

American Journal of
Research, Education and Development

REED



ISSN 2471-9986

American Journal of Research, Education and Development

REED

IMPRESSUM

American Journal of Research, Education and Development
ISSN: 2471-9986

Publisher: DEVLART LLC
250 Camelback Ridge Ave. Henderson, NV 89012
red@devlart.hu

Editor in Chief:
dr. habil Gyula KÓRÓDI MD. PhD

Managing Editor:
Dr. János RIKK

Editorial Secretary:
Géza HORVÁTH

Table of Contents

Symmetries in the final inflection of the intonational contour of unmarked declarative utterances

Renáta Kovács-Henriques

POSSIBILITIES FOR FURTHER DEVELOPMENT OF THE DISASTER MANAGEMENT AUTHORITY SYSTEM

Bence Roland Lakatos – Gyula Vass – László Teknős

Energy demand of ATP resynthesis, its effect on energy supply processes and training theory

Z. Klink; J.Tóth Jr.; J.Tóth ;L. Prukner

MILITARY COGNITIVE INTELLIGENCE AND ARTIFICIAL INTELLIGENCE I. (PLANS AND INITIAL STEPS.)

Dr. habil. NÉGYESI Imre PhD.

MILITARY COGNITIVE INTELLIGENCE AND ARTIFICIAL INTELLIGENCE II. (RESEARCH RESULTS AND IMPLEMENTATION.)

Dr. habil. NÉGYESI Imre PhD.

Examination of the physiological effects of functional foods pilot study

Géza Horváth

Similarities in the intonational features of Italian spoken in Naples and Porteño Spanish spoken in Buenos Aires

Symmetries in the final inflection of the intonational contour of unmarked declarative utterances

Renáta Kovács-Henriques

Eötvös Loránd University of Budapest

kovacs.k.renata@gmail.com

Abstract

This paper presents a descriptive model of the melodic characteristics of the Spanish of Buenos Aires, called Porteño, and the current Italian spoken in Naples, based on the acoustic analysis of a spontaneous speech corpus. The corpus consists of 60 unmarked declarative utterances extracted from YouTube interviews and from the *Interactive Atlas of Romance Intonation* (Prieto et al., 2010-2014). The paper is a product of a research based on the method *Melodic Analysis of Speech* (elaborated and created by Cantero and Font-Rotchés (2009)) using the acoustic analysis software *Praat*. After the segmentation of the utterances a standardisation is carried out and the results are presented in graphs. During the study, the focus will be on the characteristics of the stressed vowels of the utterances' final inflections, because the rise in pitch at the final inflection is, to the human ear, the most striking similarity between the two variants. The objective of this research, therefore, is to discover the symmetries of the tonal movements in the final inflections measured in percentage between the two variants and to justify my hypothesis with concrete data. The value of the stressed syllables will be analysed and compared to the values of the previous and the following syllables. The results of this analysis confirm the hypothesis of the melodic similarities between the variants in question.

Keywords: Intonation, Final Inflection, Spanish of Buenos Aires, Porteño, Italian of Naples, Unmarked Declaratives, Melodic Analysis of Speech Method, Tonal Movements

1. Introduction

According to relatively recent research, the Argentine Spanish language variant still preserves traces of Italian, which is not surprising given that hundreds of thousands of Italians emigrated to Buenos Aires at the turn of the 19th and 20th centuries (LIPSKI 2004).

As a result of nearly a century of migration, 40-50% of the Argentine population today has Italian ancestry, as also evidenced by the abundance of Italian surnames. Even according to the census of 1852, Italians were the largest minority, accounting for 3.8% of the population at that time (DEVOTO 2009, 235). As the migration wave started before the unification of Italy (1861), the emigrants spoke only dialects. It has been shown that between 1880 and 1894 immigrants came mainly from the north-western regions of Italy (Piedmont, Liguria, Lombardy), and between 1895 and 1929 from the south of the country (Calabria, Naples, Sicily) (CACOPARDO AND MORENO 2000, 65). In this latter period, Naples and its surroundings probably accounted for the largest number of emigrants, although it is difficult to say, since the ships that brought the population from the south of Italy left from the port of Naples.

Given the large number of immigrants from Naples to Buenos Aires, it is assumed that the Neapolitan dialect, like other Italian dialects, may have influenced Argentine Spanish at all linguistic levels. The presence of a large number of Neapolitans may also be attested to by the fact that in Argentina today Italians are still referred to colloquially as *Tano*, which is an abbreviation for Napolitano.

