Advances in Natural Science **ISSN 1715-7862 [PRINT]**
Vol. **3**, No. **2**, **2010**, pp. 51-54 **ISSN 1715-7870 [ONLINE]**
www.cscanada.net **www.cscanada.org**

The 3rd International Conference of Bionic Engineering

To Explore the Collective Animal Erratic Panic and Biomimetics

C. S. CHEN[1]
CHU Si-lei[2]
KAO Fang-yu[3]
Hsu Yu-lin[4]
Katherine Chen[5]
PAO Sheng-ying[6]

Abstract: In biomimetics, we learn and get inspiration from animals to improve our quality of life. It is important to have better understanding on what, why, and how animal did so we can apply the biomimetics more effectively. Anomalous behaviors including the collective animal erratic panic (CAEP) are some of the poorly understood and potentially very important and inspiring phenomena. CAEP is not commonly noted. But it is often noticed before, during, or right after some abrupt natural disasters. There are many speculations, confusions and controversy associated with the still mysterious CAEP. CAEP could provide us with invaluable inspiration to improve our biomimetics including sensing and signal processing. CAEP would also help us to reduce our loss in lives and properties through detecting the precursors of the forthcoming natural disasters.

We have explored the important issues on 1.What is CAEP? 2. What are the major stimuli and essential mechanisms in CAEP? and 3. What wisdoms can we gain from CAEP for better understanding and to further advance our biomimetics?We have made good advances in all three critical issues. With our preliminary results, we can explain the nearly no animal casualty in the 2004 Indian Ocean tsunami tragedy, the successful early warning in the 1975 Haicheng earthquake. We can also shed some light to the sudden disappearing of the unusually large gathering of sea lions at Pier 39 in San Francisco during 2009. Furthermore, we can fix the challenging twists of some anomalous animal behaviors in 2008 Wenchuan earthquake. Improved modeling and

[1]National Tsing Hua University, Hsinchu, 300 Taiwan; National Dong Hwa University, Hualien, Taiwan.
[2] National Tsing Hua University, Hsinchu, 300 Taiwan.
[3] National Dong Hwa University, Hualien, Taiwan.
[4] National Taiwan University, Taipei, Taiwan.
[5] Harvard University, Cambridge, USA.
[6] MIT, Cambridge, USA.
*Received 10 May 2010; accepted 3 July 2010

helpful appropriate experiments are needed to make further good advances. A better grasp of the CAEP can help us to improve our wisdom in biomimetics. It can also provide us with potentially vital systems for early warning of the deadly abrupt natural disasters.

Keywords: biomimetics; panic; collective behaviour; animal; stimuli

1. INTRODUCTION

Panic is a complex behavior that is somewhat confusing and difficult to appreciate. Panic in human being has attracted the attention of social, medical, and academic sectors, as it is a disturbing painful experience and may lead to personal and public tragedy. In animals, other than pets in some societies, the general public generally ignores panic there. On the other hand, the not commonly occurring collective animal erratic panic (CAEP) has often caught people's attention, particularly in China and Japan with worrying speculation. With some so-called "coincidence", CAEP has often been noted before, during, or right after some abrupt natural disasters, the deadly and persistently unpredictable major earthquakes in particular. Unfortunately, we still do not know how to communicate with animals to explore the "what" and "why". Furthermore, controlled CAEP experiments are difficult if not unfeasible to do. CAEP becomes a mysterious and controversy issue.

It is well known that some animals have some particular keen senses and have the ability to communicate through a great distance also. It is important for us to explore CAEP for better understanding in searching for invaluable inspiration to our biomimetics. CAEP can potentially also help us in achieving the early warning of the abrupt natural disasters.

2. METHODS

It is difficult, if not impossible to examine the CAEP with the current reductionism based sciences and technology. It is not yet being able to test the CAEP in the lab or field setting either. We have started to explore the CAEP in the anomalous animal behaviors first as CAEP can be noted in zoos, farms, and ranches. Without the good guidance of experiments, we have made some daring assumptions through reasonable selection and have also sought the help after modeling. We have applied similarities to guide our advance whenever feasible, in comparing with some human panic with appropriate modification.

3. RESULTS AND DISCUSSION

We have thus explored CAEP for better understanding and potential merit. We raise the following questions including

1. What is CAEP?
2. What are the major stimuli and essential mechanisms in CAEP?
3. What wisdoms can we gain from CAEP?

3.1 What is CAEP?

We have formulated some more specific descriptions of CAEP to reduce the possible confusion and controversy.

3.1.1 We will limit "CA" (collective animal) to a group or groups of fairly large number of the same animals or different animals in custody such as in zoos, farms, and ranches.

3.1.2 We will exclude those apparent factors including fatigue, under-nourishment, lack of sleep, known disturbance, threat of fire, flood, storm, and predators from our "E" (erratic) consideration.

