

SF Journal of Aviation and Aeronautical Science

No Sky for Old Men? Cognitive and Psychomotor Factors of Licensing 60+ Pilots for Single-Pilot Aircrafts

Tarnowski A^{1*} and Galazkowski R²

¹Faculty of Psychology, University of Warsaw, Poland

²Emergency Medicine Department, Warsaw Medical University, Poland

Abstract

A practical need of evidence-based criteria for assessing individual permission for piloting single pilot aircrafts after 60 years was an inspiration to perform research and formulate a guideline for psychological examination. Due to lack of empirical data from active 60+ pilots we analysed cognitive, intellectual and psychomotor performance of over 3000 professional drivers aged 18-76 years to estimate level of deterioration of crucial psychological functions after 60. The Test2Drive battery has been applied to collect the data. As expected, we observed worsening in complex reaction task, speed estimation and visual search, but still majority of elderly subjects met the criteria for first class pilots. The proposed methodology of psychological examination requires full assessment after 60 with double-check of most frequently deteriorating functions, and next control every 6 months.

Keywords: Fitness to fly; Senior pilots; Psychological assessment; Cognitive functions; Motor skills

Introduction

In 2015 Polish Aviation Authority worked on a specific challenge. Polish Medical Air Rescue traditionally hires experienced military pilots and, based on experience this institution, many of them are still in full performance even after 60 years. Normally, after 60 years old pilot can only be certified to fly multiple crew aircrafts. PMAR is actually equipped with Eurocopters, which are single pilot aircrafts. In this situation, experts from Polish Aviation Authority, Military Institute of Aviation Medicine and Polish Medical Air Rescue have to work out a methodology of psychological and medical examination of the pilots 60+, to allow them to apply for individual permission for piloting.

There are lot of experimental evidences for relationship between age and psychological performance.

Reduced perception performance and attention for the elderly is associated with a reduction in the efficiency of the visual analyser, especially in terms of speed accommodation, twilight vision and contrast sensitivity [1]. Furthermore, important consequence is reduced range of the useful field of view [2], which, as has recently been shown by Matas et al. [3] is associated with the deterioration speed of processing and the quality of the recognition. The ability to understand the situation should be clearly identified with the intellectual performance-weaker perceptive capability condition the poorer quality of the available data. The level of fluid intelligence is lowering with age, but the crystallized intelligence (more difficult to measure and allows to compensate for the weaker sides by the cumulated experience can improve by up to 70 years of age. The ability to anticipate, or predict complex situation is the most complex function, dependent on both the perception and the understanding of its individual components [4]. In complex situations reduced processing speed can lead to confusion, and therefore what is going to be the cause of errors.

We assumed, that psychological ability to piloting is decreasing gradually. After 60 cognitive and motor skills are significantly lower, but still there is a group of people who have their characteristics on average (or above average) level [5].

Material and Methods

To check this assumption we used a large database of professional drivers psychometric scores (including perception, attention, reasoning, anticipation, personality factors, speed and adequacy of reactions and coordination). The analogical aviators data were not available, but we assumed

OPEN ACCESS

*Correspondence:

Tarnowski A, Faculty of Psychology,
University of Warsaw, Stawki 5/7 00-
183 Warsaw, Poland.

