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### A DOLL-BASED CLOSING CHIME SYSTEM FOR WORKSTYLE IMPROVEMENT IN JAPANESE WORKPLACE

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#### *Abstract*

Recently, work style improvement is one of the important themes in Japanese society. In traditional Japanese sense of values, long working hours have been regarded as a virtue. Recently many companies are becoming recommended to leave on time. Therefore, many offices have some promoting activities to facilitate on time leaving. However, many managers still struggle to let leave workers on time actually. Under such a background, how to support work style improvement using light weight information technology is the big question of this study. Actually, the traditional computerization of previous generation offices often used heavy technologies. But unfortunately, heavy technologies have often been a barrier to adoption, spread, or response to change. In contrast, light weight technologies such as IoT recently shown are expected to improve not only personal life but also work environment. As a first step, this study conducts a questionnaire survey to find out psychological factors that impede on-time leaving. Next, based on results of the first survey, this study proposes Doll-based closing chime system "SADATOKI JIZOU" using speech synthesis technology. This doll automatically speaks some topics that triggers of closing works around the closing time. Such topics provided from the server PC managing several types of information. The results of the experiment at the actual office showed not only the direct effects on on-time leaving but also by-product potentialities such as community activation, conversation promotion, unity improvement, and healing provided.

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**Keywords:** Office, work-style improvement, speech synthesis is technology, community activation.



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## 1. Introduction

Work style improvement is one of the important themes in recent Japanese society (Azizah, Matsumoto, & Naka, 2013). In traditional Japanese sense of values, long working hours have been regarded as a virtue. However, in recent years, many companies are becoming recommended to leave on time (Egawa et al., 2018). There are various reasons for such a change from the viewpoint of management, such as improvement of efficiency, improvement of creativity, health promotion, energy saving, reduction of labour cost and so on. On the other hand, expectations from the worker's individual perspective include improvement of work-life balance, women's social advancement, management of motivation, Contribution to the local community, etc. Under such background, even though many offices have promoting activities such as "No-Overtime-Day" and "Premium-Friday", many managers still struggle to let leave workers on time actually. When the fixed time comes at work, people feel difficulties leaving the office, in no small measure, without any specific reason. The opposite way around, as the regulation for overtime work gets tighter, people have become extra mindful also to work overtime. In this research, we defined the stress and time caused by the attentions from each other around the fixed time, "unprofitable pent-up feelings of the fixed time". Our previous research (Matsumoto, Iwane, & Naka, 2014) sent out various information using the audio broadcast. It worked well as triggers for communication amongst workers and made the sense of togetherness as a team. Drew from this experience, we developed a system "SADATOKI JIZOU" to reduce the "unprofitable pent-up feelings of the fixed time". In this system, the synthetic voice read out the contents to broadcast at the office, which should trigger workers to switch actions and smoothly sort the workers between the ones who wish to leave and the ones who wish to stay working.

## 2. Problem Statement

To understand the current situation of the unprofitable pent-up feelings of the fixed time and use it as a guidance of the system development, we conducted a "consciousness survey about leaving at the fixed time and the overtime work" of 139 workers. There are 11 questions and the questions are divided into three categories: 1) Consciousness of leaving and overtime work, 2) Reasons and excuses to leave, 3) Difficulty leaving and not wanting others to leave (Table 1).

**Table 01.** Attitude survey on leaving work on-time / overtime work (n=139)

Consciousness of leaving on time and overtime work
Q1. How often do you feel psychological barrier to leave the office on time, even if the work for the day is over? (6-point scale)
Q2. What is the reason you feel psychological barrier to leave the work (free description)
Q3. Do you think leaving on time is desirable? (5-point scale)
Q4. How often do you feel psychological barrier to work overtime, even if you want to work more? 6-point scale)
Q5. What is the reason you feel psychological barrier to work overtime? (free description)
Q6. Do you think overtime work is desirable? (5-point scale)
Reasons and excuses to leave
Q7. What is the trigger when you usually leave the company? (free description)
Q8. If you have made an excuse to make the timing of leaving office, please tell us about the contents. (free description)
Q9. Please tell us the reasons to allow other workers to leave (free description)
Difficulty leaving and not wanting others to leave
Q10. When the following persons ;seniors, juniors, associates are still working after the scheduled time, do you feel psychological barrier to leave the work ? (5-point scale)
Q11. When you are still working after scheduled time, do you have any negative feelings of the following persons; seniors, juniors, associates leave the office before you? (5-point scale)

