


Analysis of Working Conditions and Modeling of Activity Algorithms for Contact-Center Operators



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Abstract The article examines the issues of ensuring the reliability of the activities of information processing operators who work in contact centers. A study of factors that reduce the effectiveness of call center operators was carried out. A method of formalized description of operators' activities based on functional networks of professor A. Gubinsky is proposed. The use of this method makes it possible to assess reliability taking into account the structure of the operators' activities and working conditions. A model is proposed to justify the number of operators, design the structure of activities and working conditions. The study can be useful to justify the feasibility of improving ergonomics in contact centers of commercial and government organizations.

Keywords Contact-center · Reliability · Simulation · Ergonomics · Working conditions · Man-Machine system

1 Introduction

For more than half a century of the existence of call centers and contact centers, a developed market for mass acceptance of telephone and Internet calls (both calls from customers in the service sector and requests from control systems of various levels) has formed [1, 2]. This is a globalized market: many Western companies use

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the services of contact centers located, for example, in India or Malaysia. Despite the seeming ease of work, due to the absence of heavy physical labor, the operators of such centers work under conditions of time pressure, tension and even stress [3, 4]. And the emergence of COVID-19 caused not only a surge in this area of business, but also the aggravation of a number of inherent problems.

2 Problem Statement

Despite the huge amount of research, for example [1, 2, 5–7], devoted to improving the efficiency of contact centers (the list of topics is extensive: automation, decision support systems, the use of robots and answering machines, office equipment and room design, relaxation technologies and etc.), the tasks of ergonomic support for the activities of such centers [7, 8] require new formally substantiated methods focused on quantitative assessments. These methods should enable prompt decision-making to ensure acceptable working conditions and, as a result, guarantee high efficiency in performing the functions required from contact centers.

Based on this, the problem statement can be formulated as follows—on the basis of the fundamental principles of ergonomics [8–11]: (1) identify the problems of providing working conditions for operators of contact centers; (2) develop principles for constructing descriptive models of the activity of contact center operators, necessary to predict the quality of activities and substantiate measures aimed at improving working conditions.

3 Methods

The proposed methodology for ergonomic support of contact center operators is based on an anthropocentric approach focused on the priority of the man-operator in the «human-technology-environment» system [12–16], with the obligatory construction of models that ensure the forecast of error-free and timely execution of requests and taking into account the following factors:

- working conditions;
- characteristics of hardware, software and interfaces;
- characteristics of operators (preparedness, functional state, motivation, etc.);
- organizational and technical characteristics (number of operators, activity settings, methods of distributing requests and organizing queues);
- technology of activity (including self-control);
- organization of quality control of operators-executors by operators-managers.

Despite the fact that there is a special system of standards and ergonomic norms for organizing the activities of operators, business owners often do not want to

comply with all its requirements, since this is associated with significant costs. The proposed methodology provides for the formation of an explanatory component that makes it possible to substantiate the positive impact of the proposed ergonomic measures on economic efficiency.

4 Results

4.1 Global Challenges Negatively Affecting the Effectiveness of Contact Centers and Analysis of Working Conditions at Operator Workplaces

A survey of operators was conducted (with the participation of student Shapochka Yulia and graduate student Krivodub Anna), consisting of two parts:

- Global challenges that negatively affect the effectiveness of contact centers (in the context of Covid-19). Period of the survey: June–September 2020, number of respondents: 297 respondents from Ukraine and Russia. The results are shown in Table 1.

Table 1 Assessments of the significance of factors that negatively affect the effectiveness of contact centers (results of processing operator opinions)

Problematic issues of organizing the activities of operators of contact centers	Percentage of operators who consider the problem urgent
Insufficient automation of the processes of distribution and processing of applications (including decision support)	40.1
Lack of a single window for processing contacts through various channels	36.4
Usability issues and difficult to use databases (CRM)	29.9
Lack of resources (technical and human) to service all incoming requests	27.3
Lack of proper training (coaching) of operators	26.8
Lack of customer confidence in the system when communicating with robots (creates an additional burden on operators)	26.2
The need to be distracted by secondary work	19.8
The complexity of organizing remote (home) work (requirement due to the impact of COVID-19)	19.1
Poor (inadequate and (or) non-ergonomic) equipment of workplaces	13.5
Lack of feedback and the difficulty of promptly obtaining information about customers	10.1

- The negative (according to the operators themselves) influence of the factors of the working environment. Period of the survey: June 2015–September 2020, number of respondents: 517 respondents from Ukraine and Russia. The online questionnaire (in Russian) used in the survey is located at <https://goo.gl/0j2ulZ>. The results are shown in Fig. 1.

