

Towards an Interdisciplinary and Scientific
Approach in Design Education:
Petr Tučný and his Applied Aesthetics

Petra Nováková

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Petra Nováková

Palacký University

petrisha@centrum.cz

Abstract

Petr Tučný (1920-2012) was a Czechoslovak architect, an associate professor of design at several renowned universities and a respected designer. In 1950, Petr Tučný became the head of the Laboratory of Experimental and Applied Aesthetics at the University of Economics in Prague. His premise that "*aesthetical experience is not only emotional enjoyment but a rather complex process*" led him to pursue the interdisciplinary approach to tool-handle design based on medical research. Tučný's scientific viewpoint was parallel yet independent from the famous School of Arts in Zlín (Czechoslovakia) led by the sculptor and pioneer designer Vincenc Makovský and later by the internationally acclaimed Czechoslovak designer Zdeněk Kovář.

When comparing Tučný and Kovář's teaching methods in detail we can witness two different approaches in perceiving the designing strategy. While Kovář's rather intuitive way of designing was based on organic aesthetics and kept a distance from the rational and technical perception of design and scientific progress, Tučný, on the contrary, evolved a strict interdisciplinary and scientific approach. The paper will illustrate two different viewpoints on the ergonomic of hand-tools. At the same time, it attempts to shed light on Tučný's designing and teaching methods not only in the Czechoslovakia but also *further afield* (at the Academy of Fine Arts in Warsaw, at Halle University and at the Ulm School of Design).

Keywords: Petr Tučný, interdisciplinary approach, ergonomics, hand-tool, education, Czechoslovakia

Introduction

It was during the revolutionary spring of 1968, when a group of Italian students and activists occupied the Palazzo dell'Arte, the seat of Triennale di Milano, the world-famous exhibition of design and applied arts where the Czechoslovak architect and designer Petr Tučný became successful. At the 14th Triennale, Czechoslovakia decided to display prototypes of different manual working tools that focused on the relation between hand and object and were theoretically based on Petr Tučný's studies. Tučný's mock-ups and models of working tools, which took into consideration manual labour needs, appealed to left wing rebellious activists and thus they acknowledged him as their hero and leader¹⁾. Eventually, Tučný was awarded a special Triennale '68 Personal Award.

Petr Tučný (1920-2012) was a Czechoslovak architect, an associate professor of design at several renowned universities and a respected designer who also collaborated with, among others, the Belzer company. Tučný became involved in their product design and was responsible for a successful collection of working tools (in 1965, this collection was awarded the Design Award in the United States of America). He believed that good working tools could only come from an understanding of workers' needs together with complex studies of the central nervous system, ergonomics, functionality and construction and form. His premise that "*aesthetical experience is not only emotional enjoyment but a rather complex process*"²⁾ led him to pursue the effect of tool and machine on human behaviour. Most of his advanced studies were based on the assessment of complicated physiological processes in the human body. This paper attempts to shed light on Tučný's designing and teaching methods not only at universities in Czechoslovakia but also further afield (at the Academy of Fine Arts in Warsaw, at Halle University and at the Ulm School of Design).

The Laboratory of Experimental and Applied Aesthetics

In 1939, when the closure of all Czechoslovak universities due to the German occupation interrupted Tučný's studies, he and other students were sent to maintain the Bustěhrad railway. There, he experienced "with his own hands" the harsh impact of tough manual labour on the human body and started to be interested in designing tools that would protect the body, especially the fingers and hands, from the harmful effects of hard labour. Product design, especially fitting handles, would become Tučný's lifelong concern and his professional interest.

In 1950, Petr Tučný became the head of the Laboratory of Experimental and Applied Aesthetics at the University of Economics in Prague. The laboratory focused on the empirical studies of aesthetic reactions and processes in the central nervous system during the appraisal of beauty. Tučný claimed that an aesthetic reaction, either positive or negative, results in measurable changes in the body's organ activity. In his opinion, if a designer aims to influence people's

1) ————— From Petr Tučný's memoirs, also in: Klivar, M. (1968), *Trienále dnes a zítra* [Triennale Today and Tomorrow], *Rudé právo*, 4. 7.

2) ————— Typescript, Petr Tučný's private family archive.