## 2.1. Consciousness of leaving on time and overtime work

36% of workers feel the difficulty leaving the office on time, even when their work is complete (Figure 1). 40% answered that they feel the difficulty staying to work overtime. Overall, people shared the feeling that it is preferred to leave the office on time and the overtime work is undesired.

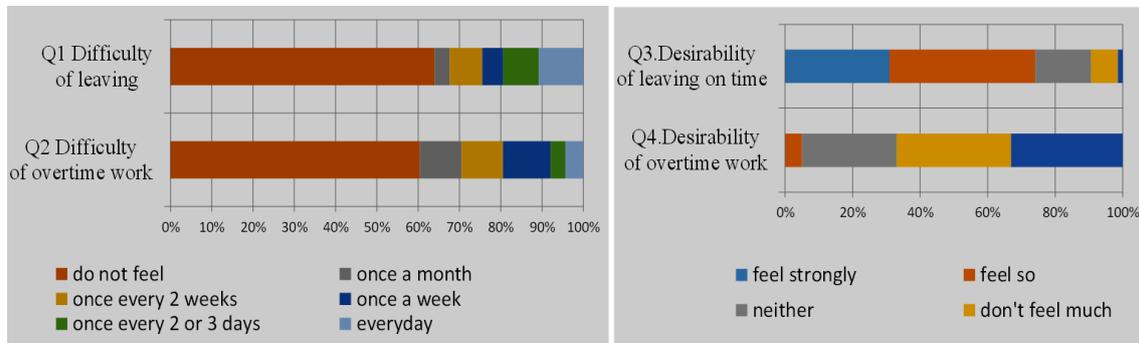


Figure 01. Consciousness for leaving work and overtime work

## 2.2. Reasons and excuses to leave

We divided the answers to the Q2 "Reasons for the difficulty leaving the office" into three (Table 2) and the answers to the Q5 "Reasons for the difficulty staying to work overtime" into five (Table 3). For the reasons for the difficulty leaving, most answered "feel bad for others" and for the reasons for the difficulty staying to work overtime, it was mainly "company's rules and regulations" or "I get asked to leave". It became apparent that the workers feel difficulty leaving or staying the office from their environment.

Table 02. The reasons difficult to leave(Q2)

About paying mind to nearby workers (52 answer)	About evaluation of work (4 answers)
<ul style="list-style-type: none"> <li>A colleague is working overtime</li> <li>Many other workers are staying</li> <li>It's not desirable for me to leave the office first</li> <li>Atmosphere that I cannot say that I will leave because other workers are still working</li> <li>Atmosphere that overtime work is normal</li> </ul>	<ul style="list-style-type: none"> <li>A quota and a sales target can't be achieved.</li> <li>Because work may seem not done.</li> </ul>
	<b>About tasks have not ended yet (7 answers)</b>
	<ul style="list-style-type: none"> <li>I want to finish today's work today.</li> <li>Works of the whole project are not finished</li> </ul>

Table 03. The reasons difficult to work overtime(Q5)