Obviously, in different contact centers, depending on national and professional specifics, the priority of problem areas and negative factors will be different. Therefore, separate studies are needed to eliminate the existing negative impacts on man-operators and, as a result, on the effectiveness of the contact centers themselves. The study showed that where the required effective feedback is established and the wishes of the operators are taken into account (67.3% of the contact centers surveyed by us), the operators' assessments of the attractiveness of their working conditions increase significantly within a short time (2–3 months).

For the integral scoring (0–60 points) and determination of the category of labor severity (1–6), as well as certification of workplaces, the authors have developed a special computer program [17].

4.2 Principles of Modeling the Process of Fulfillment of Requests by Contact Center Operators

In addition to the above factors, the structure of the operators' activities also significantly affects the reliability of the execution of requests by the operators of

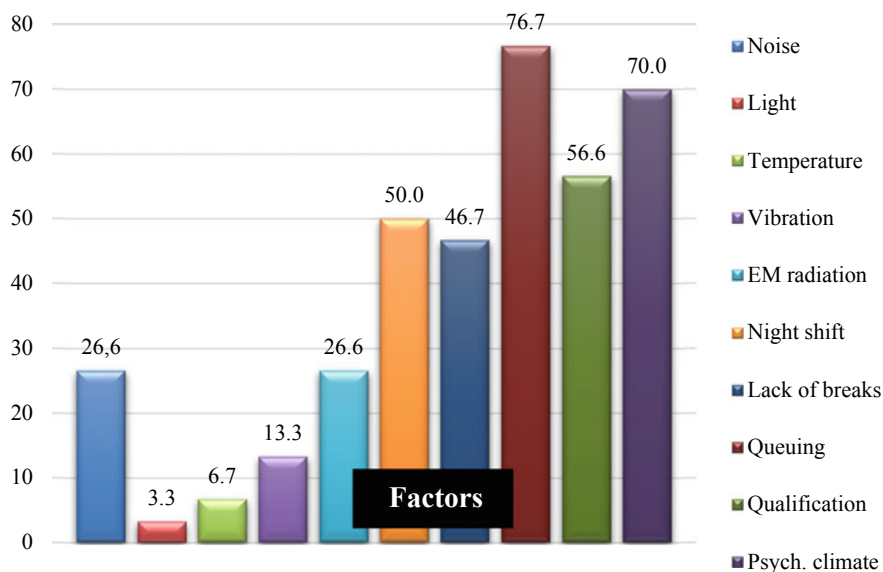


Fig. 1 The results of assessing the degree of negative impact on operators of physical and psychological factors of the workplace (according to operators' estimates)

contact centers. The organization of the execution of requests can usually be represented in the form of the activity algorithm [18].

The most convenient apparatus for describing and assessing the reliability of activity algorithms are functional networks [18, 19] on the basis of which the authors have developed the methodology for describing and evaluating the activities of contact center operators.

The value of the proposed model for describing activities is that it allows to obtain estimates of the reliability and time characteristics of all activities for execution of requests. To do this, it is required to use the software developed by the authors [19], having previously generated for each operation data on the probability of its error-free execution, as well as the mathematical expectation and variance of its execution time using either reference data or statistical databases of the enterprise (taking into account the values of all factors affecting working conditions, characteristics of operators, technical equipment, etc.).

The developed examples of assessing the reliability of the operators of contact centers for controlling access to distributed information resources are given in [20]. It also shows how working conditions affect the final results of activities. An example of such estimation is shown in Fig. 2.

