Evolution of creating difficulties for others

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My research refers to studies of evolution of complex interactions between the struggle for survival versus cooperation and help versus counteraction.

Each of us, from time to time, has come across difficulties and problems created to him or her by others. Some of these difficulties were destructive, and other ones were constructive, positive for us.

Moreover, many of us are university teachers and we design special instructional problems and difficulties for our students so that they are able to solve professional problems in their areas of interests.

Let me give an example of creating a difficulty in everyday life.

Westlake father facing potential charges after 'testing' sons with stranger
By Kaylee Remington, *The Morning Journal*
http://www.morningjournal.com/article/MJ/20160415/NEWS/160419621
(the reduced text)

A 46-year-old father put his 14- and 16-year-old sons to the test when the man's 45-year-old friend went to the front door of the home and asked to be let in, to see if the teens listened to instructions to never let anyone in the home except known relatives.

The 14-year-old son let in the friend, who acted as a recently released convict claiming the father owed him money. The friend also made physical threats.

The sons barricaded themselves in a bedroom and then jumped out of a second floor window onto the garage roof and landed on the ground close to a sidewalk.

Westlake City Prosecutor will consider child endangering charges against the father and his friend.

One can pose the question: what are evolutionary roots of such behavior and many other behaviors related to creating difficulties?

In my talk I will address 3 main issues. Firstly, I will briefly describe a typology of difficulties, and then we will look at how this relates to evolution. Finally I will comment on the role of uncertainty in designing difficulties.
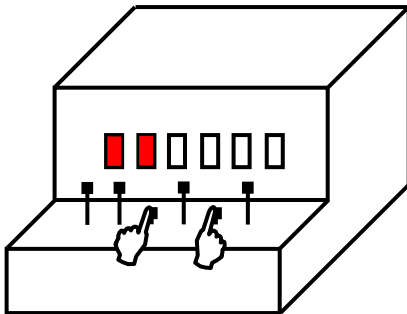
The types of difficulties created for others

One can roughly distinguish between, at least the following types of difficulties created by humans and non-human animals for one another.

1. Destructive difficulties created to cause damage.

2. Constructive difficulties created to help the other subject to develop (for example, instructional problems posed by a teacher, "secrets" hidden in puzzles, etc.).

The problem-solving toy containing some math dependence relations which must be revealed

3. Diagnosing difficulties created to explore the condition and potential of another subject.
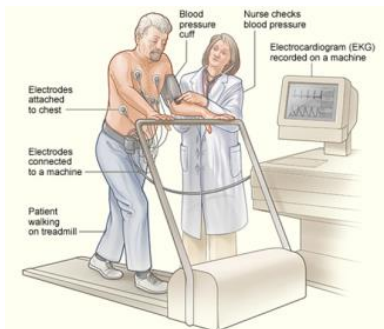
Treadmill Stress Testing
http://studynursing.blogspot.ru/2010/05/tmt-or-stress-test.html

All the types of the difficulties can be interwoven with one another.

The stages of development of creating difficulties in evolution

My hypothesis is that the stages of development of creating difficulties in evolution are the following.

1. Inhibition
This initially refers to destructive difficulties, the first type of difficulty invented in evolution. Even primitive organisms can create difficulties for other organisms, for example, by producing toxic substances inhibiting the growth of neighbors.

"To defend their territory against invading competitors, plants employ <… > toxic compounds that can inhibit growth and development of other plants"
https://www.mpg.de/9731123/plants-allelochemicals-competition

http://www.desertusa.com/creoste.html

2. Trial attacks and aggressive exploratory behavior
The second stage is diagnosing difficulties aimed at subsequently inflicting damage (e.g., mock chases, probe attacks, prey testing behavior, etc.). Different animals - from sharks to wolves - carry out trial attacks. Animals carry them out to test the capacities and vulnerabilities of potential prey or enemies, to identify the weakest individuals in a group of potential prey, etc. A key feature of the probe attacks is that they are performed not at full capacity and can be redirected, intensified or weakened depending on the situation.

