A system for breaking poor posture in performing VDT tasks using pseudo-negative effects associated with user actions

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Abstract

In this paper, we propose a system for breaking poor posture as a user's habit in performing a task. Poor posture in tasks with a video display terminal (VDT) is one of bad habits. Due to poor posture, users who perform tasks might suffer from weakening eyesight and pains on neck and shoulders. In order to break bad habits, users have to be aware that the habits occurred. While users perform a task, the load of awareness tends to disturb their concentration on it. As a result, users might not accomplish it. Therefore we consider that a method for breaking bad habits should maintain users' concentration on a task. We propose a system that makes pseudo-negative effects associated with poor posture on users. The system produces a blur effect on a PC's display while users have poor posture. We conduct experiments on our system about disturbances of VDT tasks and effects on correcting poor posture. The results show that the system does not disturb the tasks and motivates users to correct break it

1. Introduction

People have some habits unconsciously while they perform daily tasks. In order to break habits, they have to be aware that they are engaging in habitual actions. The load of awareness tends to disrupt their concentration on tasks. Most researches on the awareness of habits have provided a solution for only one of these problems [1]. If a notification system gives the appropriate awareness to users, they could break their habits. The current system disturbs their concentration on tasks. They cannot complete the tasks smoothly because they are engaged in the habitual action frequently. Therefore, we consider that a notification system should maintain users' concentration on tasks as well as correct bad habits.

2. Approach

There are some methods to correct a bad habit: attaching an instrument that controls the body to avoid a habit [2]; removing the cause of a habit [3]; and providing motivation to break a habit by competitiveness with other people such as with a game [4]. Though these methods may break habits, users do not understand the cause of their habits. In order to break a user's habit, it is important for a user to emphasize long-term results caused by the habit rather than short-term ones [5][6]. We consider that the understanding of a habit's negative effect can motivate users to correct the habit.

Our target is poor posture in VDT tasks. In case of breaking poor posture, a user has to attach weight to negative effects such as eyestrain and visual loss rather than positive effects as ease in sitting. Therefore, we focus on blurred vision as one of negative effects associated with poor posture. Our method produces a blur effect on a PC's display while users have poor posture. The degree of blurred effect changes depending on user's posture.

3. Related works

For VDT tasks, Harrison, et al. proposed a notification system that magnifies a displayed image when posture changes [3]. Users recognize that tiny characters on the display cause bad posture. They try to correct the bad posture by magnifying the characters on the display. In this system, removing the cause of the habit can correct bad habits. On the other hand, we try to correct bad habits by consciously identifying the effect of the habit.

Nasr, et al. researched the motivating factors for engaging in healthy activities [4]. They found that participants could be divided into two groups: (1) participants who were competitive and liked to compare their performance with friends or others in the community, and (2) participants who preferred to see their progress in a non-competitive way. They thought that competence was a key motivator and that comparing competence motivated the competitive group and therefore focused on competitiveness to motivate people. On the other hand, we focus on users' understanding of a long-term results caused by bad habits, i.e., negative effects to motivate people.

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4. Implementation

Our system identifies a user's posture as the distance between the user and the display. The system estimates poor posture depending on the distance. Our system notifies the user of his/her posture using a blur effect on a PC's display. The system consists of a distance detection component that perceives the distance of the user from the display, a notification component that notifies a user of the user's posture and a connection component that links the distance detection and notification components.

4.1. Distance Detection Component

Our system measures the distance between the user and display using a distance sensor on Kinect. The distance is divided into several levels, called the distance group (DG), depending on its value. When DG is high, the blur level on the display is high. The more the user moves from the ideal distance, the more is the increase in the DG level. We define the ideal distance between the user and a display to be 40cm. Kinect should be placed in 50cm behind the display because the sensor cannot measure distances less than 50cm. Kinect should be placed on a stand, 40cm tall because the display is in occlusion position from the user. We should convert the distance between the user and the display into the distance between the user and Kinect. For example, if the distance between the user and display is 40cm, the distance between the user and Kinect is 94cm.