Tel: +48 22 554 97 77

E-mail: Adam.tarnowski@psych.
uw.edu.pl

Received Date: 19 Dec 2017

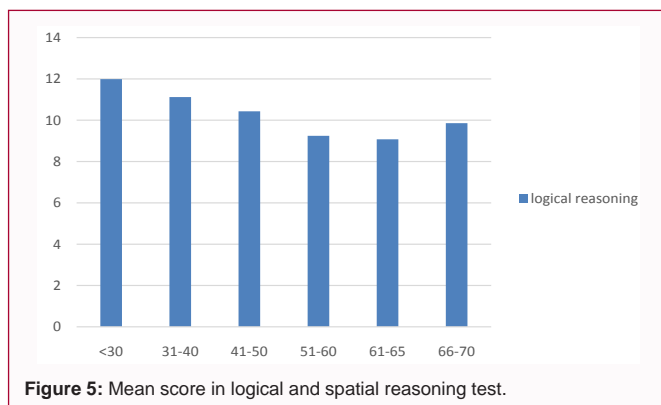
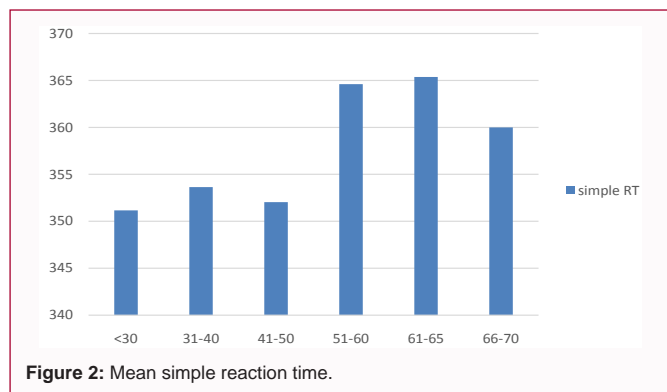
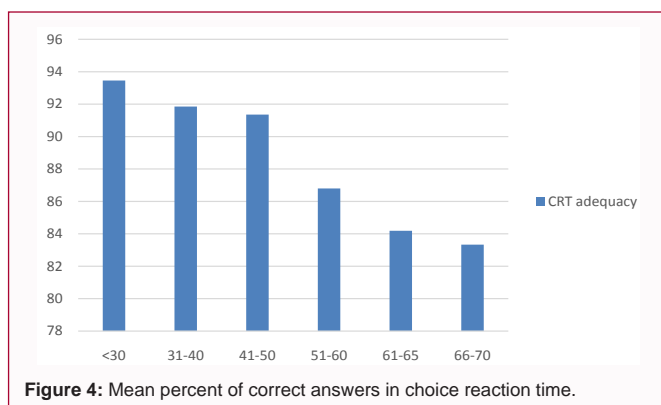
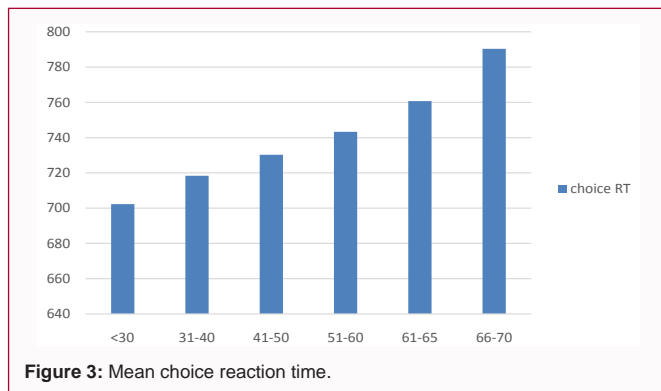
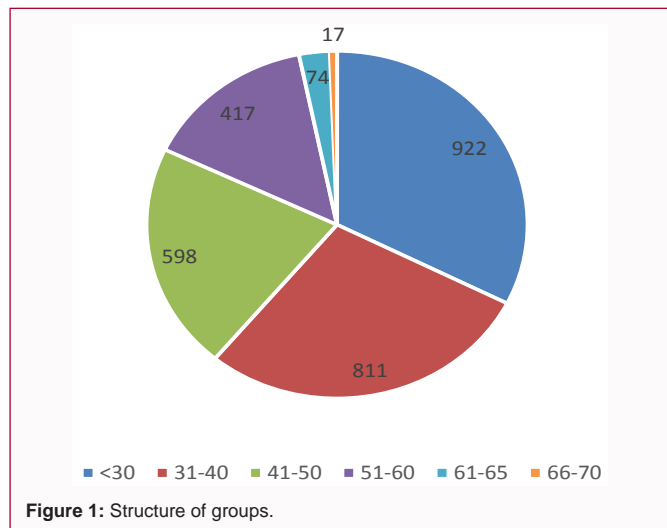
Accepted Date: 15 Jan 2018

Published Date: 26 Jan 2018

Citation: Tarnowski A, Galazkowski R. No Sky for Old Men? Cognitive and Psychomotor Factors of Licensing 60+ Pilots for Single-Pilot Aircrafts. SF J Aviation Aeronaut Sci. 2018; 1(1): 1005.

ISSN 2643-8119

Copyright © 2018 Tarnowski A. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



that both groups are continuously involved in job demanding high psychological performance, and we applied criteria as for class I pilots to tests evaluation. In further simulation no personality factors has been taken into account. The Test2Drive™ test battery has been used, and a group of 2712 active professional drivers, aged 18-70 years (few older were excluded) has been analysed.

The group was divided into subgroups, structure of age is presented on Figure 1. It shall be stressed, that a most interesting group (aged 61-65 years) counted 74 drivers. An oldest group (66-70 years) counted 17 subjects and is presented rather as illustration [6].

