

Effect of mental sweating on fingertip friction

K. Mizuhara^{1*}, H. Hatano², S. Ozaki¹, T. Washio³

¹) Department of Mechanical Engineering, Tokyo Denki University, 5 Senju-Asahi-cho, Adachi-ku, Tokyo, Japan

²) Kits Corporation, Nakase 1-10-1, Mihama-ku, Chiba, Chiba, Japan

³) Surgical Assist Technology Group, AIST, Namiki 1-2-1, Tsukuba, Ibaraki, Japan

*Corresponding author for mizuhara@cck.dendai.ac.jp

1. Introduction

The usability of touch pad is inferior to the other device such as mouse [1]. One of the authors found that the usability of the touchpad is closely related to the frictional coefficient. The higher the friction is the lower the usability [2]. The factors affecting the friction most are the surface roughness and difficulty of the task. The mechanism with which the task difficulty affected is the cautiousness required for difficult tasks and it is suggested that the mental sweating might be the other mechanism.

The aim of this paper is to investigate the effect of mental sweating on fingertip friction.

2. Experimental

Friction test were conducted using the index finger touching the touch pad, which moved in traverse direction. To stimulate the sweating, stresses were applied by unpleasant sound (90dB, 0.5sec), gripping 300N grip trainer for 10 seconds by the other hand and a mathematical task for 10min. The moisture level of the fingertip was monitored by the MoistSense intermittently.

3. Results and discussions

Figure 1 shows an example of the relation between the friction coefficients on smooth plastic surface after different stresses. At the same load range the friction are higher for stressed conditions. However for subjects who shown relatively low friction were not affected by the stress.

It was found that the gripping or sound stress increased the normal load, which was consistent with the human behavior under negative affect [3].

Figure 2 shows an example of friction during mathematical task from 3 subjects. The friction

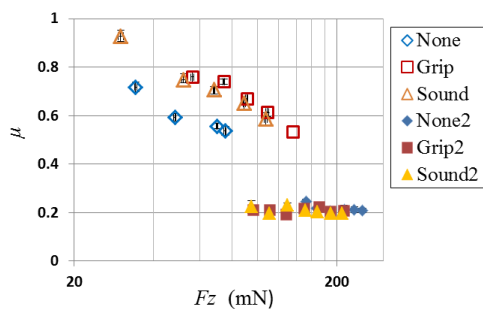


Figure 1. Correlation between normal load and friction, before and after stimulations.

coefficients show rather common load dependence however the each individual responded to the stress differently. The tendency of increasing load by stress was not relevant for the mathematical task.

Concerning the moisture level at the fingertip, increased moisture level was often detectable (10-20% in reading) for sound stress and the mathematical task, but not always. Weak correlation was found over moisture level of 50, [4] for the mathematical task. However it was difficult to find the general trend reported before. This could be attributed to the occlusion time [6] necessary for moisture level to affect the friction.

Also, the moisture level tended to decrease with times of stimulation for sound and duration over 6 min for the mathematical task. Subjects might have accustomed to these stresses easily.

Further discussions including the effect of surface roughness or moving direction will be made.

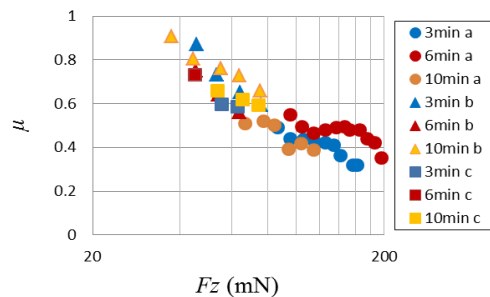


Figure 2. Correlation between normal load and friction during the mathematical task

4. Summary

It is confirmed that the mental stress affects the friction at the fingertip. Sound and gripping stimulation tend to increase the normal load but the mathematical task. The effect of sweating seemed to depend on the initial moisture level.

5. References

- [1] Accot J, Zhai S, CHI 99 Papers, 1999, 295-302.
- [2] Mizuhara K, Washio T, Ishii T, Proc. WTC 2009 Kyoto, 2009, 190
- [3] Mentis HM, Gay GK, Proc. 4th IEEE Int. Conf. on Multimodal Interfaces, 2002, 406-410
- [4] Tomlinson SE, Lewis R, Liu X, Texier C, Carre MJ, Tribology Letters (2011) 41:283-294
- [5] Pasumarty SM, Johnson SA, Watson SA, Adams MJ, Tribol Lett (2011) 44:117-137