4.2. Notification Component

The notification component notifies a user of his/her posture that is estimated from the distance the distance detection component measures. Depending on the posture, the system sets the level of the blurring filter on the display. In the blurring filter, the average with nearby pixels changes each pixel in the displayed image. The more the average range expands, the more the displayed image is blurred. The more the average range contracts, the more the displayed image is sharp (Figure 1).

4.2. Connection Component

The connection component controls the average range. We associate the distance between the user and the display with the blurring level. We call this range the "range of blur." When notification is modest, "range of blur" is called "standard range." In this system, the "standard range" is changed in accordance with the user's posture. Namely if a user does not recognize the blurring filter and does not correct his/her posture, the "range of blur" would expand. If a user keeps his correct posture, the "range of blur" would contract.

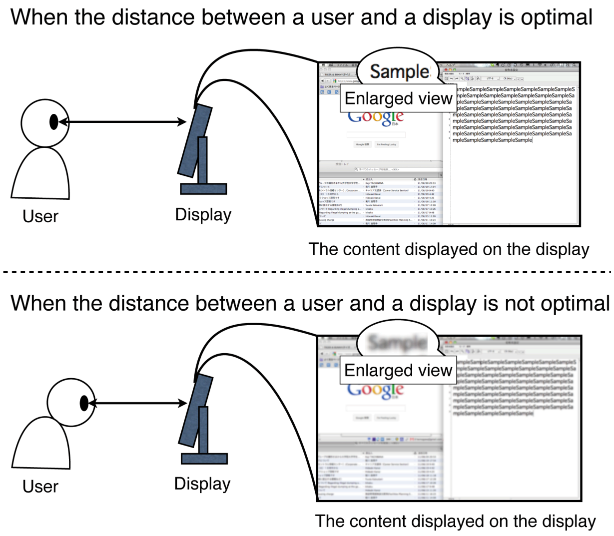

Figure 1. System Behavior

5. User Study

We conduct two experiments on our system about disturbance of VDT tasks and effects on correcting poor posture. In user study 1, we evaluate whether our system disturbs a participant's concentration or not. In user study 2, we evaluate whether our system can alert the user about his/her posture and motivate him/her to correct it or not.

5.1. User Study 1

We conduct a test of typing task after system's calibration. Participants receive posture information when they were performing the typing task. We inform the participants: nine males and one female about the notification system. The participants spend about one hour to finish the task.

5.1.1. Method

The blurring level perceived by the users differs the actual one. So, before starting the task, we identify the blurring level perceived by each participant. We conduct three kinds of task for the typing task test. In "Task 1," they copied 150 numbers in reverse. In "Task 2," they copied arbitrary single- and double-figure numbers from 150 numbers. In "Task 3," they copied 50 characters moving horizontally, vertically, and spirally. Participants can be allowed to review their answers.

5.1.2. Notification Methods

Participants perform VDT tasks with four notification methods. “Notification Method A” means that no notification will occur if participants have poor posture. “Notification Method B” means that the window-notifying participants of their posture will be displayed if they have poor posture. Then they have to press the Enter key to close the window and continue their task. “Notification Method C” means that the message about participant’s posture will appear at the corner of the display. The message does not overlap the text copied by the participants and the text editor used by them. “Notification Method D” the displayed image will blur if the participants have poor posture.

5.1.3. Result

In order to determine whether the concentration on the typing tasks is maintained, we measured the work efficiency on the tasks. We examined the completion time of performing them and the percentage of correct answers for each notification method.

Correct Answers:
In Task 1 and Task 3, we calculated the percentage of correct answers from “((the number of characters in copied text) - (the number of characters missed)) / ((the number of characters in copied text) - (number of characters typed which inexistent in copied text).” In Task 2, we calculated the percentage of correct answers by subtracting the number answered by the participants from number of correct answers. We calculated the average of these values with each notification method. In Task 1 and Task 3, the percentage of correct answers was higher than 95% for all the notification methods. In Task 2, both single-figure and double-figure numbers were less than 1 for all the notification methods. The percentage of correct answers was high for all the notification methods.

