

**Ilija Barukčić**  
**Causality. New Statistical Methods.**

---

Email: Barukcic@t-online.de  
<http://www.causation.de/>

---

Professor  
**Lotfi A. Zadeh**  
asked:

---

Professor Lotfi A. Zadeh wrote:

"Von: "Lotfi A. Zadeh" <zadeh@eecs.berkeley.edu>  
An: "Ilija Barukcic" <Barukcic@t-online.de>  
Cc: "Lotfi A. Zadeh" <zadeh@eecs.berkeley.edu>  
Betreff: thanks for the message/Barukcic  
Datum: Sonntag, 29. Oktober 2006 06:26

Dear Ilija Barukcic:

Thank you for your message and links to your papers. Could you explain to me how your theory would apply to the three problems posed in my message?

Thank you in advance.

Sincerely yours,  
Lotfi Zadeh "

Lotfi A. Zadeh,  
Professor in the Graduate School, Computer Science Division, Department of Electrical Engineering and Computer Sciences  
University of California, Berkeley, CA 94720 -1776. Director, Berkeley Initiative in Soft Computing (BISC)  
Address:  
Computer Science Division, University of California, Berkeley, CA 94720-1776. zadeh@cs.berkeley.edu  
Tel.(office): (510) 642-4959. Fax (office): (510) 642-1712. Tel.(home): (510) 526-2569. Fax (home): (510) 526-2433  
<http://www.cs.berkeley.edu/~zadeh/>

**The question of Professor Lotfi A. Zadeh was :**

> 1. I am a manufacturer of raincoats. I would like to increase my  
> **sales**. To this end, I increased the **advertising** budget by 20%. Six  
> **moths later**, sales went up 10%. Was the increase in sales caused  
> by the increase in the advertising budget? If so, to what degree?

---

I was allowed to post the/this question/s on the web. For further purposes (copyright etc.) please contact above.

---

Answer to  
Professor  
**Lotfi A. Zadeh**

31.10.06

---

Dear Prof. Lotfi A. Zadeh,  
thank you very much for your email. You are asking the following:

"I am a manufacturer of raincoats. I would like to increase my **sales**. To this end, I increased the **advertising** budget by 20%. Six months later, sales went up 10%. Was the increase in sales caused by the increase in the advertising budget? If so, to what degree?" (Zadeh).

In so far, your question deals about the relationship between an increase of an advertising budget and an increase in sales 6 months later. You want to know, is there a causal relationship between an increase in advertisement and an increase in sales. At the end, you want to know, was the increase in sales caused by the increase in the advertising budget and if so, to what degree? And much more than this.

Answer to  
Professor  
**Lotfi A. Zadeh**

31.10.06

---

You are asking at the end, is there a causal theory at all, which can answer your question?

In so far, let the last be the first.

**First.** Yes, the job on causation is done, your question can be answered. It is of course possible to answer the question whether there is a causal relationship between an increase in advertising budget and an increase in sales. Naturally, the question, was the increase in sales caused by the increase in the advertising budget can be answered too without any difficulty. Further, it is of course possible to answer the question, to what degree was the increase in sales caused by the increase in the advertising budget. You will have to use my methods. Your question can be answered without any problem after performing some calculations on a suitable databody.

Answer to  
Professor  
**Lotfi A. Zadeh**

31.10.06

---

**Second.** Can your data above be used to answer your question? No, not at all. Your data are not suitable or sufficient enough to proof whether an increase in sales was caused by an increase in the advertising budget. Your data above cannot be used for this purpose.

**Example**

Today, you have only the following material: one piece of steel ( 1 m ) and nothing else. 6 months later, you must have finished a new empire state building only with this material and nothing else. In so far, is it possible to build a new empire state building? Yes! Is it possible to build a new empire state building using only the material above ( Condition: one piece of steel (1 m) ) ? No, not at all.

# Answer to Professor **Lotfi A. Zadeh**

31.10.06

---

## **Reasons**

Besides of all, let us **assume** you are right, it is possible to extract cause - effect relationships from your data above. Thus, what are the essentials of your data above? What are the consequences in general?

On this view, you are assuming that a cause ( advertisement ) precedes its effect ( increase in sales ) in time (6 months later). In so far, according to your data, there is a period of time, ( 6 months ) where we have had a cause ( advertisement was still active or not), but we did not have had an effect. In other words, according to your question and your data above, a cause has to precede its effect in time. But, at this period of time (6 months) where the cause (advertisement) precedes its effect, we have had a cause, a cause that has not produced an effect, an effect (increase in sales) was

Answer to  
Professor  
**Lotfi A. Zadeh**

31.10.06

---

produced 6 months later. In other words, according to your data, we have had a cause, that was not a cause, this cause has not produced an effect.

How can a cause be a cause without being able to produce an effect? According to your data, the cause (advertisement) is a cause and equally is not a cause and both has to be true at the same period of time (6 months) until the effect is produced.

We would have to accept logical contradictions in nature if we were able to extract cause effect relationships from the data you delivered. You are delivering data that are assuming that a cause must precedes its effect in time. Thus, at the end, if we would use your data above to proof whether there is a causal relationship between advertisement and sales, we would commit the so called

Answer to  
Professor  
**Lotfi A. Zadeh**

31.10.06

---

**"post hoc, ergo propter hoc"**

logical fallacy.

This logical fallacy says in other words,  
after this, therefore because of this.

**Another example of this logical fallacy.**

Example.

Just now, a black cat is increasing the velocity by 20 % while crossing the street. The pulse rate increased by 10 % 6 months later. Is the increase of pulse rate caused by the increase of the velocity of the black cat and if yes to what degree?

