*Seu modelo de prova está na página seguinte

Curso de Inglês Instrumental Online

preparatório para Provas de Proficiência do Mestrado e Doutorado com Certificado de Proficiência

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IDIOMA	ÁREA DE PESQUISA
ING	2

EXAME DE PROFICIÊNCIA EM IDIOMA INGLÊS PARA PROCESSOS SELETIVOS DE PROGRAMAS DE PÓS-GRADUAÇÃO DA UFMG

ÁREA 02: CIÊNCIAS EXATAS E DA TERRA, ENGENHARIAS

Candidato(a) (escreva somente o nº do CPF):_____Nota_____

Data: _____/_____/_____ Corrigida por: _____

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INSTRUÇÕES:

1 . Esta prova é constituída de 01 texto em língua inglesa, seguido de 5 (cinco) questões abertas, totalizando, juntamente com esta folha de rosto, 7 (sete) páginas. Qualquer problema identificado, solicite a substituição da prova.

2 . Leia atentamente o texto e responda as questões propostas, respeitando o limite de linhas **pré-definido** para as respostas de cada questão. As questões deverão ser respondidas em português, **a tinta** e em **letra legível**.

3 . A duração da prova é de **3** (três) **horas.**

4 . É permitido o uso de dicionário impresso. O candidato deverá utilizar seu próprio exemplar.

5 . Os rascunhos deverão ser entregues ao examinador juntamente com a prova e o texto.

6 . Responda as questões de acordo com o texto.

The Nature of Technological Knowledge: Extending Empirically Informed Studies into What Engineers Know

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Different viewpoints for reflecting on technological knowledge

In his survey of the philosophy of technology, published in the book. 'Thinking Through Technology', Carl Mitcham identified 'technology as knowledge' as one of the four ways of considering technology (the other three ways are: technology as artifacts, as activity, and as volition). In his chapter on technology as knowledge, Mitcham summarises the main outcomes of philosophical studies in this field. It appears that not that much has been published in this respect. Several philosophers wrote about the fact that technology cannot be described adequately as 'applied science'. Nowadays, most philosophers of technology accept the idea that technological knowledge is different from scientific knowledge. But how it differs from scientific knowledge has not yet been described in much detail. The same conclusion is drawn in another synthesising book by Subrata Dasgupta. For philosophical reflections on the nature of technological knowledge Mitcham mentions at least two fields that can be used as a source of inspiration. The first is the history of technology. Philosophers' interest in drawing from this field can be related to what is called the 'empirical turn' in the philosophy of technology. Apart from the history of technology, a lot of studies into technological knowledge, and in particular the role of technological knowledge in design processes, have been done in the field of design methodology.

It would go beyond the practical limitations of this paper to give a more complete survey of existing literature about the nature of technological knowledge than Mitcham's and Dasgupta's. Instead some examples of authors in the fields of history and design methodology will be mentioned for each field to show what kind of ideas have developed in the past. These are just examples and no claim of completeness or representativeness is made here. The main motive for including this section in the paper is to show that confrontation of what has been written in these fields with existing philosophical reflections can offer interesting perspectives for new reflections on the nature of technological knowledge. Also, some philosophers that were not yet included in Mitcham's survey will be mentioned with respect to that confrontation.

So, in the first place, we can find historians who have reflected on the nature of technological knowledge. As mentioned before, in the philosophy of technology an 'empirical' turn is taking place. Philosophers have developed an interest in reflecting on empirical data about technological developments. According to Rachel Laudan, such material is generated not in the least by historians. Two names in particular should be mentioned here: Edward Constant and Walther Vincenti. Both have been involved in studying the development of flight technology. Both Constant and Vincenti have emphasised that it is not only scientific knowledge that plays a role in engineering design (other historians had made the same statement before, e.g. Edwin Layton, Michael Gorokhov, and Henryk Skolimoski) but that there is a body of knowledge, different from science, which is used by engineers in their design work. Vincenti made an effort to classify the different types of knowledge that aircraft engineers used. According to him engineering design knowledge can be fundamental design concepts (operational principles and normal configurations), design criteria and specifications, theoretical tools (mathematics, reasoning, laws of nature), quantitative data (descriptive and prescriptive), practical considerations and design instrumentalities ('procedural knowledge'). He also identified the origins of these types and knowledge and found that science makes a very limited contribution to the engineers' knowledge and that the design process itself is also a knowledge generating activity.

