

Measuring pain

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It is impossible to access other people mental space other than from the behavior they display or the verbal responses they tell. Even those signs may be misleading if the participants decide to deceive the experimenter and fake or lie. The student of pain in addition faces two other methodological hindrances:

- a) because pain stimuli are harmful, e.g. pain is often produced in experiments with tying a tourniquet around an arm or leg to cut off circulation and starve downstream tissues of oxygen. The pain is acute but there is a risk to harm those participants who might not be able to feel pain, e.g. in congenital indifference to pain (see experiment 1);
- b) the participants might be willing to feel pain for various other interfering motivations (see experiment 2) or mental diseases. The anoxia method for seeing how long you can withstand the pain is especially dangerous, for lesions may develop in the oxygen-starved tissues of highly motivated participants.

The general principle of conflicting motivations avoids largely most of these difficulties and may be used with animals as well (see experiment 3).

Experiment 1, was simple psychophysics using not anoxia or electrical stimuli but harmless simple temperature stimuli. The participants were asked to report and quantify the intensity of pleasure/displeasure experienced when dipping one hand in well stirred water at a regulated temperature between 10°C and 50°C. As the pain thresholds are 15°C and 45°C the range for pain is largely available without being dangerous or harmful. That method was applied to normal healthy participants and to two persons with congenital indifference to pain. The results showed that within that limits the sensation covered the whole range between very unpleasant and very pleasant, according to the participants internal core temperature.

Experiment 2. Isometric muscle contraction, another method to inflict pain, was used in Experiment 2. The participants had to adopt a sitting position with their backs against a wall and their lower limbs at right angles, but without a seat. Such a position can be maintained only by keeping extensor muscles fully contracted¹. The participant doesn't move and the tonic contraction keeps blood from irrigating the thigh muscles. A painful ischemia soon appears and steadily increases to the point of becoming intolerable. This was the pain that participants endured in conflict for a monetary reward, as in that experiment they received money at various rates over different sessions, The longer they tolerated pain, the higher the amount of money they recieved at the end of the session. The results showed that it was thus possible to calibrate pain against money as the duration tolerated was proportional to the logarithm of money earned.

Experiment 3. In that experiment both the methods used in Experiment 1: temperature stimulus, and 2: conflict of motivations, were used with rats. The animals wer housed in a warm 'home' with food and water available *ad libitum*, and they had access to a palatable reward at the end of a 16 m long zig-zag alley. But the ambient temperature outside the warm home was -15°C, *i.e.* cold enough to presumably produce pain in these rats. The results showed that the rats repeatedly ran to the palatable taste stimuli but at the cost of pain as they had tail tip and ear tip frostbite necrosis. Yet the pain must not have been severe as the animals were not forced to endure it, they could have stayed in their warm home, but decided by themselves that it was worth to obtain the palatable reward².

Thus, these methods avoid most of the difficulties and dangers encountered in quantitative experimental studies of pain.

¹*This exercise is part of the training for competing downhill skiers.*

²*That experiment had been approved by Laval University "Comité de protection des animaux."*