International Journal of Approximate Reasoning 98 (2018) 132–145

Contents lists available at ScienceDirect

International Journal of Approximate Reasoning

www.elsevier.com/locate/ijar

Kurt Weichselberger's contribution to imprecise probabilities and statistical inference ☆

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ARTICLE INFO

Article history:
Received 20 December 2017
Accepted 25 April 2018
Available online 27 April 2018

Keywords:
Interval probability
Imprecise probabilities
Logical probability
History of probability and statistics
Weichselberger's symmetric theory
Fiducial inference

ABSTRACT

Kurt Weichselberger, one of the influential senior members of the imprecise probability community, passed away on February 7, 2016. Almost throughout his entire academic life the major focus of his research interests has been on the foundations of probability and statistics. The present article is a first attempt to trace back chronologically the development of Weichselberger's work on interval probability and his symmetric theory of logical probability based on it, aiming at a new framework for statistical inference. We also try to work out the intellectual background of his different projects together with some close links between them.

1. Introduction

Kurt Weichselberger, who passed away on February 7, 2016, has been "a man of the first hour" of the ISIPTA meetings, perceiving them as the natural place to discuss the foundations of probability. He enthusiastically participated in the first six ISIPTAs, from the 1999 Ghent symposium to the Durham meeting in 2009, contributing several papers, a tutorial in 2005 and a special session in 2009. From the mid sixties of the last century onwards, the foundations of statistics and probability have always been Weichselberger's great passion – although he had worked on a variety of different topics,[1] and had been intensively engaged in academic self-administration and societies. By this engagement he had a lasting impact on the academic self-organization of German academics in general and the discipline of statistics in particular.

This paper is a first attempt to trace back fundamental aspects of Weichselberger's ideas as well as their links to his challenging research program. Our work is embedded into the *HiStaLMU* project (History of Statistics at LMU Munich). Among other activities, its members interview former leading personalities of the Department of Statistics by using methods of oral history [7] and build up an archive around Kurt Weichselberger's estate.[2]

☆ This paper is part of the Virtual special issue on Tenth International Symposium on Imprecise Probability: Theories and Applications (ISIPTA '17), Edited by Alessandro Antonucci, Giorgio Corani, Inés Couso and Sébastien Destercke.

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[1] The work on applied statistics includes among others research on survey and census methodology (e.g. Weichselberger [48]), regional price indices [69], and time series [49], see also Section 4.4.

[2] See also the workshop in March 2016 (https://statsoz-neu.userweb.mwn.de/research/ws_historystatistik_2016/index.html); last access April 4, 2018.

https://doi.org/10.1016/j.ijar.2018.04.009
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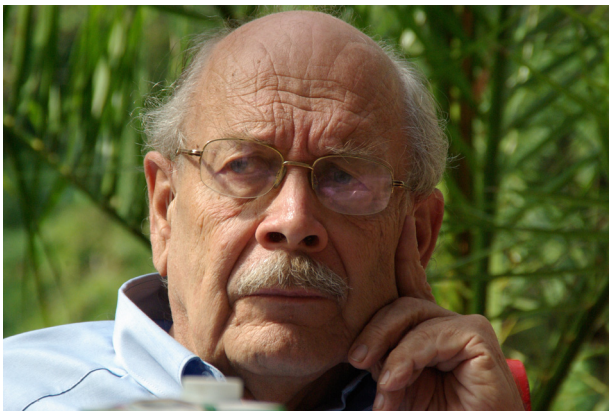

Fig. 1. Kurt Weichselberger (photo kindly provided by Kurt Weichselberger's family).

This paper is structured as follows. After a brief biographic sketch (Section 2), Section 3 briefly looks at those activities in academic self-administration that are motivated by Weichselberger's understanding of statistics as a general methodology. In the main part, focusing on Weichselberger's foundational work, the structure of presentation in this paper is chronologically. We distinguish four main periods: the first intensive research on logical probability (see Section 4), the work on probability intervals in the context of modelling uncertain expert knowledge (Section 5), the axiomatic foundations of an interpretation independent theory of interval probability in his book *Elementare Grundbegriffe…* and its direct predecessors (Section 6), and eventually the aim to synthesize the previous results towards the *symmetric theory of logical probability* (Section 7) as a general framework for statistical inference. Section 9 concludes.

2. A short biographic sketch

In this section we briefly summarize the main stages of Weichselberger's career.[3]

Kurt Weichselberger (see also Fig. 1) was born in Vienna on April 13, 1929. He studied mathematics there, and worked from 1951 to 1953 as a junior assistant (*Wissenschaftliche Hilfskraft*) to Leopold Schmetterer and Wilhelm Winkler at the Department of Statistics in Vienna. In 1953 he earned his PhD (*Dr. phil.*) for a thesis on Bernstein polynomial approximation supervised by Johann Radon [45]. Until 1960 he was employed at a social research institute in Dortmund. Afterwards Weichselberger joined Johann Pfanzagl's chair in Cologne, where he received his *Habilitation* in 1962 with a thesis on controlling census results [48].

From 1963 to 1969 Weichselberger held the chair in statistics at the Technische Universität Berlin. In 1967 he was elected rector of this university and substantially contributed to the by then vivid public debate about the role of education and scientists in the modern society with some visionary ideas, anticipating many aspects of the recent discussion in Germany. This includes the comparably high age of German students, the squeezing of the German mass universities between the demands for a quick preparation for the labor market versus a long-term preparation for research and a continuously changing society, the self-referential character of examinations, and the self-production of social status through the German education system (see, e.g., Weichselberger [52], or also Rüger [31, pp. 6–10]).

From April 1969 on, for almost 50 years, Weichselberger has been a member of the Ludwig–Maximilians–Universität München (LMU Munich), where he also was the driving force in establishing an autonomous Department of Statistics and Philosophy of Science (see also Section 4.3). From 1997 on, Weichselberger continued his research activities as a professor emeritus. On February 7, 2016, he passed away in his house in Grafing among close family.

3. Statistics as a general methodology: institutional activities

Weichselberger's research can not be understood without studying his deep engagement in academic self-administration. It had been driven by his understanding of statistics as a methodology that is independent of concrete application fields, and this fact had to be expressed by the institutional alignment of statistics. Indeed, in Germany, Weichselberger has been perceived as one of the major driving forces for the institutionalization of statistics as a discipline of its own, locally at LMU Munich, as well as in the German university system.

In his first years in Munich, Weichselberger had worked intensively on emancipating statistics from political and economic sciences, and thus in particular from its fixation on any specific area of application, but also without reducing it

[3] For more details see in particular Rüger [31] and Rüger's obituary [32]. Many students and academic companions until the mid nineties are assembled in the Festschrift edited by Rinne, Rüger, and Strecker [30].