Analysis of the Usability of a Semiautomatic Pistol: the Perception of Public Safety's Agents

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1 Context

Even today it is possible to observe situations of disregard or misalignment of ergonomic factors in projects of the arms industry, which can expose individuals to systems and products that demand extreme environmental, physical and psychological pressure from human factors, and that may result in the inefficiency of the System or even the appearance of accidents.

Regarding to state criminal and police enforcement officers, there is a number of reported cases of serious failings in the armaments they carry, such as accidental firing of the gun still in the holster, additional non-intentional firing, and even explosions, showing the possible disregard for the usability or design flaws in the manufacturing process of certain types of weapons distributed to the country's security forces (Tribunal de Justiça do Distrito Federal e dos Territórios, 2016; Leal, 2014; Instituto Defesa, 2013).

In this way, this article aims to present a survey on the ergonomic conditions of the pistol model PT 840 (Taurus), used by prison officers, military, civil and road polices, identifying possible usability problems, as well as the users' risk perception.

2 Method

The techniques of structural and task analysis were used according to Löbach (2001) and Baxter (1998) to find out more about the pistol. Next, the components of the PT

840 model were analyzed and compared to of anthropometric recommendations presented by Henry Dreyfuss Associates (2015). The action-decision flowchart of Moraes & Mont'Alvão (2009) was also used in order to investigate, establish and organize the step-by-step interactions with the weapon.

Direct and indirect systematic observations (Moraes & Mont'Alvão, 2009) were developed with a male and a female criminal enforcement agent, as well as unstructured interviews to prepare a questionnaire for further application. In general, 12 interviews (9 men and 3 women) were carried out with state criminal enforcement agents at the Justice and Prison Administration Office of the State of Maranhão (SEJAP-MA).

A pre-test of the questionnaire was experimented with 8 respondents before its definitive application to investigate possible incompatibilities and structure incomprehension. After execution of the adjustments, the definitive questionnaire was subdivided into three different sections: the section of respondent's profile elaboration; the System Usability Scale section; and the use experience section.

An adaptation of the System Usability Scale technique – SUS (Brooke, 1986) was applied, being justified by its effectiveness, low cost of application for evaluating products and interfaces, and by its objectivity, since it contains a metric scale for usability evaluation (Bangor, Kortum and Miller, 2009; Boucinha and Tarouco, 2013).

Regarding the sample, the research sought to investigate the interactions of the pistol among public security agents, (road, civil and military polices and also state criminal enforcement agents). A total of 101 security officers participated in the questionnaire: 81 men and 20 women. There were no regional restrictions, since the national circulation of the pistol PT 840 between the responsible public agencies, a strategy achieved by the virtual application of the questionnaire.

3 Results

Based on the information collected during the task analysis, it was possible to delineate the main constituent elements in the tasks carried out with the PT 840 pistol, which are: reloading and conditioning the pistol, safety locking, and firing. The structure of the PT 840 uses features such as the "hold" of the loader, a kind of push button that expels the loader of the weapon. Although only one is vital to its operation, there are two of them and both are found on both sides of the gun, near the trigger area. The reason for the existence of two units is to welcome both right and left-handed users. However, although this is a positive point, the dimensions of the knobs are considerably small, measuring only 7 millimeters in diameter. According to Henry Dreyfuss Associates (2005), for comfort and proper operation, they should vary between 13 and 51 millimeters, thus being outside the recommended parameters.

As for the gun's measurements, more inadequacies were observed, such as those seen in the grip and the diameter of the trigger area. For Henry Dreyfuss Associates (2005), the minimum measures for these references are, respectively, 107 and 28 millimeters. The PT 840 has measures lower than these, since its grip is only 93 millimeters high, while the diameter of the trigger area is 24 millimeters. The measure alluding to the length of the hilt does not reach the ideal point of 45 millimeters, exceeding it in 5 mm. The only analyzed measure that met the recommendations was the height of the pistol grip, in which the size of the PT 840 exceeds the average by 3 millimeters.

About the interviews, three female officers showed dissatisfaction with the physical attributes of the PT 840 pistol, while two male officers indicated a good handling of the pistol when compared to previous models. However, they also described error situations such as failure to fire, failure in the gun feeding, among others. There were also two reports of accidental firing in which one of them resulted in tragedy. In this way, there is discontentment regarding the features of the weapon, in addition to an insecurity and mistrust that permeates the interviewees when it comes to using the PT 840.

The results of the questionnaire reinforce the problems related to the pistol's feeding stages, the preparation and the firing of the shot. 26.7% of respondents indicated that their guns have functional failures, an index that is alarming, given the continuing state of risk of the professionals. In addition, among the 27 responses, 13 (48.1%) reported problems in the task of feeding ammunition, in the bolt and in the barrel, which are precisely the parts and tasks of the pistol responsible for the preparation and execution of the shot, a primordial function of the gun.

Among the 17 (16.8%) agents that went through situations where the pistol stopped working, 11 (64.7%) alluded to or mentioned tasks related to gun power and firing.

Regarding the accidents witnessed by the agents, 21.8% reported that they have already undergone this type of situation, and the most frequent occurrence was accidental shots, with 22 citations. These data confirm previous investigations that identified several cases of the accidental firing of Taurus weapons, leading to physical damage and even death (G1 SE, 2017).

The overall mean obtained from the calculations of the SUS was 70.06, reaching the standard that corresponds to a good usability result of the pistol. However, the average of the female audience is lower than the ideal (65,83), contributing to a scenario of dissatisfaction and usability failure among them. Other profiles that also presented lower averages are the security agents with

over 5 years of experience with armaments (65,83) and the group of civil, road and military police (66,81).

4 Conclusions

The results showed that the weapon presented incompatibilities regarding the ergonomic and usability criteria that can compromise its use, exposing public security agents to risk situations. And although the SUS results reached a general average considered acceptable, there are important groups in which the usability proved to be inferior to the desirable level. And when the context involved is considered, which has a direct relationship with security, high-reliability demand and the exposure of users to risk factors, a sensitive and lacking framework is presented, needing improvements for the development of marginal performances in usability.

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