Completion time:
We calculated the average number of seconds spent for completing each task. The result is shown in Table 1. It shows the significant difference between notification method A and each other method at a 5% level. In Task 1, the number of seconds spent completing the task with notification method B is much different than that with other notification methods. In Task 2 and Task 3, there are no differences between each notification method.

Table 1: The average completion time in each notification method

Task	Method A	Method B	Method C	Method D
Task 1	229.7	337.2	261.7	275.2
Task 2	105.3	89.12	105.6	81.54
Task 3	123.9	132.8	136.3	114.6
Sum	458.9	559.1	503.6	471.34

(Seconds)

5.1.4. Discussion

The percentage of correct answers is high in all notification methods because we allowed participants to review their answers. The completion time in the notification method B is the longest because it took much more time to press the key every poor posture occurred. One participant said, “I remembered numbers partly, but I forget numbers during the close window.” Thus, we consider that the notification method B disturbed users’ concentration on the tasks. The completion time in the notification method D was shorter than the one in notification method B and C. We consider that the notification method D did not disturb the users’ concentration on tasks as compared with other methods.

5.2. User Study2

We estimate that our system can notify a user of his/her posture and accelerate correcting it.

5.2.1. Method

We conduct a test for estimating that our system is usable in daily tasks. We adopt a reading task as daily tasks because the task is one of the most the popular activities for persons. In the test, participants read a chosen article and the related ones for one hour.

5.2.2. Notification Methods

Our system gives users a long-term result, i.e., pseudo-negative effect associated with user action. In our system, the more the user breaks their posture, the more long-term result is emphasized. Thus, we consider that that our system gives users long-term result and information about posture. In order to estimate showing long-term result, we have to examine effect on showing long-term result and one on giving information about the user's posture separately.

In the test, we use two notification methods: visual based notification based on long-term results and textual based one. The former is our method that produces a blur effect on a PC's display depending on the level of poor posture. The latter is other one that gives only textual information about the participant's posture at the head of the display by text.

In the test, all the participants are informed about working principles of these notification methods. We consider that our method can accelerate the correction of their posture at the case that our method can make their posture better and the other method cannot change the participant's posture.

5.2.3. Evaluation

After finishing the task, participants answered two questionnaires: "Do you recognize notification?" and "Do you want to remove notification?" If a participant answer "yes" to the former question, we will ask participants "Do you understand trigger of the notification?" Moreover, we ask participant who understands that the trigger of notification "Do you tell how to act the notification? "

5.2.4. Result

We observed translation of the participant's posture in practice. In the method that gives textual information about a participant's posture, 50% of participants could recognize the notification. All of them understood the triggers of notification. They found that the notification worked according to user's posture. All of them would not like to remove the notification. Therefore, we consider that they did not intend to correct their posture using the other method. On the other hand, in our system, all of participants recognized notification. 50% of participants understood the trigger of notification. 50 % of them found that notification principle according to user's posture.

6.5. Discussion

Though participants understand the notification based on textual information, the notification cannot motivate the participant to correct his/her posture. On the other hand, participants recognize the notification based on our method. They understand the notification principle difficultly. They answered that they would like to do anything to remove the notification. Namely our method motivated the removal of notification. We consider that the motivation might help participants to correct their posture.

Therefore, we consider that the power of accelerating correction of poor posture in our method is stronger than one in textual based method as comparing with textual-based method.

6. Conclusions

We proposed a system for maintaining concentration on VDT tasks and correcting habitual behavior, i.e., poor posture. The system that makes pseudo-negative effects associated with poor posture on users. The system produces a blur effect on a PC's display while users have poor posture. We conduct experiments on our system about disturbances of VDT tasks and effects on correcting poor posture. The result of user test 1 shows that the system does not disturb the tasks. The result of user test 2 shows that our method motivates users to correct poor posture rather than textual based notification method does. In the future, we will study the timing of a system action and its effects on other VDT tasks.

7. References

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