PSYCHOLOGON

How Does the Brain Perceive a Break-Up? Similarly Like When You Burn Your Hand

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czech version

"That hurts," "That hurt me," – examples of expressions that can be used to express both physical and emotional pain. Could this similarity have a deeper foundation? Even though people clearly differentiate between hurt feelings and hurt skin, does the brain work the same way?

Un-Break My Heart

One can examine the dismal waters of tragic love or social rejection in different ways. K. H. Mácha (a Czech Romantic poet) tried to capture them in his lyrical epic poem *Máj* (*May*), and N. I. Eisenberger tried the same using the functional magnetic resonance. Which approach will we focus on in this post? Unfortunately for all the romanticists, PsychoLogOn.cz's thematic focus is a bit closer to the latter.

Metaphor or Reality?

We can find metaphorical phrases like "broken heart", "you've hurt my feelings" and so on in many languages. It is apparent that the person who describes his or her feelings, hardly suffers from a broken cardiac muscle. Or rather, a number of nations and cultures (independently of each other) have come to the conclusion that psychological pain is best described when comparing it to physical pain.

Are those really mere metaphors, or do physical and psychological pain have more in common than it seems? Naomi I. Eisenberger could not get this question out of her mind, so she set out to find the answer using the functional magnetic resonance (fMRI).

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You Can't Play with Us!

Naomi I. Eisenberger with her colleagues (2003) published the first of a number of studies focusing on the relation between physical and social pain in Science magazine. The social pain in this experiment was created by the feeling of rejection.

The research was planned in the way that the researchers would compare the data about which brain centres activate when feeling physical pain with the data about which centres activate when feeling rejected. Psychologists from other areas of research had already known which brain centres activate when experiencing pain. But how to find out which centres activate during social pain?

For that, you will need a few unsuspecting volunteers to whom you promise that they will play a computer game with others during the fMRI scan. However, just like in real life, the rules of the game are sometimes created by someone else...

The test participants were put into an fMRI scanner and told that they would play virtual catch with two other probands. However, in reality the catch was controlled by a computer in the following way: first, the participants learned that they could not participate in the game due to technical difficulties, so they only watched others play catch. After some time they could participate in the game, and when they got the ball, they could decide who they would throw it to. However, after a few throws the computer stopped passing the ball to the participant. The participants trapped and immobilised in the tunnel of the fMRI scanner could do nothing else but watch the game of their two "team-mates". And hope in vain until the end of the experiment that someone would pass the ball to them. The participants fully experienced the feeling which they probably so intimately knew from the kindergarten – nobody wanted to play with them!

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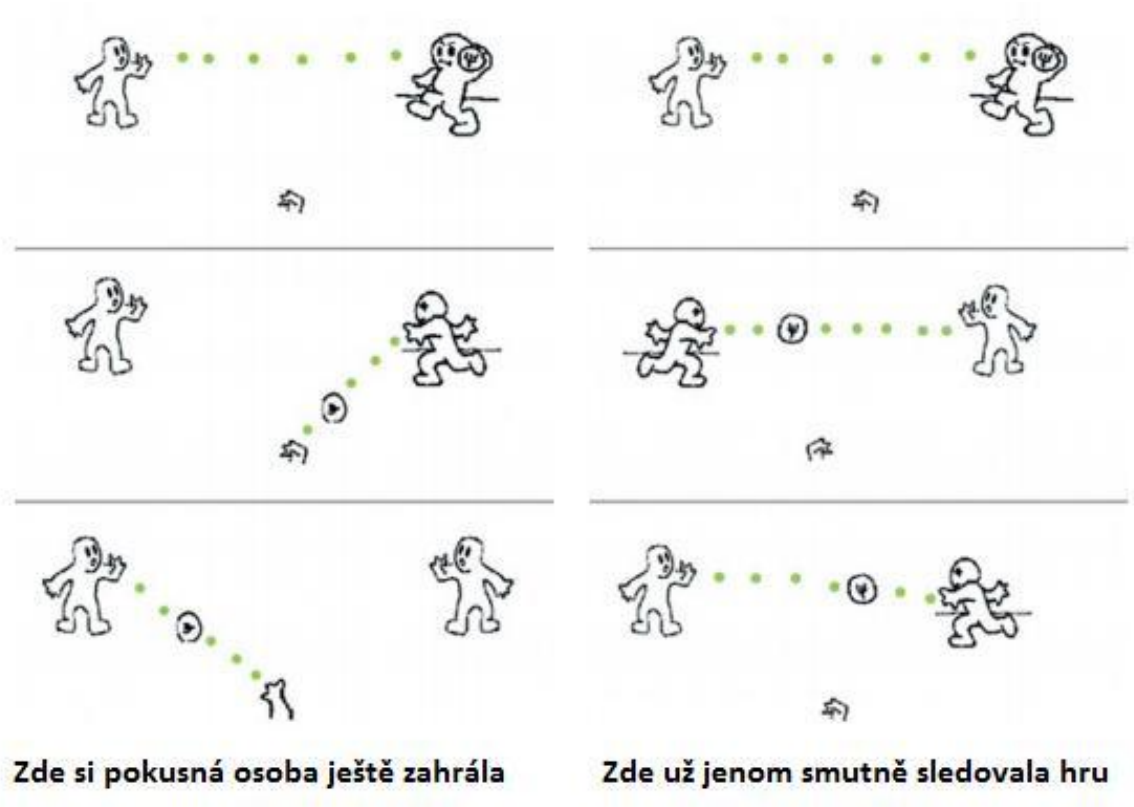

Fig. 1. An example from the game which the participants "played" with two others – however, those were controlled by a computer. Adapted from: Eisenberger (2004)

Experiencing the Pain

At that time the researchers had the information about which parts of brain activate during social inclusion and exclusion. Comparing the data with already known data about physical pain provided the final results.