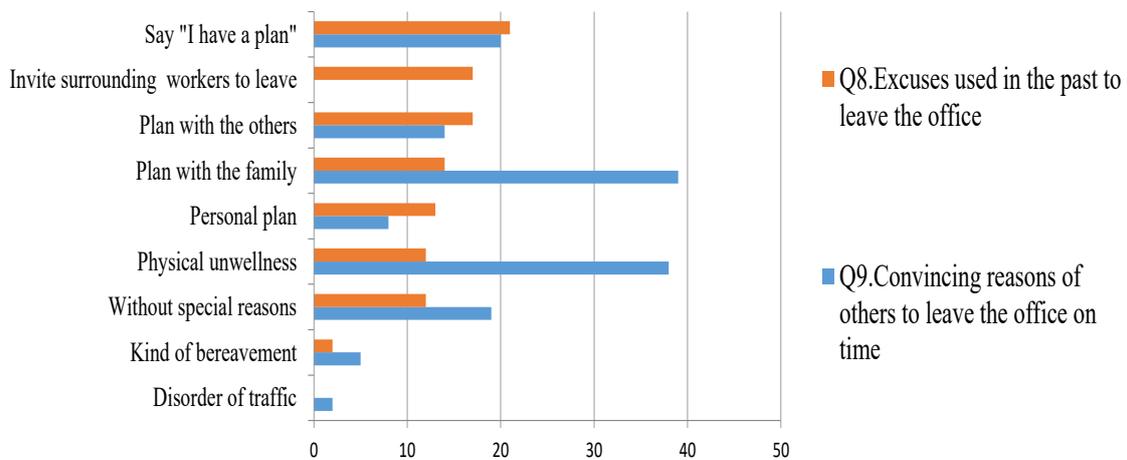
Rules and systems of company (26 answers)	Atmosphere around (12 answers)
<ul style="list-style-type: none"> <li>There is a tendency to strict adherence to leaving work on time.</li> <li>Company rules</li> <li>System of no overtime work day</li> </ul>	<ul style="list-style-type: none"> <li>Atmosphere not to work overtime</li> <li>The social trend of work style change</li> </ul>
<b>Prompted to leave (14 answers)</b> <ul style="list-style-type: none"> <li>Workers are instructed to leave the office early.</li> <li>My boss encourages me to leave.</li> </ul>	<b>About evaluation of work (4 answers)</b> <ul style="list-style-type: none"> <li>I do not want others to think that work is slow</li> <li>Overtime has a negative impact on the assessment</li> </ul>
	<b>Personal circumstances (3 answers)</b> <ul style="list-style-type: none"> <li>Raising a child</li> </ul>

We analysed the result of Q8 and Q9, "Reasons used in the past to leave the office" and "Convincing reasons to leave the office on time" using the text-mining approach. And we created the list

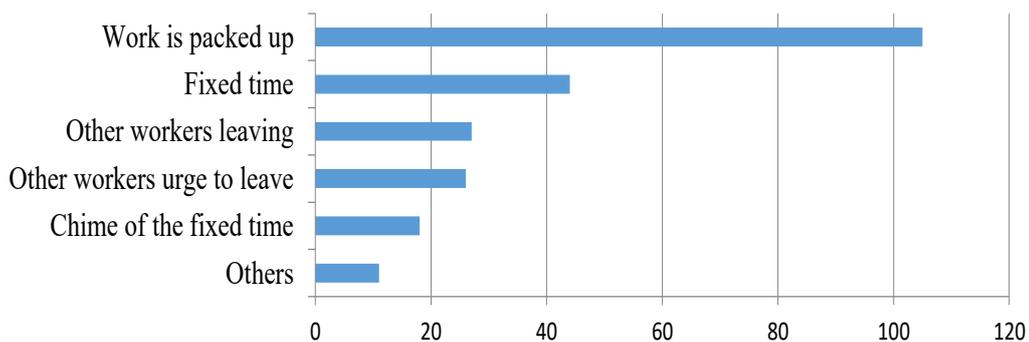
of extracted words that has high appearance frequency. Then referencing to the words that appear frequently and co-occurring network, we predicted the kinds of excuses and named them. We aggregated each kind of excuses by taking out the words that seem to be included in each kind from the list of extracted words and searching by the words from the list of survey result.

