIT Press.

Smets, G. 1995. Industrial design engineering and the theory of direct perception and action. *Ecological Psychology* 7(4):329–374.

Sullivan, L. H. 1896. The tall office building artistically considered. *Lippincott's Magazine* 57:403–409.

Thaler, R. H., and Sunstein, C. R. 2009. *Nudge: Improving Decisions About Health, Wealth, and Happiness*. Penguin Books.

Vicente, K. 2004. *The Human Factor: Revolutionizing the Way People Live with Technology*. Routledge.

Volkswagen. 2009. The speed camera lottery. The Fun Theory. http://www.thefuntheory.com/2009/11/12/fun-theory-award-winner-speed-camera-lottery.

Wilson, Q., and Kelling, G. L. Broken windows. *The Atlantic Monthly* 29–38.

Zichermann, G. 2011. *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps*.