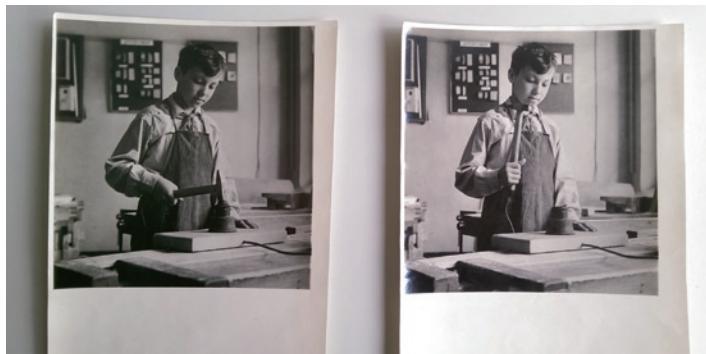


Fig.1 Experiments with manual working tools for children

feelings and aesthetics, he or she should not linger only on the external appearance. All technical aspects of a tool that affect our body and senses such as touch, sight, hearing or muscle control must be taken into consideration.

Consequently, since grey matter is a major component of the central nervous system of the human body and is involved in muscle control and sensory perception, Tučný decided to tackle this area of the brain. He performed numerous experiments with manual working tools in collaboration with leading physicians, such as professor Teissinger from the Institute of Work and Health, Prague, who investigated complex physiological processes and treated neurological disorders. Manual working tools were chosen as a basic example of the interaction between man and machine, with the aim of developing a highly efficient tool. Tučný aimed to prove that there are reciprocal relations between the dynamic stereotype of hand and brain. He assumed that if manual labour develops and maintains job-readiness and skilfulness, it also influences the brain and its complex functions, while the well-developed brain retroactively controls the creative manual activity of the hand.

Two Different Viewpoints on the Ergonomic of Hand-tools

Tučný's scientific viewpoint was parallel yet independent from the famous School of Arts in Zlín (Czechoslovakia) led by the sculptor and pioneer designer Vincenc Makovský and later by the internationally acclaimed Czechoslovak designer Zdeněk Kovář. The educational methods at Zlín School of Arts (as well as at School of Arts and Crafts in Bratislava led by Josef Vydra) continued to spread the Bauhaus ideas and Ruskinian effort to connect life and art.³⁾ The school in Zlín did not follow the traditional academic concept of *belle arti* teaching. On the contrary,

3)———Many key Bauhaus personalities such as László Moholy-Nagy or Hannes Meyer were invited as the guest lecturers at the School of Arts and Crafts in Bratislava. When the Bauhaus closed in 1933, Josef Albers asked Josef Vydra for a teaching position in Bratislava. However, soon after he received an offer from Black Mountain College in North California, which he accepted. See Kolesár, Z., Two Bauhaus Inspirations – The School of Arts and Crafts in Bratislava and the School of Arts in Zlín, in: Jakubíček, V., Kolesár Z., Mílek, V., Pomajzlová, A. (2015), *An Island of Art in a Sea of Industry*, Zlín: Regional Gallery of Fine Arts in Zlín in cooperation with Václav Chad's Gallery in Zlín, p. 91.

the education system led students towards practical aesthetics and industrial arts. The main asset was the practical cooperation between students of the School of Arts in Zlín and companies or state institutions on specific design projects.

The teaching methods of Vincenc Makovský based on the sculptural approach that put emphasis on the final artistic form without any reference to economics or market requirements did indeed provide very important input and a starting point for Czechoslovak industrial design in general. Subsequently, Zdeněk Kovář refined and elaborated Makovský's teaching methods but his humanistic and artistic approach remained noncognitive. When comparing Tučný's and Kovář's teaching methods in detail we can witness two different approaches in perceiving the design strategy. While Kovář's rather intuitive way of designing was based on organic aesthetics and kept a distance from the rational and technical perception of design and scientific progress, Tučný, on the contrary, evolved a strict interdisciplinary and scientific approach influenced by the principle of "die gute Form".

