

ANALYSIS OF THE SUBSYSTEM OF A MAN AND A PRODUCT IN THE CREATIVE PROCESS OF AN INDUSTRIAL DESIGNER

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Abstract: The submitted paper belongs to the area of ergonomics of industrial design. It is going to concentrate particularly on the relationship of a man and a product, on problems of respecting of human factor in designing of products for serial production. Admittedly, we understand this question as topical nowadays, but not always in its complexity. We are going to describe an ergoalgorithm issuing from level of a man's integration into the appropriate activity within the relationship of a man and a product. The approach represents new possibilities for understanding of a designer's creative process with direct impact on practice of product designing within designing of new products.

Keywords: industrial design, ergonomics, human factors

1 Introduction

We may say that design will not concentrate on variety of goods in the future, but on improvement of their quality. Importance of a man – his/her dimensional proportions and psychological processes – is closely connected with it. One of the possibilities how to reach a first-class functional design is to analyse the relationship of a man and a product solved within the initial phase of designing, and to proceed from the analysis in the next successive steps. It means that we have to give more care not only to constructional and functional parameters and overall appearance of the product, but also to respect properties and abilities of people connected with use or control of the designed item or equipment.

2 Objectives

The work will deal with problems of observing ergonomic requirements when designing products produced in series. Insufficient observing of ergonomic principles in designs of technical objects, often resulting from unfamiliarity with the objects, has been the impulse for submitting this project.

Ergonomic requirements are generally identical, but their separate indices differ in individual products – and namely this is the cardinal and innovative idea of the project. For we can't limit ourselves to application of generally applicable or randomly determined ergonomic requirements.

Specific ergonomic requirements should be determined for a specific product. Only this way we are able to reach optimum outputs in the form of products suitable in ergonomic terms.

The aims pursued:

- effort to reach a complex view of the problems explored that may eliminate certain, not sporadic, isolating of some individual problems from links;

- to specify product categories depending on their nature in ergonomic terms;
- part specification of ergonomic criteria for each of the product categories;
- general validity of the whole set for all areas of the products;
- making orientation in the given problems easier, and its usability for both specialists in practice and students of the appropriate universities;
- spreading of the theoretical knowledge in the area of ergonomics through industrial design, indicate new possibilities in understanding of the creative process by the appropriate specialist.

3 Methods

As it was mentioned above, ergonomic requirements for individual products are different, sometimes they differ substantially. First, we will specify groups of similar products in the ergonomic terms. To be able to carry out the specification, a classification algorithm – a progress chart resulting in definition of product categories depending on their ergonomic nature – will be made. A level of a person involvement into the given activity within the frame of the Man – Machine – Environment system should be the basic implication of the classification. Then, the part requirements – the corresponding ergonomic requirements (but not the concrete parameters) – should be specified for each of the groups. The step represents the most demanding phase of the project because there are not two completely identical products, and that is why we are not able to define completely identical requirements for them within the appropriate category. First, we will identify the Man – Machine subsystem as the main links of the Man – Machine – Environment system for as many products as possible. Then, we will form the classification algorithm, use of which will result in determination of a certain number of categories of products similar in ergonomic terms for this moment. The step will be followed by classification of the ergonomic requirements as a part of certain categories, namely characteristics of size design, controllers and communicators, safety aspects etc.- the part of the task has been solved at present, and that is why it is not dealt with in this text.

4 Results

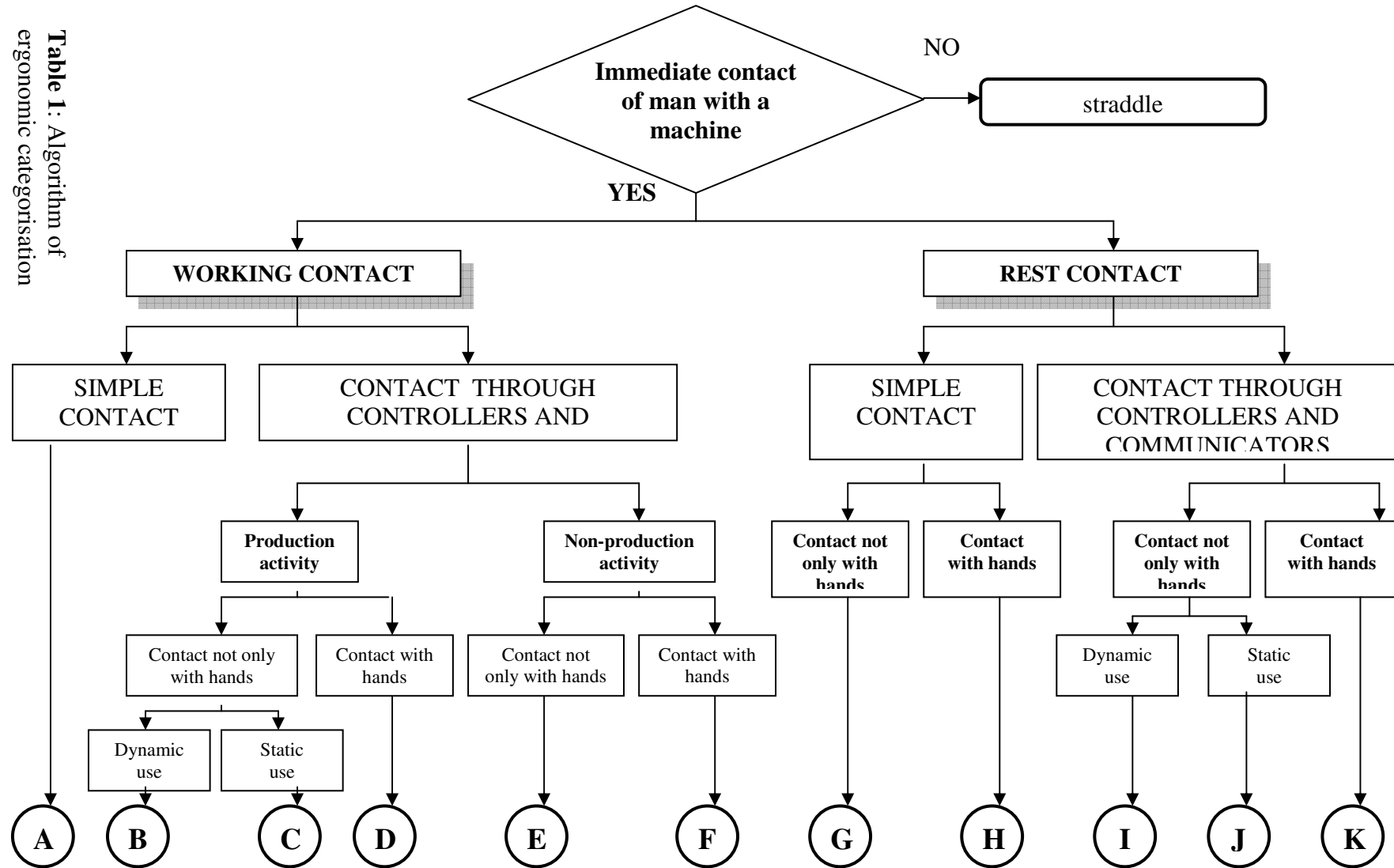
So called “ergo-algorithm” has been formed that should be used for classification of products into ergonomic categories, which is in fact a progress chart aiming at so called ergonomic categorization. This is the main idea of the project because the existing designer’s assortment categories don’t fully correspond to the ergonomic view of the products.