The cat tries to attack a small snake
http://www.thetrendingfacts.com/2016/05/a-cat-attempts-to-attack-live-snake.html

3. Creating practical difficulties as helping behavior
Some animals teach their young by bringing them live prey. It is more difficult for the parents, and fighting with live prey is more difficult for the young. But because of this opportunity the young learn how to deal with the different defense strategies of their prey.

"Opportunity teaching"
Adult "helper" meerkats bring live prey to pups to give them opportunities to practice tackling prey under a helper's supervision (http://www.bbc.com/earth/story/20141124-animal-apprentices-the-complex-relationships-required-to-succeed; the photo: BBC / Theo Webb)

Thus, in the animal world one can find examples of creating both destructive and constructive difficulties.

4. Creating diagnosing difficulties as helping behavior

Maybe only humans create and use diagnostic "trials by difficulty" that have a constructive purpose, i.e., to help the one whose status is being tested. Here one can mention stress-tests in medical diagnoses, initial testing of the trainee before training, etc.

Such activity requires high-level cognitive organization. A subject creating difficulties should design and conduct a test accurate enough to estimate precisely the condition (process, behavior) which must be treated or improved, and at the same time not go too far during this diagnostic activity. It is necessary to avoid transforming diagnosing difficulties into destructive ones – e.g., not to kill or mutilate while testing, for example, while medical stress-testing.

One can assume that only humans can plan and carry out this complex diagnostic activity aimed to help. I couldn't find examples of such behaviors in non-human animals.

5. Creating meta-difficulties: difficulties for creating difficulties

This level (as well as metacognition and other meta-activities) is achieved mainly by humans. Functions of creating meta-difficulties are management and control of difficulties of the lower levels. For example, it includes designing different instructional problems not for students, but for instructors to teach them to pose developing problems for their students. A good example of this would be a trainer of math teacher who designs special problems for them so they can teach children to pose math problems for one another.

Meta-difficulties can be not only constructive, but destructive and diagnosing – just like difficulties of lower levels. For example, in the Soviet Union, psychological testing was prohibited for a few decades. This in itself was a great destructive difficulty for the design of diagnosing and constructive difficulties. Therefore, we see a well-differentiated multi-level system of work creating very different difficulties in human society.

The ratio of constructive, destructive and diagnosing difficulties

In general, it seems that the ratio of constructive and diagnosing difficulties is increasing in evolution, and the ratio (but not the absolute amount) of destructive difficulties is decreasing. Even in military activities the role of diagnosing activity and preliminary simulations is becoming more and more significant.

A developmental trend of creating difficulties: to increase their unpredictability

An important developmental trend of all types of difficulties is to increase their unpredictability.

The highest level of complex constructive difficulties can be found in astronaut training. The training must prepare the astronauts to be ready to explore and work with unpredictable things—unpredictable even for the instructors themselves. In general, if a teaching system develops readiness to novelty, it necessarily creates constructive difficulties for learners because exploration and mastery of novelty are always challenging.

Concerning diagnosing difficulties, I can say that now some standard educational tests for secondary school students include tests of exploration of novel objects. They require experimenting on new technical systems with unknown structure and functioning. It gives one an opportunity to estimate how the students cope with novelty.

One should emphasize that creating difficulties of any kind can lead to ambivalent and often unpredictable results. Difficulties created to be constructive can result in inhibition of development, and vice versa. Knowledge obtained through diagnosing difficulties can be used for the future creation of both constructive and destructive difficulties.

Thus, one can see complex interplays between creations of different types of difficulties in evolution.

The evolutionary late achievements in areas of creating difficulties are:
- diagnosing difficulties aimed at helping the subjects tested;
- constructive difficulties aimed at teaching people to be ready to work with the unpredictable, and
- creating meta-difficulties of different types.

To conclude, why can it be interesting to study creating difficulties of different types? The answer is the following. It gives an opportunity to see an additional dimension of complex interplays between counteraction and help in evolution. It is interesting to observe transformation of difficulties created to do damage into creating difficulties as helping behavior and into meta-difficulties created to manage and control other difficulties.

Reference
Poddiakov, A. (2014). Complicology: Study of Developing, Diagnosing and Destructive Difficulties. Moscow: Publishing House of HSE. (English translation of selected chapters at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2645207)