Speed and adequacy of reaction has been measured with SIRT (Simple Reaction Test) and CHORT (Choice Reaction Test).

As an indicator of coordination served the SPANT (Spatial Anticipation Test). The procedure demands of pressing a button on the screen corresponding to two spatial cues, indicating its coordinates.

As a logical reasoning test we implemented TRIT test, measuring logical and spatial reasoning in 5 series of tasks, demanding exocentric orientation, mental rotation and rules discovering (social reasoning TRIT subtest was not included in the study).

The attention and perception was tested by PUT (Pop-Up Task), requiring to indicate a “black vertical triangle” among increasing number of distractors.

Anticipation has been measured with PAMT (Perception and Anticipation of Motion Test), where subject is required to avoid two moving objects with the cursor.

In first step, we tested differences between groups in measured parameters. Next, we established cut points, corresponding to 25 centile for each parameter, on population of subjects younger than 60 (analogical to creating norms for procedures used in Polish military aviation pilots assessment). Ideal “candidate” should meet the norm above 25 centile in ten orthogonal parameters. Because such criteria are very difficult to meet (even for youngest group only 33% was able to pass them) we agreed, that for statistical purposes it would be enough to pass 8 of 10 tests. In practice, such candidates after double-checking of predispositions and compensating mechanisms are in most cases qualified as fit.

Results

First of all, the analysis of variance was conducted for all variables. The results are presented in Table 1.

The results confirmed (of course) significant differences in most of factors against 60+ group, but in all factors majority of subjects (in particular dimensions) represented sufficient results to be qualified as

Table 1: ANOVA results.

		SS	df	MS	F	P
SIRT_median_RT	Between	57,718,860	5	11,543,772	5,005	,000
	Within	5,850,921,232	2537	2,306,236		
	Total	5,908,640,092	2542			
chort_median_rt	Between	636,366,184	5	127,273,237	22,520	,000
	Within	13,609,007,708	2408	5,651,581		
	Total	14,245,373,891	2413			
SIRT_PROLATE	Between	1,161,013,275	5	232,202,655	12,149	,000
	Within	48,491,055,494	2537	19,113,542		
	Total	49,652,068,768	2542			
chort_percent_correct	Between	16,431,447	5	3,286,289	28,835	,000
	Within	297,914,038	2614	113,969		
	Total	314,345,485	2619			
spant_median_rt	Between	57,630,932	5	11,526,186	1,297	,262
	Within	19,916,311,638	2241	8,887,243		
	Total	19,973,942,570	2246			
spant_percent_correct	Between	7,577,087	5	1,515,417	7,680	,000
	Within	496,475,778	2516	197,327		
	Total	504,052,865	2521			
trit_score_logic	Between	1,133,208	5	226,642	12,430	,000
	Within	21,989,838	1206	18,234		
	Total	23,123,046	1211			
Pamt_total_correct	Between	15,329,509	5	3,065,902	30,981	,000
	Within	248,387,947	2510	98,959		
	Total	263,717,456	2515			
PUT_inspectiontime	Between	47,337,239,465	5	9,467,447,893	31,860	,000
	Within	804,114,026,181	2706	297,159,655		
	Total	851,451,265,646	2711			

pilots (details are presented on Figure 2-6) It shall be stressed, that in post-hoc testing no differences between “51-60” and “61-65” group were observed. The radical rule binding 60 year of life with absolute ban of single pilot aircraft licensing seems not to have empirical base.

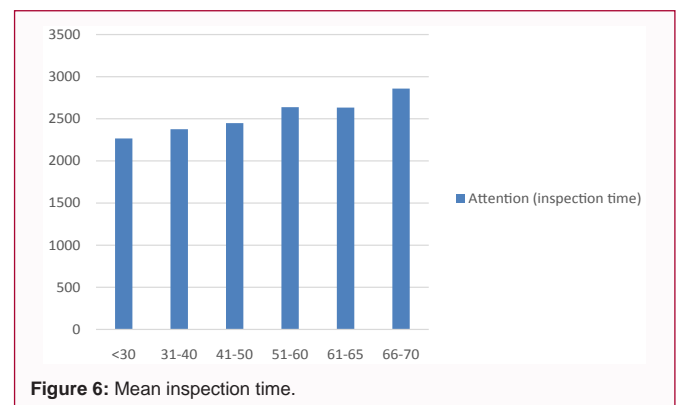
The largest differences have been observed in complex reaction task (both speed and accuracy), speed estimation and effectiveness of visual search.