3.1.3 We will explore some irrational, bizarre panic different from that normally noted. They include the over nervousness, restlessness for no noticeable reasons, overly aggressive without provocation, total confusion, excessive agitation, intense fear, difficult or impossible to be calmed down, eager to flee and actual escaping if succeed. "EP" also often occurs suddenly without noticeable early sign. Constant monitoring is important.

3.2 What are the major stimuli and essential mechanisms in CAEP?

With our considerations in 3.1, some daring assumptions, and reasonable elimination, we have reached the following preliminary understanding on CAEP.

3.2.1 CAEP comes from animals' reaction to some life-threatening fear. It may also be their born instinct through evolution.

3.2.2 Most stimuli will come from the disturbances as some relatively sudden changes in the surrounding environment unfortunately difficult to be detected or undetectable by human being.

3.2.3 Abrupt natural disasters including tornado, severe storm, and major earthquake are the most likely sources for the stimuli.

3.2.4 Physical (vibration, sound, light, heat, electro-magnetic waves) and chemical (taste, odor) stimuli are the most probable threatening stimuli.

3.2.5 Those stimuli will propagate through the earth and/or the atmosphere above the earth.

3.2.6 Animals detect those stimuli through their uniquely sensitive sensory organisms including hearing, smelling, and touching/feeling with the ground and through the air.

3.2.7 Groups of animals in zoos, farms, and ranches may trigger some instinct to escape and flee to an area that is safer for them spontaneously in responding to the same threat noticed simultaneously. Infectious response to the threats is possible among the different groups of animals. For instance if animals see birds sudden flying away, or if they see other animals running in panic, they are going to get nervous too just like we used to see in the Tarzan movies.

3.2.8 Some discussion

With the above scheme, we can explain the nearly total miss of the wild animals by the 2004 Indian Ocean tsunami while 230,000 people were killed in fourteen countries. Reports indicated that animals fled away from the coming water to the safer higher ground. Animals there could have detected the life-threatening disturbances in the environment. The instinct for survival in animals made them escaping and running away from the dangerous threat. Inland and higher grounds are the only available alternatives. The early detection of danger and right response might have thus saved the life of animals there.

The erratic panic of animals just before the 1975 Haicheng earthquake (海城大地震) can be explained in a similar fashion.

The sudden disappearing altogether of the unusually large gathering of over 1500 sea lions at Pier 39 in San Francisco was another erratic behavior of animals puzzling many people. A series of strong earthquakes in the surrounding area afterward was an unexplained and worthy exploring "coincidence" and could be considered as an unexpected support to our results.

The 2008 Wenchuan earthquake (汶川大地震) gave a more challenging picture. Thousands of toads poured out onto the city's streets in the nearby Mianzhu County (綿竹), Zebras inexplicably butted heads; elephants almost hurt a zoo worker as they wildly swung their trunks at the zoo in the far distanced Wuhan (武漢) and Guangzhou (廣州). Peacocks there screeched just before the quake also. But no anomalous animal behaviors were reported at the nearby zoo in Chengdu (成都). It indicated that the disturbances animals received could be distorted or interrupted by the environment. Animals at the zoo in Chengdu might have received an un-alarming disturbance or no disturbance at all.

4. CONCLUSION

We have made some advances in exploring the "mysterious" CAEP. CAEP could be the lifesaving response of animals to the early signs of the deadly abrupt natural disasters. It would help us to reduce our loss in lives and properties if the anomalous animal behaviors could help us in detecting the precursors or providing us with some early warning of the forthcoming abrupt natural disasters. More importantly, CAEP will provide us with invaluable inspiration to improve our sciences and technology in biomimetics, particularly in sensing and signal processing.

REFERENCES

CHEN Chu-Shiang, ZHU Ou, CHEN Katherine, Hsu Yulin, KUO F Y. (2008). A Holistic systems science approach to explore the possible links between the anomalous animal behaviors and earthquake. *Proceedings of the 2nd International Conference of Bionic Engineering-ICBE'08*, Changchun, China, 6-8

Collective behavior [2010-06-19], en.wikipedia.org/wiki/Collectivebehavior

Famous San Francisco Sea Lions Abandon Their Pier 39 Post Read www.wired.com/.../2009/12/disappearing-sea-lions

Panic [2010-06-16] en.wikipedia.org/wiki/Panic

Smelser Neil J. (2000). *Theory of Collective Behaviour.* Routledge and Kegan Paul, Ltd, London, 131-221.

The December 26, 2004 Sumatran Tsunami,. www.ess.washington.edu/tsunami/Sumatra.htm

The Earthquake of February 4, 1975 in Haicheng, China, www.drgeorgepc.com/Earthquake1975ChinaHaicheng.html

Wilson E O (1975). *Sociobiology.* Harvard University Press, Cambridge.

2004 Indian Ocean earthquake [2010-06-27], en.wikipedia.org/wiki/2004_Indian_Ocean_earthquake

2008 Sichuan earthquake, en.wikipedia.org/wiki/2008_Sichuan_earthquake