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Author(s)	原崎，正；石井，仁
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Study on Night Camping in the Igloos (1)

Tadashi Harazaki and Hitoshi Ishii

Physical Training Department, Sapporo Branch, Hokkaido. Gakugei University

原崎正・石井仁： 雪穴夜営に関する研究 第1報

Introduction

Of late years we have had winter-mountain accidents increasingly. we can find various kinds of causes of them. One of them, which is very important, is that they who have become the victims of these accidents did not try to protect themselves against the sudden changes of the weather by making snow shelters. In fact we hear and read that in various cases many lives were saved when they were in danger of being frozen to death by camping for the night in the snow shelters.

Therefoe, as the first step of this experiment, I am going to inquire into fatigued condition of human being using "flicker test" and "Tapping test" under the date about these :

Construction of the snow shelters
Method of piling up snow blocks
Difference of the temperature inside and outside the snow shelters
Direction of the wind
Speed of the wind
Maisture
Phisiological records of night-camping in the snow shelters

Methods

Date of the experiment : March 2-3, 1960
place of the experiment : Summit of Mt. Moiwa, Sapporo (hight 530.9m)
Members : 3 (2 students of the Physical Training Department of Hokkaido Gakugei University and their teacher.)
Tool and Meters ;

scoops 3 (released scoops of U. S. A, prttable)	
saw	1
thermometers	2
hygrometer (wet and dry bulb hygrometer)	1
anemometer	1

lanterns (National UM-I 1.5 V×2)	2
torch lamp (Single 1.5 V×2)	1
air-mats	2
sleeping-bags	3
poncho	1
flicker test (yamakoshi Seiakusho)	1
stop watches	2
tappings	2
old newspapers	lots

Results

We constructed four snow shelters in all. One of them was constructed as a snow-break. Others we constructed just as Eskimos do. we call them "igloos" hereafter and name them Igloo No. 1, Igloo (Fig, 1-B. C) No. 2 (Fig, 1-A) and Igloo in reserve. No. 2 was of the same size with Igloo in reserve ; hight 1.6M, diameter of the base 1.5 m. But one had its enterance in the side different from those of others.

This is how we constructed the igloos. First we marked a circle 1m in diameter and then went on digging down. Next we piled spuare-cut snow-blocks around the circle and as they grew higher, we piled a little nearer to the center of the igloo so that they might cover it. Thus we had four snow shelters. After that we cut the entrances open. It took about falf an hour for one person, about a quarter an hour for two others to make Igloo No. 2. Igloo No. 1 was 1.8m in heights, 3M in diameter, and it took about an hour for two persons to finish. As to the situation of the entrances, as it is illustrted, that of Igloo No. 1 faced to the south, that of No. 2 fo the northwest, and that of Igloo in reserve to the southwest.

Now this is how we camped for the night. Two of us camped in No. 2. We spread a sleeping-bag on the air-mat and hung only an old newspaper to cover the entrance. In Igloo No. 1 we spread a poncho and covered the entrance with its corners. Then we piled our rucksacks at the entrance. We spread air-mat on the poncho and moreover we had sleepingbag on it.

Two of us confined ourselves in the Igloo No. 1 and we measured weather conditions every two hours. We kept almost all the tools and meters in the No. 2. In each igloo we kept on a big condle (Hope, I. S. G, M. F. G. Co, LTD) burning all the night. During the night we hurnt no other fuel than the candle except when wegot out of the igloo in order to take back the former temperature, but in vain. (We use a big can of portable fuel with the label of "Bear")

As for the food, after dinner we took bread, oranges, cakes, tea, etc. at 0 o'clok for the mid-night snack. And even after that we set no limit to eating till morning,

Report of the first step of the experiment of camping in the igloos ;

Table 1 : Outside the igloos

time	18 hours	20 hours	22 hours	0 hours	2 hours	4 hours	6 hours	8 hours
weather	snowy (dry snow)	snowy	snowy	fine	snow-stormy	slighty cloudy	slightly cloudy	cloudy
temperature	−7.5°C	−7°C	−8°C	−9°C	−8.5°C	−9°C	−9°C	−8°C
wind-speed	2.25M	3 M	3 M	7 M	7 M	3 M	3 M	3 M
wind-direction	north-northeast	north-northeast	north-northwest	northwest	northwest	northwest	northwest	northwest
moisture	/	/	/	/	/	/	/	/