In the field of design methodology, too, reflections on the nature of the knowledge that is used in design processes have been published. One of the oft-cited contributions in this respect was made by Nigel Cross in his Design Studies article 'Designerly Ways of Knowing'. Cross in that article focuses on the problem solving skills and their tacit character (that type of knowledge seems similar to what Vincenti called 'practical considerations'). Another well known contribution to this field is Donald Schön's book 'The Reflective Practitioner' (1983). Here, too, we see a concentration on process-oriented skills (the epistemology of reflection-in-action, in Schön's own words). Nigan Bayazit is an example of an author who took a broader view by referring to the distinction between procedural and declarative knowledge. In addition, Bayazit mentioned normative knowledge (preferences, values, tastes, attitudes) and collaborative design knowledge. Bayazit does not define this last category but only points out that knowledge development of individuals collaborating in a group is different from knowledge development of individuals working alone.

Perhaps, surprisingly, the discipline that seems to have a backlog in theories about technological knowledge in design, is philosophy. This is probably due to the fact that in the past technology has not had much attention in the mainstream of philosophical debates. The philosophy of technology is a fairly recent field within philosophy, at least more recent than, for example, the philosophy of science. There has not yet been much serious effort to seek for ways of applying philosophical theories about knowledge to technology. One of the few philosophical efforts to classify technological knowledge was made by Günther Ropohl in 'What Technologists Know and How They Know It' (a title that refers to Vincenti's book 'What Engineers Know and How They Know It'2). Ropohl – like Vincenti – defines a number of categories of technological knowledge: technological laws, functional rules, structural rules, technical know-how and socio-technical understanding. At first sight, there seems to be a fair amount of overlap between Ropohl's and Vincenti's categories. Only Ropohl's socio-technical knowledge category, according to himself, is missing in Vincenti's analysis. Ropohl is not an epistemologist and does not refer to epistemological debates on the nature of knowledge. Davis Baird has called attention to the 'thing-y-ness' of things and, related to that, for what he called 'thing knowledge'. According to him in the philosophy of technology material aspects have not sufficiently been taken into account. Taking these into account would pose an interesting question to classical epistemology, namely, the question whether or not thinking about innovations in the material realm is adequately described by defining knowledge as 'justified true belief'. Reflecting on the knowledge of artifacts in technology may well cause us to propose revision of this definition. Randall Dipert already pointed out that in an epistemology of artifacts rationality in our attitude towards artifacts is less a matter of having true beliefs by the most reliable criterion available than a certain usefulness in regarding them to be a certain way.

We have seen examples of authors in different disciplines who have reflected on the nature of technological knowledge. We noticed historians who provided empirical data, design methodologists who focused on the skill-types of knowledge that are involved in design, and philosophers who in an 'empirical turn' have started to exploit the empirical case study material. We also saw several efforts to define categories of technological knowledge. It is striking that there is not much cross fertilization between the fields mentioned above (philosophy, history and design methodology). Each has its own academic journals and international research networks. A

comparison between the different approaches would be an interesting impetus for a new research. A second impetus for new research may be found in confronting what has been written about the nature of technological knowledge so far with the definition of knowledge as 'justified true belief'. Mitcham briefly referred to that definition, but did not yet compare it with the categories he collected from the other authors. Comparison of this definition with what has been stated about technological knowledge in other views (see above) immediately raises interesting questions about this 'standard' definition of knowledge. We already mentioned Davis Baird's view on 'thing knowledge' and Randal Dipert's remark about usefulness rather than truth being a criterion for our beliefs about artifacts. One could question how the intentional and normative aspects of engineers' and designers' knowledge would fit into the standard definition of knowledge. Can knowledge about the purpose and functioning of an artifact be described as 'justified true belief' or is it of a different nature? And what about the knowledge to determine if an artifact is 'successful' or not? Michael Polanyi has defined the concept of 'skills' and Gilbert Ryle has written about the difference between 'knowing that' and 'knowing how', whereby the last type of knowledge is closely related to Polanyi's 'skills'. Many of these 'skills' have the property of being 'tacit'. It can be questioned here too if such knowledge complies with the definition of 'justified true belief'. It seems that various questions emerge when the 'standard' definition of knowledge is applied to technological knowledge and ample opportunities for further reflection show up here.

QUESTÕES

1) Em relação ao conhecimento tecnológico, qual a conclusão compartilhada por Mitcham e Dasgupta?

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2) O que há, mais especificamente, de comum entre Edward Constant e Walther Vincenti ?

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3) No modo como vê o conhecimento, em que Bayazit difere de Cross e de Schon?

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4) O que falta em Vincenti para que haja uma grande sobreposição entre suas categorias e as de Ropohl?

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5) Levando-se em conta os esforços para definir categorias do conhecimento tecnológico, o que causa espanto no autor em relação aos campos da filosofia, da história e da metodologia do design?

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