Excuses such as "plan with the family or others" and "physical unwellness" are easily acceptable, even "have a plan" can be an acceptable reason as shown in Figure 2. Also, there was an answer saying that the worker prompts to leave the office by encouraging others.

Figure 3 shows the actual daily trigger of the workers. As the trigger to leave the office in the daily life (Q7), the most popular answer was "the work is packed up", followed by "the fixed time".



**Figure 02.** Excuses used in the past(Q8) and Convincing reasons of others (Q9)

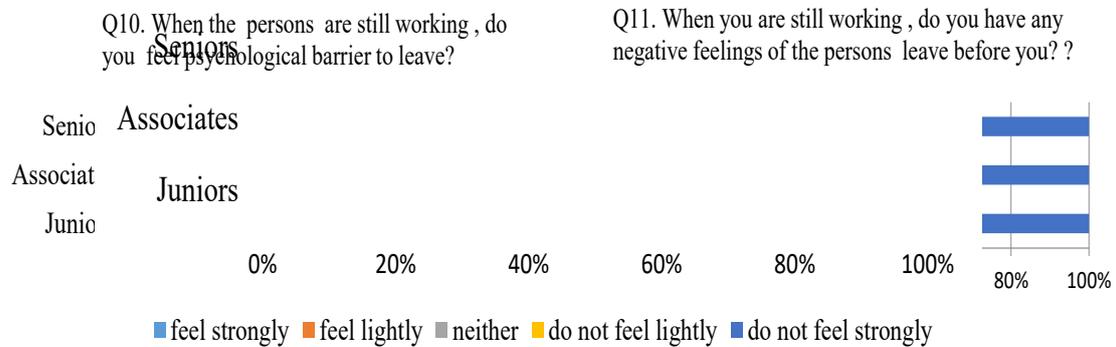


**Figure 03.** Triggers to leave in the daily life (Q7)

### 2.3. Difficulty leaving and not wanting others to leave

Q10 and Q11 are questions about consciousness (toward seniors/ juniors/ associates) to difficulty leaving and not wanting others to leave (Figure 4). Regarding the difficulty leaving the office (Q10), "feel strongly", and "feel so" was answered most to the seniors, then to juniors, finally to associates. "Feel lightly" and "do not feel so" was answered most to the associates. Close to half of the people feel difficulty leaving earlier than the seniors. Regarding not wanting others to leave (Q11), over half answered "do not feel so". "Feel strongly" and "feel so" was less than 15%. From the result of these two

and Q2, the reasons for feeling the difficulty leaving the office are due to feeling bad for others. However, the "others" around are not feeling negative about them leaving, as much as the leaving ones feel. That is to say, here is the perception gap. The possibility of unnecessary care, stress and overwork became apparent due of the ones leaving the office feeling unnecessary difficulty.



**Figure 04.** Consciousness to difficulty leaving (Q10) and Not wanting others to leave (Q11)

### 3. Research Questions

Actually, the traditional computerization of previous generation offices often used heavy technology. But unfortunately, many heavy technologies have often been a barrier to adoption or spread. Of course, they also often lead a difficulty to keep up with changes of the business environment. In contrast, light weight technologies such as IoT that have recently emerged are expected not only to improve personal life but also work environment (Dery, Sebastian, & Van der Meulen, 2017). Hence, the big question in this study is:

- How to support work style improvement using light weight IT.