Tale 2 : Inside the igloos

time	18 hours	20 hours	22 hours	0 hours	2 hours	4 hours	6 hours	8 hours
temperature in Igloo No. 1	−2°C	0°C	−2°C	−4°C	0°C	−1°C	−4°C	−1°C
temperature in Igloo No. 2	−2°C	0°C	−2°C	−6°C	/	/	/	/
moistute	80 %	/	/	/	/	/	/	/

Table 3 : Result of Flicker test

	usually	18 hours	0 hours	6 hours	drunken (for reference)
Ishii	43	39.5	38	37	39
Ogawa	42	39.0	38	38	35
Sato	42	41	37	40	39

Table 4 : Result of Tapping test

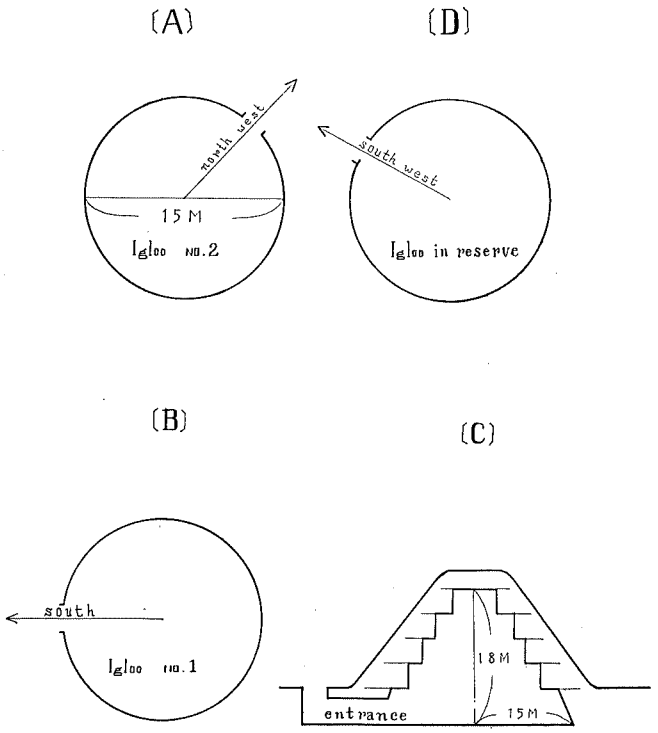
	usually	18 hours	0 hours	6 hours
Ishii	281	194	190	227
Ogawa	364	274	201	307
Sato	250	208	187	230

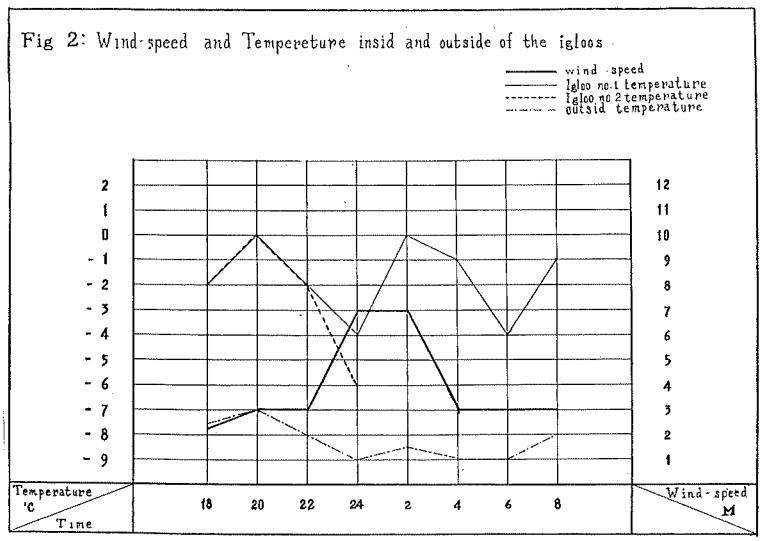
(Noice)