It transpired that there really exists a statistically relevant overlap of areas which activate during both types of pain. Those are namely the anterior cingulate cortex and the right ventral prefrontal cortex.

The former area is considered to be the "alarm system" which activates when something is not right – for instance, when experiencing pain. It activated in this research when the individual was excluded from the game, i.e. he or she was experiencing social pain.

The latter area activates (among others) during inhibition and coping with physical pain. In this research, however, it activated when the player re-joined the game and was passed a ball. This research brought the information that experiencing physical and social pain has the same base.

However, at least one question remained unanswered. An overlap was found especially in affective centres in the brain, when in experiencing the pain. But what about the sensory experiencing of pain as such? Are there the same centres for physical and social pain?

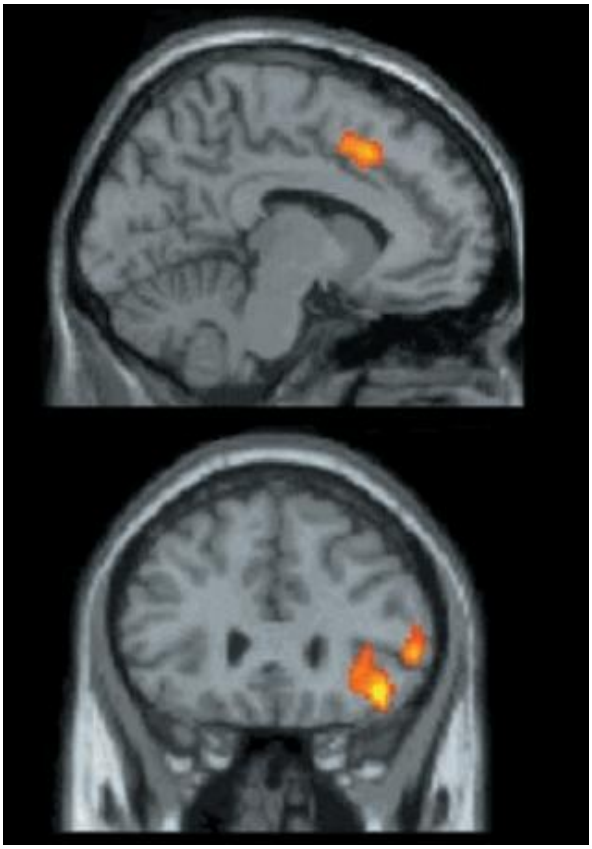

Fig. 2. The upper image shows the activation in the area of anterior cingulate cortex, the lower in the right ventral prefrontal cortex. Adapted and edited from Eisenberger (2003).

Feeling the Pain

Ethan Kross and his colleagues (2011) noticed that sensory areas activate only when the physical pain is strong enough. They decided to find out whether these centres activate even in case of very strong social pain. Therefore, they needed to evoke a more intensive feeling of rejection than the one used in the previous research. And they needed participants. Let us show their experiment on a hypothetical advertisement which they use to find volunteers for the research:

A unique opportunity!!! Have you broken up with your partner recently? Have you been hurt? Take his or her picture and come to our research! We will immobilize you, put you in a narrow tunnel of a fMRI scanner, where you will be encouraged to think about the painful break-up,

and at the same time we will be showing you his or her picture and occasionally burning your hands from!

Surprisingly, 40 individuals took part in the research. The researchers probably formulated the recruiting advertisement in a different way than we did.

Nonetheless, our advertisement nicely sums up the course of the experiment. In addition, the researchers carried out a test measurement with neutral and weak stimulations (a picture of a friend instead of a partner, agreeable warmth instead of unpleasant burning).

Contrasting all the obtained data showed a significant overlap in certain brain areas which activated when experiencing both rejection and physical pain, but did not activate during neutral (weak) stimulations.

Social pain (or a rejection or break-up, if you will) therefore shares not only the affective but also some of the sensory centres with physical pain.

No Two Pains are the Same

The realization that rejection and physical pain activate shared brain centres is certainly interesting. However, that does not mean that those types of pain are completely interchangeable. Various types of pain affect our mind in various ways. We will show that on the following research which proves that there is a difference in the intensity of re-experience between physical and psychical pain.

Zhansheng Chen with colleagues (2008) let the test participants recall pain. What is more, they had to think about various types of pain. One time, they recalled a situation when somebody hurt them emotionally, but then they also had to think about a moment when they hurt themselves physically.

The level of re-experienced pain was considerably higher in social pain in the participants. In addition, during cognitively demanding tasks, the participants did better when they were thinking about physical pain. On the other hand, they did worse when they were thinking about social pain. It is apparent, that even though both types of pain have a lot in common, they also have many differences.

And What It All Means?

Pain is a tool which the organism uses to notify us that something is wrong with it. And people, being social creatures, need to know all the time if everything is fine in their relationships with people close to them. Under the influence of this statement, it might not seem so surprising that physical and social pain often share the same mechanisms of working which these and other studies have proven. They also prove the hypothesis that social pain "evolved" from physical pain. And especially the saying about a broken heart proved to be correct in principle.

Translation: Patrik Míša (pmisa@phil.muni.cz)

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