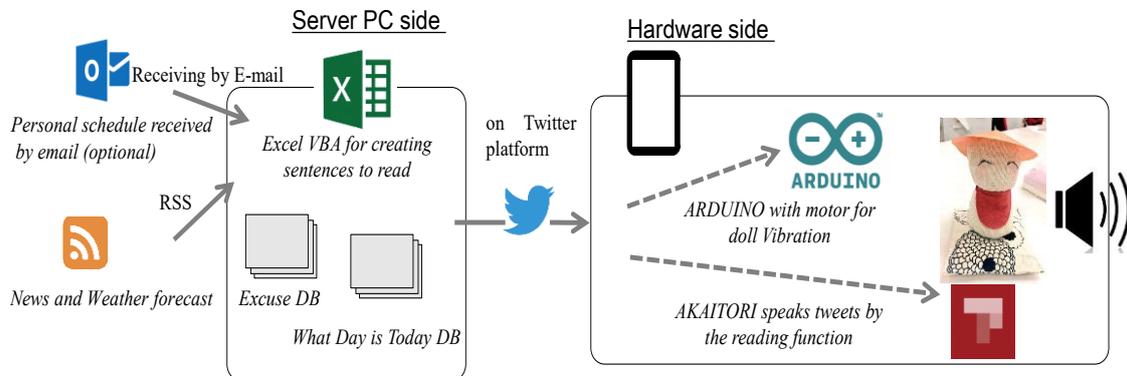
### 4. Purpose of the Study

As mentioned above, many workers have "unprofitable pent-up feelings of the fixed time". The first purpose of this study is to clarify the actual condition and factors of such "unprofitable pent-up feelings" about leaving the office. Also, the second purpose is to develop a doll-based system using speech synthesis technology and show its effect and possibility. Our past research experiences (Egawa, et al., 2018; Matsumoto, Okada, Kidosaki, Naka, & Yamaguchi, 2011) has brought such a way to do small developments after understanding the reality.

### 5. Research Methods

Based on results of above questionnaire survey to find out psychological factors that impede on-time leaving, this study proposes Doll-based closing chime system "SADATOKI JIZOU" using speech synthesis technology. The proposed system consists of a speaker, a doll, a vibrating pedestal with microcomputer, and a smartphone as a control device as shown in Figure 6. Around the closing time, this doll automatically speaks some topics that triggers of closing works. Such topics provided from the server

PC managing common Excuse DB, What Day is Today DB, actual worker's tweets, information about news and weather forecast. Figure 5 shows an overview of the system configuration and data flow.



**Figure 05.** System configuration of SADATOKI

### 5.1. Character setting of doll

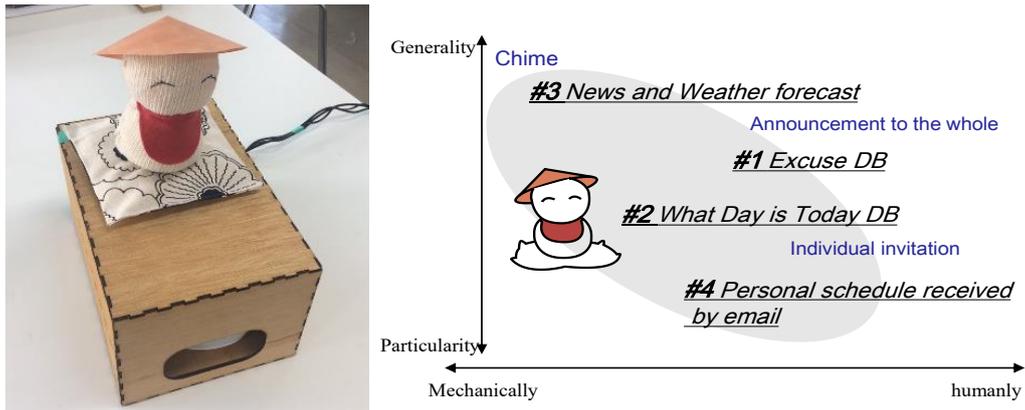
As we build up the system, we set Jizou (Ksitigarbha) as the character, familiar for Japanese people and neutral. With this, we named the system "SADATOKI JIZOU".

### 5.2. Creating the Excuse DB and What Day is Today DB

We created the "Excuse database (DB)" from the data of excuses we obtained from the field survey. We extracted 40 excuses that seem to have high general versatility after breaking the high frequent excuse terms down into patterns. In addition to the Excuse DB, we also created "What Day is Today DB" as the static motivator information that has broad utility. This database is a list of memorial days of 366 days, comprised of 602 data.