Tučný's advanced way of designing was criticised by several theorists and art critics such as Josef Raban. Raban did not believe that the future of tool design would depend on science. So, he perceived Tučný's competitive theories and published articles as personal insults against himself, Zdeněk Kovář and the whole School of Art in Zlín. For example, in the article about Kovář's project for Tatra Kopřivnice (a Czechoslovak manufacturer producing well-known vehicles) Raban spoke out strongly against Tučný's exact and interdisciplinary scientific approach: "*So, a designer cannot get along without science? Do we really have to create artistic work based on scientific findings? Let's see, the shape of the car that was designed by Kovář was far more elaborate than the other one based solely on scientific research and technology. In my opinion, a designer's matured and cultivated taste results in projects that are not against recent research. Social praxis is the foundation, scale and goal for a designer who cannot and, thank goodness, does not have to wait until Petr Tučný's interdisciplinary scientific approach sets the foundation and system of our discipline*"⁴⁾. With regard to the rapid progress of industrial design and science that had made great strides, Raban's preconceived article that aimed to defend Kovář's work and Raban's own opinions appears biased and reactionary. Opinions and theories that used to be valid at the beginning of 1950's were ten years later totally outdated. Form and design as a discipline changed dramatically towards rationalism and minimalistic forms.

Tučný believed that a designer's attitude and formation must integrate clear thinking and responsibility for the high standard of a final product: "*At first sight, design may seem to overflow with playfulness, cultivated forms and a humanistic approach. However, from an insider's point of view, things are far more intricate. An effective design process requires understanding, responsibility, complex education and a capacity to integrate scientific knowledge into an emotional expression. During such a demanding process, a designer as a creator of new material and spiritual values, is obliged to respond to several simple yet crucial questions: what, how, when and who for?*"⁵⁾"

4) ——— Raban, J. (1957), O průmyslovém výtvarnictví a jeho estetice, *Tvar* IX (4), pp. 105-118.

5) ——— What shall a final product fulfil? What material, technology, construction or economic circumstances shall be adopted? Who is the user and what are his needs? The question "when" includes a time factor in both dimensions, i.e. seasonableness and lifespan of the project. Typescript, Petr Tučný's private family archive (year 1994).

The interdisciplinary approach to tool-handle design based on medical research was a challenging task for Petr Tučný. In his opinion, previous approaches and the use of traditional cylindrical handles did not incorporate enough knowledge to enable a useful and usable tool design.

It should be recognised that ergonomic principles had already been included in the design process (e.g. by the Institute für Griff-Forschung in Germany or by the above mentioned Zdeněk Kovář in the Czechoslovak Republic). There were also many other designers and theorists concerned with the ergonomic design and usability of working tools such as László Moholy-Nagy and Otto Kolb (Nagy's colleague at the New Bauhaus in Chicago) as well as Thomas Lamb, an American industrial designer, whose anatomical studies of handles were presented at the exhibition at the Museum of Modern Art in New York in 1948⁶⁾.

However, Tučný discovered that it was not possible to derive the final shape of a handle from a simple plastic imprint of fingers flexed to clench an object during an appropriate action. The resulting power grip handle appears to be ergonomic at first sight, yet it does not adequately impact sensory organs on the surface of the hand. Workers use tools in limited monotonous positions through repetitive movements and the hand becomes a dull vice without creative employment and as a result grey matter is poorly stimulated.

Moreover, using tools that require substantial muscle force and stressful working postures can lead to discomfort, pain and cumulative trauma disorders. Consequently, inaccurate motor activity and reduced skilfulness influence the upper nerve system and create negative emotional sensations followed by harmful perceptions. The defensive reflex that arises from this may be repressed, but this action consumes a lot of nerve energy and influences the behaviour, working skills and the tonus of grey matter (i.e. alertness and skilfulness rapidly declines).

Seven Zones of the Hand

Tučný searched for different criteria to determine a fitting handle that would result in the optimal shape to increase the performance and comfort of the worker and stability of the working tool in the hand. He conducted a great amount of research which considered all aspects of manual labour including; a subjective comfort rating of a worker using a hand-powered hand tool, finger force measurement, efficiency of muscle and nerve activity. Knowing the task, workplace⁷⁾ and condition of tools were crucial factors for the designer.

A deep knowledge of the anatomy and mechanism of the human hand was critical for Tučný's method. He knew that a hand possesses plenty of sensory nerves that may supply vast sensory information. So, he created a mapping system defined by seven zones to identify the grasping strategies and studied the dynamic stereotype of the pressure distribution and contact forces. The below mentioned seven zones are activated actively or moderately during every ac-

6) —————— Three years later, a collective exhibition *Hand und Griff* that focused on the problematics of working tools was organised in Europe (Vienna). Subsequently, the renowned British magazine *Design* published a series of articles analysing the ergonomic approach to product design. See: Tomlery, C. G. (1952), The Problems of Handles, *Design* 39, pp. 8-13; Jones, J. C. (1954), Handles, The Ergonomic Approach, *Design* 72, pp. 34-38.