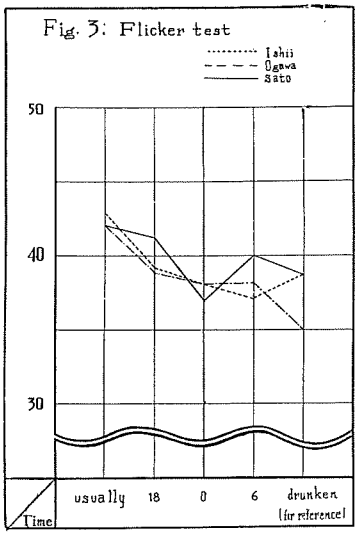
1) As a hygrometer we used a wet and dry bulb hygrometer and we measurd only inside the igloos, but we could not measnre outside the igloo since it was frozen and became of no use.
2) The results of Flicker test illustrated are representative of several measurements.
3) The results of Tapping test illustrated are representative of several tests of 30 seconds each.

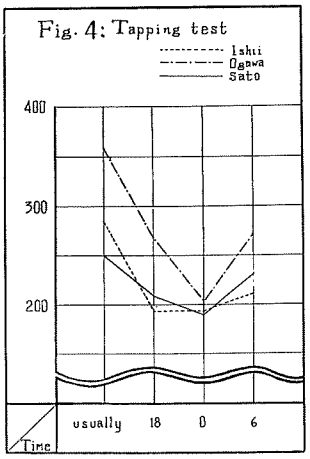
Tadashi Harazaki Direction of the entrance of the igloo

Fig. 1









Discussion

We began to camp for the night in the igloos we made. But just at midnight we felt a little cold. Especially in Igloo No. 2 (Fig.-1A) the temperature fell to -6°C as the graph shows. (Table. 2. Fig. 2) We surveyed the igloos and found lots of crevices. This was one cause of the falling of temperature. Another cause was that after 20 hours the direction of the wind changed to the northwest and the 7m cold wind had deen blowing direct to the entrance which had been shut with only one old newspaper. Therefore we temporarily repaired the igloos. Igloo No. 2 had more crevices than Igloo No. 1 (Fig.1-B. C) After that we removed from Igloo No. 2 to Igloo No. 1, and continued measuring phenomena except inside Igloo No. 2 after 2'

The next morning we re-surveyed Igloo No. 1 and found several big crevices. In spite of our efforts in careful constructing and repairing, nature surpassed human work. How difficult it was to fill up crevices and to make perfect igloos!

However, if we could perfectly exclude outside cold air. it might have been possible to keep the temperature always near 0°C. Beside the defects mentioned above, we can indicate anther defect. It is about the entrance. The longer and the narrower, but not so narrow as a man can not crawl in it, the passage of the entrance is, the better it is for stopping it up. The entrances we made were 1m long and wide enogh for an adult to crawl easily on hands and knees.

That night we tried to keep out the cold air by using poncho and by piling up the rucksaccks. But they were not enough and we felt the cold air coming into the igloos.

The maximum speed of the wind was 7m/sec and the menimum temperature was -9°C, so the body felt temerature seemed to have fallen to about-16°C. But the temperature in the igloo was-4°C. (See Table 1, Table 2.) As we crawled out every two hours, the temperature was affected so often. Here it is considered that if we contrive a more

perfect entrance and a better way of going out and in, we shall not have such a fickle temperature as we experienced in the igloos that night. Further we should like to all that Igloo No. 1 had the capacity of three men lying or six men sitting.

We three testers had been tired very much by skiing all day long, so it is possible to consider that we were in the same condition as that of the tourists skiing all day long when we began comping in the evening of March 2. Therefore even we, who are the students and a teacher of the Physical Training Faculty, are considered to have been very tired at 18 o'clock when the first Flicker test was held.

In the results of Flicker test, Sato's numerical value at 6 o'clock March 3 is 40. We consider it is because he had slept for about 4 hours between o and 6 hours. (Table-3) As to the Tapping test, the numerical value at 6 o'clock is pretty high. We consider it is because we had slept for some time and because we hed been accustomed to the frequent tests. (Table, 4)

Closing remarks

This experiments was executed in the snow shelters called Eskimo's igloos. And we found various kinds of faults to be improved. For example, When we whanted to lie down or to lean against, we felt very uncomfortable because of the snow wall and its foot cut and piled aslant as you see in the illustration. (c)

In the next step of the experiment we are going to improve the method of building igloos and the construction of the entrances as well as to contrive the way of getting out and in for measuring, in addition to the test of using snow cliffs covereing downward.