Mutual interaction of man and a machine – which means a level of man inclusion – should be the decisive criterion for classification of products into the concrete groups.

4.1 Algorithm of ergonomic categorisation

Algorithm of ergonomic categorization, let’s call it ergo-algorithm, makes classification of products into individual categories A-K possible.

Table 1: Algorithm of ergonomic categorisation



The following terms are used in the ergo-algorithm:

- immediate contact of man with a machine- it includes communication and motor processes, controlling and inspection activity, i.e. any direct contact with the item;
- working contact – activity aiming at fulfilling of the working task, assignment, any work in general;
- rest contact – activity aiming at fulfilment of personal requirements and needs, human activities in general;
- simple contact – the contact of a person with the item has the form of manual and motor processes, the person uses the item within the activity without links in the form of controllers and communicators;
- contact through controllers and communicators – contact of a person through controlling elements (indirect control) and communication elements (the machine provides information concerning its state), it is characterized by the Man-Machine feedback;
- production activity – it consists in production of a concrete product, production of a substance or its processing;
- non-production activity - working activity aiming at improvement of the existing state that doesn't result in obtaining any product; it is typical for housework;
- contact with hands – the controlling process carried out with hands – a palm, fingers,.... the other parts of a human body are not important for the given activities;
- contact not only with hands – the other parameters and positions of a human body are important (field of vision, handling, pedipulation area,...);
- dynamic use – the item that a person is in a contact with is a mobile one; its use consists in its movement;
- static use – the item is a stationary one; it shouldn't be confused with static work, when: "...muscles don't move thanks to their own strength..." [1].
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It is obvious from the ergo-algorithm in Table1 that the highest number of the ergonomic aspects relate to the products that a person is in the working contact with – controllers and communicators form their part – they are used for working activities – the contact with the person is not only with hands, and it is not important whether they are used statically or dynamically, it is the B (e.g. a tractor, self-moved lawnmower, construction machinery,...) and C categories (a sewing machine, machine tools, textile machines,...). On the other hand, the "simplest" from the ergonomic view is the A group. It contains products that people are in simple working contacts with, e.g. tackle and tools.

Individual products made by industry may be classified into the groups (categories) with similar or identical properties thanks to the algorithm made; it is a classification activity.

5 Discussion

At present we work on classification of the ergonomic criteria into the categories. Criteria that are typical for products of each of the categories and fulfilment of which shouldn't be forgotten. A set of typical requirements in ergonomic terms – so called list

of ergonomic aspects – will be made for each of the eleven categories. For better orientation, the requirements will be divided into a few groups: size design, controllers and communicators (in case they are a part of the product), physical a psychical load, hygiene and safety.

General requirements will gradually be specified and divided into more detailed ones, so called part requirements. A spectrum of ergonomic requirements will be determined in advance for any product, with design of which an industrial designer deals. The researcher may confront the requirements with results of his/her own analyses made on the initial stages of the solution. Each “designer of the material world of human” should respect the specified requirements and develop them individually always taking into account specificities of the problem solved.

6 Conclusions

The main area of use of the thesis is the specialization of Industrial Design.

Results of activities in this area have direct impact on life of people that is not only made easier but also more pleasant thanks to their specific means. Results obtained in this work may influence the process of product designing not only in the general level but also, as we have intended, in quite concrete situations. After the list of ergonomic aspects are made, they will enable solution of any project together with the ergo-algorithm, they will make orientation in the given problems easier and the designer’s work will be much more efficient. The work does not offer quite closed solution, it gives possible direction of approach to the researched area, and it may be developed in the future.

This method has been compound and now is used on the Department of Industrial Design in Brno University of Technology. The resulting projects of our students include an appropriate drawing documentation and, in the case of thesis, also ergonomic posters proving that anthropologic data of a man in the mutual contact with the product designed have been respected.

7 References

[1] Rutenfrantz, J. 1992. Zur Lage der Arbeitsmedizin und der Ergonomie. Harald Boldt Verlag.