7) —————— Tučný himself very often visited workers *in situ* – in factories, mines, engineering plants and so forth.

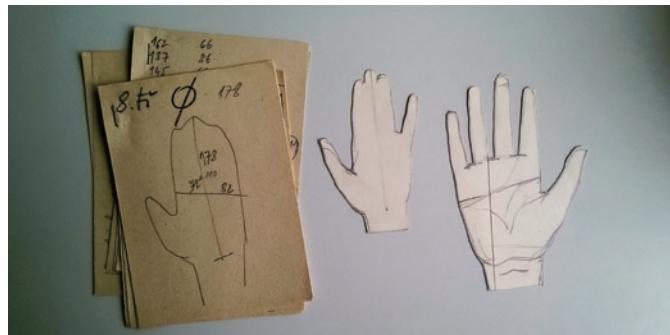


Fig.2 Experimental measurements (from Tučný's private archive)

tion of a hand (whether controlling a machine or when developing fine motor skills during sculpting or playing a musical instrument):

1. Gripping ring
2. Zone of the second and third finger with dominant function of secondary orientation
3. Zone of the little finger with function of fine precision
4. Interdigital space between fingers, essential for performing a power grip. It is also the most exposed part of the hand.
5. Hypotenar muscle, the ball of the little finger
6. Thenar muscle, the ball of the thumb
7. Well of the palm, least protected part of the hand⁸⁾

Based on the findings, he altered the ideal shape of the handle with improved ergonomics that resulted in very positive subjective reactions (including aesthetics reactions), new motion habits and better working results. Meticulous assessment and a number of experimental measurements resulted in the finding that the three-sided truncated squared timber is the most suitable form of a handle⁹⁾. Such a handle provides good grip, reduces the effort needed to use the tool effectively, prevents the tool from slipping out of the hand and minimizes the risk of laceration and work-related musculoskeletal disorders¹⁰⁾. On the contrary, handles with a circular cross-section were found to be completely inappropriate.

8) ——— Tučný, P. (1994), *Ergonomie, Funkční analýza projektu rukojetí šroubováku*, Prague.

9) ——— The three-sided truncated square timber handles were used in Tučný's successful collection for the Belzer company. The same manual working tools were also presented at the already mentioned Milánis exhibition. At the Triennale di Milano, surprisingly and paradoxically, the Socialist Czechoslovak Republic officially presented the above mentioned project that was designed and financed under the auspices of the West-German private company. Due to the political and economic situation in socialist Czechoslovakia in the 1960s such products would not have been produced and as with most other promising ideas would have remained prototypes.

10) ——— From 1950s to 1960s Tučný published a series of articles on the manual working tool aesthetic such as Tučný, P. (1952), *K problematice výrobního výtvarnictví*, Prague; Tučný, P. (1962), *Teoretické základy technické estetiky*, Prague.

Tučný's Educational System: from General to Specific

At the beginning of the 1960's, despite a limited possibility to get a travel permit, Tučný could travel abroad and spread his innovative design approach among students at various universities in Europe. (The Socialist Czechoslovak Republic allowed him to travel in exchange for foreign money that the state earned owing to his patents.) Between 1961 and 1962 he was appointed associate professor at the Academy of Fine Arts in Warsaw (Poland). After that, he moved to Halle (Germany) where he became the head of the design department between 1963 and 1965. In 1965, through the intercession of the German Embassy in Prague, Tučný got the permission to leave Czechoslovakia for the famous the Ulm School of Design (West Germany). Following the Bauhaus tradition, the college of design in Ulm earned international recognition by emphasizing the multidisciplinary context of design. Tučný was appointed associate professor at the department of product design but unfortunately, the college was closed one year later as the result of cessation of grantsⁱⁱ⁾. (Later on, between 1979 and 1989, Tučný taught design at the Hochschule für bildende Künste in Hamburg, Germany.)



