

ADAPTIVE QUESTION LOGICS FOR SINGULAR CAUSAL EXPLANATION

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November the 26th 1914, early in the morning. In the river mouth of the Medway, a fleet of impressive battle ships is ready to oppose maritime attacks on Great Britain. But everything is still quiet, at that moment. However, at a couple of minutes to eight, one of the ships is suddenly surrounded by flames, without the slightest previous warning. Next, a big explosion was heard for ten miles around. [1]

Immediately, people began speculating about what had happened to the battleship named the Bulwark. Was it an accident or the result of sabotage? Till know, the cause(s) are unclear.

The skies were clear and the sun shone on the cold freezing morning of January 28, 1986. Kennedy Space Center in Florida was busy preparing the launch of the 25th space shuttle into space. Mission 51-L, the 10th flight of Orbiter Challenger. This was one of the most publicized launches because it was the first time that a civilian, a school teacher, was going into space. The launch of Challenger had been delayed five times due to bad weather, January 28 was the coldest day that NASA had ever launched a shuttle. The time had come, at 11:38 AM Eastern Standard Time, Challenger left Pad 39B at Kennedy. Seventy three seconds into flight, the Orbiter Challenger exploded, killing all seven of its crew. [4]

Following this accident, a presidential research team has been appointed to investigate the causes of this disaster. One of them was the Nobel prize winner Richard Feynman (1918-1988). Centrally in his search for an explanation stood the questions: “What went wrong with the Challenger?” and “What went wrong in the policy of the NASA?”

In [5] we’ve been making adaptations to and applications of the adaptive logic for causal discovery of [2]. This logic is apt to formalize causal reasoning concerning general processes using correlational information. **ALcd** is clearly able to capture the way in which a lot of researchers reason in their scientific work related to causal generalization. Nevertheless, this logic is not at all made for, and is by consequence useless in, formalizing people’s natural reasoning towards singular causal explanations. For example, one looking for the cause of Kims tra_c accident, or people wondering about the cause of the perish of the Bulwark, or Feynman investigating possible causes of the explosion of the Challenger.

Our intention in this paper is to develop a logic that is able to analyse the process of questioning and answering within the search for singular causal explanations, leading to the selection of a cause for such events as the perish of the Bulwark or the explosion of the Challenger. Statistical reasoning, which formed the basis of **ALcd** will no longer be the central ingredient here. Here, the logic will in the first place be characterized by questions concerning as well the supposed connections between variables (we prefer explicitly not to use the stronger word correlation here, because it concerns natural reasoning on singular events), as also the possible mechanisms acting between them. Thus, inspired by the heuristical approach we introduced in [5], we will develop a logic for singular causal explanations (**ALsce**) which will be based on the introduction of and on reasoning with a series of questions.

It is clear that it concerns a dynamic process of reasoning, whereby explanations are considered, and afterwards rejected, and the reverse. The more information we get, the better we will be able to discern between possible explanations. Additionally, we have to incorporate both the conjunction effect and the discounting principle [3]. This means on the one hand the choice for a multiple explanation with

supplemental components, rather than for a single explanatory component; and on the other hand, the discounting of the effect(s) of possible cause(s), given the knowledge/belief that (an) already accepted cause(s) is/are true. Adaptive logics seem to be best apt to incorporate these dynamics in the reasoning towards singular causal explanations.

We will present the outline of our logic for singular causal explanations, using an elementary singular event such as “Kim has had a car accident on Route 7 last night”. The final purpose of the paper is to be able to use **ALsce** for the reconstruction of the search for an explanation of more complicated happenings. We take as examples the loss of the Bulwark as explained by Philip MacDougall [1] and the causes of the explosion of the Challenger as analysed by Richard Feynman [4].

References

- [1] Philip Mac Dougall, editor. Schepen die verdwenen: over mysterieuze verdwijningen en onverklaarbare rampen ter zee. De Boer Maritiem, Baarn, 1994.
- [2] Maarten Van Dyck. Causal discovery using adaptive logics. 2002.