Answer to  
Professor  
**Lotfi A. Zadeh**

31.10.06

---

Thus if your understanding of causation would be correct, the increase of the velocity of the black cat while crossing the street is responsible for the pulse rate increase because the one happened after the other and thus because of the other or to say it more philosophically

**"post hoc, ergo propter hoc".**

This standpoint is already proofed in philosophy as invalid. If we would use your data above to proof for causation, we would commit the typical post hoc, ergo propter hoc fallacy. Things that happen one after another are because of this not caused by each other. A sales increase by 10 % after an increase of advertisement budget by 20 % can be caused by increase of advertisement, but must not! This cannot be assumed, this must be proofed.

# Answer to Professor **Lotfi A. Zadeh**

31.10.06

---

The relationship between an increase of advertising budget and an increase in sales can be proofed for causation but not with your data above. Other factors, the non-cause, could have caused the increase of the sales too and must be considered, where are this data?

Further, in your question, you are reducing causation at the end only to an **increase of probabilities**. This is incorrect, cause can lower the probability of its effect too and must equally be considered in causal analysis without any restriction.

Advertising may be the cause of increased sales. But this cannot be assumed in general. Advertising (because it could be worse) can reduce sales too. This is part of causation and must be considered in causal analysis without any restriction too. In other words, the

# Answer to Professor **Lotfi A. Zadeh**

31.10.06

---

possibility of a non-effect as an effect of a cause must be considered too. A non-effect can be the effect of a cause. Where are this data?

On this view, an increase / decrease can be above 100% and more. On the other hand, probability measures are working from 0 to 1. So far, your data above are not sufficient to proof for causation.

## **Causation and data**

Basically, your question has to do about the relationship between causation and data. We can indeed proof whether there is a cause - effect relationship between investigated random variables but only under certain conditions.

Let us assume, there is a causal relationship between A and B. The data, you are analysing to proof whether there is a cause

---

# Answer to Professor **Lotfi A. Zadeh**

31.10.06

---

effect relationship between A and B must be more or less a precise "picture" of the relationship between A and B and other factors too. Only under such circumstances, you will be able to extract cause effect relationship from data, if there should be some and if the methods you are using are suitable.

The quality of data is a *conditio sine qua non* for extracting cause effect relationships from data. The material, the quality of data as such must be ensured. Under this condition, we have the methodology to extract cause effect relationships from data without any problem.

In so far, let us become a little bit more mathematical.

Answer to  
Professor  
**Lotfi A. Zadeh**

31.10.06

---

**Material and Methods**

A manufacturer of raincoats to this end increased the **advertising** budget by 20%. Six months later, sales went up 10% . The manufacturer asked himself, was the increase in sales caused by the increase in the advertising budget, if so, to what degree? Barukcic's methods were used proof this.

Sampling with replacement.

Independent Bernoulli trials.

Sample size large enough.

# Answer to Professor **Lotfi A. Zadeh**

31.10.06

---

## Results

Let

$p(X = 10\% \text{ sales increase})$  denote the probability of 10 % sales increase,

$p(Y = 20\% \text{ advertising increase})$  denote the probability of 20 % advertising increase,

$p((X = 10\% \text{ sales increase}), (Y = 20\% \text{ advertising increase}))$  denote the joint probability function of both.

Use the probabilities  $p(\cdot)$ , put them in the mathematical formula of the causal relationship  $c$  (Barukcic, p. 309 ...), recalculate  $c$  and you've got it.

Answer to  
Professor  
**Lotfi A. Zadeh**

31.10.06

---

If there is a significant causal relationship between increased **advertising** budget and increased sales it could make sense to proof to what degree was the increase in sales caused by an increase in the advertising budget.

This can be proofed without any problem using the **conditio-per-quam relationship** (Barukcic, Causality, 2006, pp. 271-285).

For this purpose, please take a look at:

[http://www.barukcic-causality.homepage.t-online.de/Ilija\\_Barukcic\\_Causality\\_ISBN\\_3\\_8334\\_3645\\_X.htm](http://www.barukcic-causality.homepage.t-online.de/Ilija_Barukcic_Causality_ISBN_3_8334_3645_X.htm)

I wrote:

---

© Ilija Barukčić. Jever, Germany, 2006. My part of this publication is an Open Access publication and distributed under the terms of the **Creative Commons Attribution License** (<http://creativecommons.org/>), which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

---

Answer to  
Professor  
**Lotfi A. Zadeh**

31.10.06

---

"In a reanalysis based on the data of Mathilde Bonnet et al. ( Journal of the National Cancer Institute, Vol. 91, No 16 (1999) 1376-1381), i have proofed, that the Epstein-Barr virus (EBV) is **a cause** and not the cause of human invasive breast carcinoma ( p value = 0.000321, power > 0.99 ). According to this investigation, not all, but just about **50 % of all** human invasive breast carcinoma are definitely caused by the Epstein-Barr virus."

Invasive breast carcinoma is up to an degree of 50 % caused by Epstein-Barr virus. Another example can be found at:

[http://www.barukcic-causality.homepage.t-online.de/Barukcic\\_Causality\\_2006\\_Second\\_Edition\\_Contents.pdf](http://www.barukcic-causality.homepage.t-online.de/Barukcic_Causality_2006_Second_Edition_Contents.pdf)

I hope I was able to help you.

**Sincerely yours,**

**Ilija Barukčić**

---

© Ilija Barukčić. Jever, Germany, 2006. My part of this publication is an Open Access publication and distributed under the terms of the **Creative Commons Attribution License** (<http://creativecommons.org/>), which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

---