Fig.3 Petr Tučný (on the right) with students

The content of Tučný's lectures was always tightly connected with his lifelong research into ergonomics of manual working tools and product aesthetics. Thanks to preserved lecture notes in Tučný's private family archive we may follow the content of his lectures for graduate and postgraduate students from the 1960's. Since product design and ergonomics are interdisciplinary subjects, students had to possess a wide range of knowledge and experience to acquire a holistic design approach. Graduate students were expected to work independently and success-

ii)———Lindinger, H. (1987), *Hochschule für Gestaltung Ulm, Die Moral der Gegenstände*. Berlin: Wilhelm Ernst & Sohn Verlag, pp. 74-81.

fully solve artistic and technical problems. They were engaged in integrated, multidisciplinary projects and were expected to prepare a model documentation. The subjects of graduate design course were as follows:

- Experimental modelling
- Experimental drawing
- Structure analysis
- Visual communication
- Teamwork methodology
- Visual analysis (scale, proportion, colour)
- Final presentation of a project (visual documentation, verbal argumentation)

As a practising designer, Tučný put emphasis not only on traditional skills such as drawing or modelling, but also on effective communication and presentation skills. During his seminars he taught students how to work individually as well as within a team. Tučný considered these skills very useful for further collaboration with future clients such as private companies or institutions. Apart from practical skills Tučný included some theoretical subjects in postgraduate programmes, such as design philosophy, logic, semiotics, theory of structures and mechanical properties, methodology of industrial design, seminars on colours and lectures on chosen problems from economy, ergonomics, politology and sociology.

Postgraduate students acquired basic craftsman techniques during the first two semesters. Later on, during the third semester they were given a problem set to solve. The task was usually connected with a simple engineering object (hand-tool). Students were instructed to design a mock-up of a tool accompanied by a comprehensive analysis including a problem solving strategy. In the last semester students continued to work on other problems connected with the previous project or they were given a complementary task to solve. At the end of the course students presented their final project within the given problem framework (using anagrams, verbal argumentation and photo documentation). Overall, the system seemed to provide students with profound and complex knowledge and highly professional skills. Moreover, Tučný wanted students to acquire a specific way of thinking and philosophical outlook.

In the late 1960's, based on teaching experience from Germany, Tučný wrote a methodological proposal for a new project of a postgraduate design school in Prague. Together with a group of renowned Czechoslovak architects, artists and designers¹²⁾he wanted to establish a special educational institution that would incorporate the study of architecture, industrial design, visual communication, applied and monumental sculpture and painting with management and social science. The aim was to educate new students of architecture and design who would closely collaborate on complex multidisciplinary design projects in the public sector. Unfortunately, this promising project remained only on paper (due to the lack of "political will").

12) ——— Among the participating architects were Karel Prager, Jan Šrámek, Věra Machoninová, Miroslav Masák, Karel Hubáček; designers Petr Tučný and Jan Kotík, artistic group Huť, artists such as Čestmír Kafka or Stanislav Libenský.

Conclusion

This paper was intended as an insight into Petr Tučný's interdisciplinary and scientific approach in education and design process of hand-tools. His lifelong concern and professional interest in the design of manual working tools (handles in particular) led Tučný to study the effects of tools and machines on human behaviour. Meticulous assessment and a number of experimental measurements resulted in the finding that the three-sided truncated squared timber is the most suitable form of a handle. Tučný's Laboratory of Experimental and Applied Aesthetics in Prague focused on empirical study of aesthetic reactions and processes in the central nervous system. Subsequently, Tučný applied universally valid results of his interdisciplinary research to an educational concept that he successfully presented at several European universities. However, back in the Socialist Czechoslovak Republic Tučný did not find enough support to spread his ideas and his methods, sadly, did not thrive there.

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Author Biography

PETRA NOVÁKOVÁ

Petra Nováková is a PhD candidate at the Department of the History of Art, Palacký University of Olomouc, the Czech Republic, who completed a Mgr. in the History and Theory of Arts. Her scholarly interests focus on the cultural transfer, Czechoslovak and Italian modern arts, exhibition installations, applied arts and design. She has currently completed her dissertation entitled Czech and Slovak Artists at Biennial International Exhibitions of Applied Arts in Monza and at the Triennale di Milano, 1923-1996. She has received several scholarships at Università degli Studi di Milano, Italy. Her articles have been published in conference anthologies and cultural periodicals, such as *Design Magazine* or *Labyrinth Revue*.