In the case of a random flow of requests, operators are considered as specific ergonomic «servicing devices», which are proposed to be modeled using functional networks, but also to use models of request queues, the lengths of which are determined, among other things, by the number of operators, their qualifications and other characteristics.

Thus, the developed computer program [21] is built according to the principle «Queuing system (simulation model of the processes of arrival, waiting in queues and fulfillment of requests) + functional network (model of the algorithm of activity for fulfilling the request)» and allows, by varying the organizational characteristics of the system, to choose the optimal variant of the organization that provides the specified conditions (according to the criterion of error and the criterion of timeliness, taking into account both the execution time and the waiting time in the queue) while fulfilling the ergonomic requirements (the coefficient of the queue of applications for the operator, the average length of the queue for the operator, the coefficient of employment of the operator, etc.).

The use of these models makes it possible to determine:

- required number of operators;
- how operators should fulfill requests (setting for error-freeness or performance);
- working conditions of operators;
- how to distribute requests between operators.

As a result, the task of justifying the costs of ensuring the effectiveness of the contact center can be solved (for this, a computer system was developed [22]).

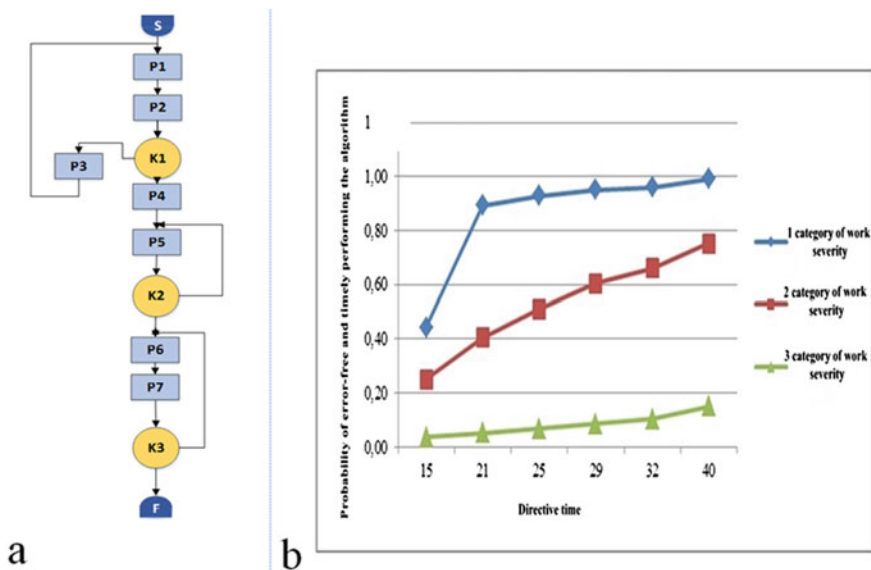


Fig. 2 An example of computer modeling using information technology: **a** functional network that simulates the process of executing an application (designations—according to [16], rectangle—working operation, circle—control of functioning); **b** dependence between the directive execution time of the application and the probability of timely and error-free execution of the algorithm (for various categories of work severity [16, 17]), modeling was carried out by Anna Krivodub

5 Conclusions

The widespread use of contact centers has made the problem of their ergonomic support urgent.

The considered task of studying the assessment by operators of working conditions and predicting the reliability of the execution of requests is solved by the complex use of methods of expert assessment and modeling of the activities of operators based on the activity approach.

For the effective functioning of contact centers, the following should be organized:

- feedback on the study of operators' assessments of working conditions;
- assessment of the influence of a set of factors (working conditions, structure of activities, number and qualifications of operators, characteristics of the flow of applications, etc.) on the ergonomic characteristics of the system and the effectiveness of the contact center.

The scientific novelty of the result lies in the fact that, in contrast to the available (usually intuitive and empirical) methods of ergonomic support, the proposed

approach is based on a set of analytical and simulation models built according to the methodology of functional networks.

The practical result is the technology of studying the assessments of their working conditions received from the operators, as well as the computer modeling technology, built on the principle of «*what will happen if*» .

The reliability is confirmed by a wide approbation of the approach in the design and operation of polyergatic control systems (banking systems, software management systems, utility payment centers, systems of access to information resources).

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