### 5.3. Framework and development of the system

As seen in Figure 6, we covered the existing motivations to leave the office such as chimes and calls by preparing a wide range of motivating information from ones that have broad utility to ones that fits individual situations. By making the #3 (individual plan) and #4 (general-purpose information), we avoid the overwhelming feeling of when one's plan is particularly called out. The data that is the base of what is read out is loaded using Excel VBA. The combination of #4 data, which is prioritized and #1 - #3 motivating information, randomly picked, are used to create the text and automatically posted on Twitter. For example, "Now is the fixed time. Today is a meat day. The weather forecast from now is cloudy then to rain. Mr. X plans to have dinner with the family tonight." Table 4 shows the examples of 4 types of trigger information. The smartphone inside of the SADATOKI will read out the tweet using the feature from the Twitter client "Akaitori" which has a speech function with speech synthesis technology, and gets broadcasted. Also, we believe in the needs of grabbing attention when reading out. For this, we moved the Jizou puppet using Arduino and motor, which brings out the mind and live feeling (Figure 5).



**Figure 06.** Visual design and Positioning of trigger information

**Table 04.** Examples of 4 types of trigger information

#1 Examples of excuse DB	#2 Examples of what day today DB
<p><i>Family)</i></p> <ul style="list-style-type: none"> <li>Picking up children (from nursery)</li> <li>Birthday of someone in the family</li> </ul> <p><i>Physical condition)</i></p> <ul style="list-style-type: none"> <li>I'm in bad condition Today</li> <li>I will go to the hospital</li> </ul> <p><i>Personal appointment)</i></p> <ul style="list-style-type: none"> <li>I will go to the exhibition</li> </ul> <p><i>Urges)</i></p> <ul style="list-style-type: none"> <li>It's time to leave!</li> <li>Let's make a no overtime work day today!</li> </ul> <p><i>Others)</i></p> <ul style="list-style-type: none"> <li>I'm so tired</li> <li>I have no motivation today.</li> </ul>	<p>Jan. 19) The day of karaoke/ The day of Home fire extinguisher check</p> <p>Jan. 25) The day of housewife's rest / The day of pancake</p> <p>Feb.25) The day to thank parents / The day of pudding</p> <p>July 13) The day of nice / The day of mountain climbing</p> <p>Nov. 22) The day of nice couple / The day to thank pets</p> <p>Dec. 19) The day of cream puff</p>
	#3 Weather forecast obtained from RSS feed
	<ul style="list-style-type: none"> <li>The weather from now on is cloudy.</li> <li>The weather for tomorrow is cloudy and snowy.</li> </ul>
	#4 Personal schedule received by email
	<ul style="list-style-type: none"> <li>I want to go back early because I want to watch the recorded TV program.</li> </ul>

## 6. Findings

This study conducted experiments to verify the effectiveness of SADATOKI at the actual office. For 7 days, we broadcasted 5 times a day including the work start time, lunch start time, fixed time, and an hour before and after the fixed time. There were 12 examinees. We held a preliminary survey, extracting the questions from the preliminary study and adding the questions regarding the current work attendance situation (11 questions) followed by the system operation and evaluation survey (25 questions) and a group interview (Table 5). Figure 7 contains the snippet of the evaluation survey result after the operation.