In simulation of passing the complex criteria we have found, that fraction of people who can be assigned as perfect fitted to be pilots is decreasing in older groups. The proportions are presented on Figure 7. Although most of 60+ subjects meet the combined criteria no longer, still over 35% reveals no significant dysfunction, and from psychological point of view can hypothetically continue the career.

Discussion

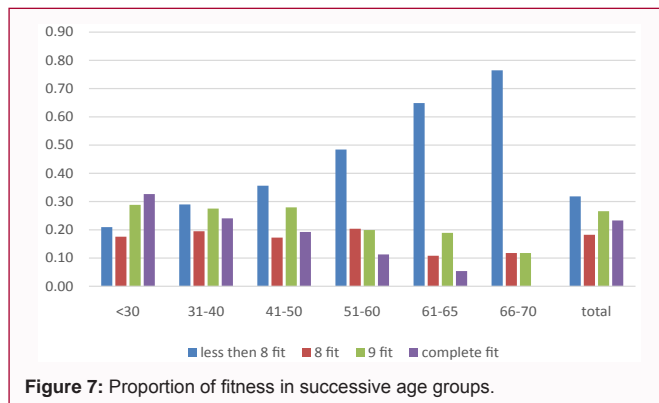
The simulation confirmed the methodology of investigating senior pilots. The areas of “special care” were adequate reactions in complex tasks, speed estimation and visual search (the methodology requires double-check of this abilities). Reaction speed, logical reasoning and coordination are relatively stable.

Because of tradition and confirmed validity in aviation psychology the final methodology of senior pilots assessment has been built



on a base of Vienna Test System (its correlation with Test2Drive™ is well confirmed). The RT test has been chosen as primary tool to assess reaction speed and adequacy (DT as secondary when needed), SIGNAL and COGNITRONE as alternative visual attention test, B19 to measure coordination and ZBA for speed estimation. CORSI, PST and Raven Matrices measure the spatial and logical reasoning.

The examination schedule requires simplified psychological testing every 6 months. As for today, 4 HEMS pilots successfully passed the tests and were individually allowed to fly single pilot



aircrafts [7].

The Test2Drive battery can be also configured for pilots psychological assessment. Comparing to former JAR-RCL3 methodology most of the crucial functions are covered by the battery. It was successfully implemented in candidates to airline qualification [8].

Two conclusions from presented analyses are most important. First, there is no substantial difference between psychological ability of active people aged 51-60 and 61-65. There is no reason to fix a borderline; many of human potential still can be useful (under condition of psychological examination). Moreover, nearly half of the 51-60 groups showed insufficient psychological ability. Even if one can assume that achieving a pilot licence guarantees fitness to fly-it is only starting point, for most people achieved in optimal age. The predispositions can decrease with age, and as shown in data presented, shall be monitored at least after 50.

References

1. Kilian M. Naturalne i patologiczne zmiany oczne w starszym wieku i ich subiektywne objawy. *Niepełnosprawność i Rehabilitacja*. 2012; 2: 91-105.
2. Ball K, Owsley C, Sloane ME, Roenker DL, Bruni JR. Visual attention problems as a predictor of vehicle crashes in older drivers. *Investigative ophthalmology & visual science*. 1993; 34: 3110-3123.
3. Matas NA, Nettelbeck T, Burns NR. Cognitive and visual predictors of UFOV performance in older adults. *Accident Analysis & Prevention*. 2014; 70: 74-83.
4. Endsley M. Situation Awareness Misconceptions and Misunderstandings. *Journal of Cognitive Engineering and Decision Making*. 2015; 9: 4-32.
5. Perbal S, Droit-Volet S, Isingrini M, Pouthas V. Relationships between age-related changes in time estimation and age-related changes in processing speed, attention, and memory. *Aging, Neuropsychology, and Cognition*. 2002; 9: 201-216.
6. Karthaus M, Falkenstein M. Functional Changes and Driving Performance in Older Drivers: Assessment and Interventions. *Geriatrics*. 2016; 1: 12.
7. Raghuram A, Lakshminarayanan V, Khanna R. Psychophysical estimation of speed discrimination. II. Aging effects. *JOSA A*. 2005; 22: 2269-2280.
8. Gugerty LJ. Situation awareness during driving: Explicit and implicit knowledge in dynamic spatial memory. *Journal of Experimental Psychology: Applied*. 1997; 3: 42-66.