### 6.1. Results of the experiments

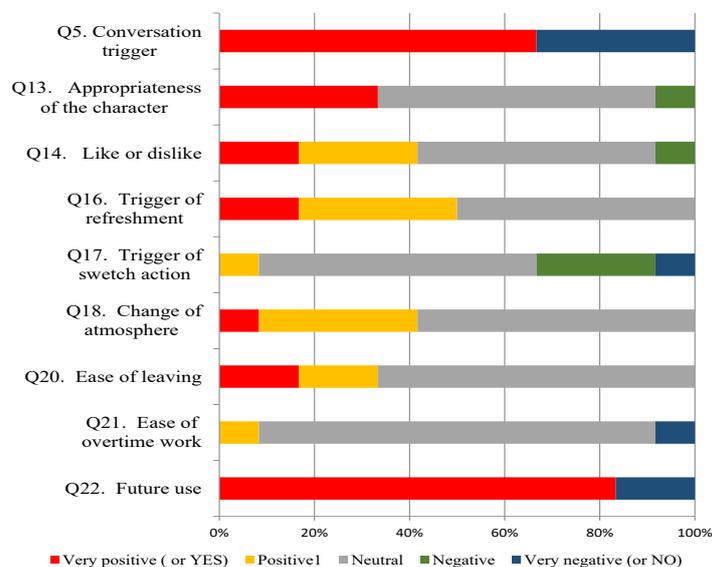
- About the character of doll:** 92% felt the Jizou character is appropriate and favourable (92%). Reasons being "cute" and "makes the relaxing atmosphere" (Q13, 14).
- Action switch:** All people answered that the broadcasting by SADATOKI works as the refreshment trigger (breath-freshener) and 92% answered that it works as the trigger to switch

actions. This shows the possibility of SADATOKI reducing the pent-up feelings about time (Q16, 17).

- **Communication:** 41% answered that conversations about the broadcasted contents occurred within the team, making the office atmosphere better (Q15, 18). At the interview, it became clear that contents that bring questions or guesses such as "What day is today" and "Excuse" triggered many conversations.
- **Easiness to leave:** 33% answered that SADATOKI made it easier to leave the office. However, there was almost no change regarding the overtime work (Q20, 21). As apparent from the result of the preliminary survey, the examinees this time already had easy leave and work overtime environment, which is a contributory factor to this result.
- **Future use:** For the Q22 "Do you want to keep using SADATOKI JIZOU?" 83% answered "Yes" with the reasons such as "the time signal provides a good change of the pace" and "the atmosphere softens by bringing conversations sometimes" (Q23). The reasons for "No" included "difficult to concentrate during meetings" (Q24).

**Table 05.** Questions item of preliminary survey

Contents of reading
Q5. Did you talk with other people about the content read by SADATOKI? (Y/N) Q6. If you chose YES in Q5, what did you talk about? Q7. Are there any other types of information you want?
Character design (5-point scale)
Q13. Do you think the SADATOKI characters fit the image of this system? Q14. Do you like or dislike SADATOKI characters?
Effects of reading (5-point scale)
Q16. Did the broadcast bring refreshment? Q17. Did the broadcast trigger to switch actions? Q18. What kind of atmosphere did SADATOKI bring to the office? Q20. Did SADATOKI make it easier to leave the office? Q21. Did SADATOKI make it easier to work overtime?
Future use and request
Q22. Do you want to use SADATOKI from now on? (Y/N) Q23. If you chose YES in Q22: The reason (free description) Q24. If you chose NO in Q22: The reason Q25. Do you have any extra functions you want?



**Figure 07.** Summary of results

## 7. Conclusion

In the first place, the main purpose of the proposed system is not to reduce overtime work directly, but to reduce unnecessary psychological stress of workers when leaving work or continuing work. From this experimental trial, the broadcasting by SADATOKI JIZOU worked as a breath-fresher and the trigger to switch actions, which has the potential to soften the "unprofitable pent-up feelings of the fix time" from the mental side.

Also, it brings out communication amongst the users depending on the contents broadcasted. The JIZOU (Ksitigarbha) character used for this system gives a positive impression to the users and helps users to find interests of the broadcasted contents. The above results are from a small number of subjects (n = 12) using the prototype system.

In the future, it will be necessary to conduct experiments in various cases. Also, some ideas gained from experiment in this study give us many suggestions for enhancing function, contents and stability of our system.

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