Theatre and the popular tango played an important role in the spread of Italian language traces. The language of Argentine theatre in the 20th century was *cocoliche*, a contact language of Italian dialects and Argentine Spanish. *Lunfardo*, also rich in Italian elements, was initially a jargon used by the lower classes of society and later, at the beginning of the 20th century, it became the language of tango (ACADEMIA ARGENTINA DE LETRAS 2008, 416). Nowadays, the inhabitants of Buenos Aires do not speak *cocoliche* or *lunfardo*, but the *porteño* variety, an Argentine Spanish language rich in Italian elements, which is analysed in this work.

In this study, I will therefore analyse from a phonetic point of view the supposed similarities between the present Italian spoken in Naples and the present Porteño spoken in Buenos Aires, offering a description of the suprasegmental structure of emotionally neutral, unmarked declarative sentences and, within that, the general characteristics of the melodic structure of the utterances, with particular emphasis on the symmetry between them. Throughout the research I will refer to the language variants in question as Neapolitan and Porteño.

The suprasegmental structure of speech, or in other words prosody, is created simultaneously with the segmental structure, which is made up of suprasegments, such as the melody, tempo, rhythm, tone, volume, stress and pauses of speech. Prosodic features are partly universal and partly language-specific, so that languages can be recognized by their prosody (GÓSY 2004, 182-184). The speech melody is produced by the alternation of the fundamental frequency (F0) or of the fundamental pitch. A speech melody is made up of melody forms, which are the result of a combination of melodic elements. A melody can be falling, descending, rising, ascending or level (GÓSY 2004, 188).

Spanish and Italian are not tonal languages, but so-called intonational languages, which means that frequency alternations do not change the meaning of the words, as in tonal languages, but only serve a pragmatic function in the utterances (HUALDE, 2014, 261).

It is not easy to capture the intonational features of a certain language, because it may depend on the regional dialect, on the emotional state of the speaker, on the individual style, on the context in which he or she speaks, and on the foreign languages he or she speaks (GÓSY 2004, 187), but there are some basic features that can be used to describe the intonational characteristics of a given language.

The melodic structure of Spanish and Italian is influenced by two factors: the stress, i.e. the stressed syllable in the word, and the final part of the utterance (HUALDE, 2014, 262). According to Cantero (2002), the intonational contour is made up of the following fundamental parts: the anacrusis, the first peak, the body, generally characterized by a declension, and finally, the final inflection. The anacrusis is defined as the first part of the melody up to the first tonic vowel, which is called the first peak. The body comprises the intermediate part between the first peak and the last

tonic vowel of the contour, which in turn is the nucleus. The final inflection is the final part of the intonational unit, which starts from the nucleus, see Figure 1.

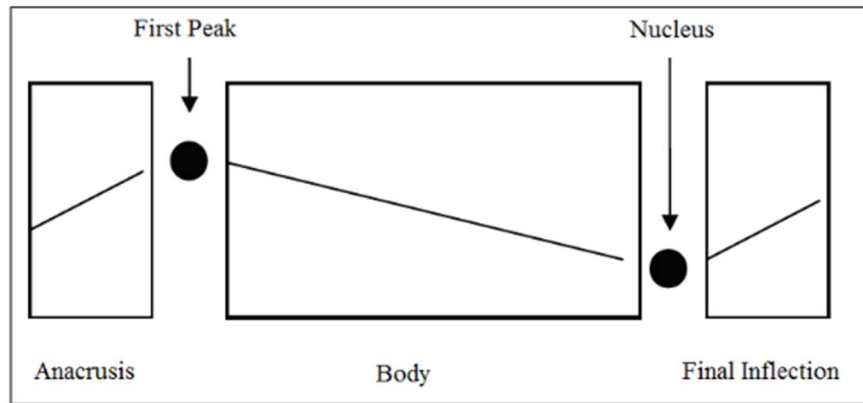


Figure 1: Diagram of the three parts of the melodic contour of an utterance (Martorell M.-Font-Rotchés, 2015)

In this study, I therefore focus only on the final inflection, which is often the most stressed part of utterances, especially in Porteño and Italian of Naples, which are often characterized by very striking changes in tone. The final inflection usually begins with the last syllable with lexical stress, followed by up to three unstressed syllables, unless the syllable nucleus is shifted to the left, in which case the syllable nucleus may be followed by more than three syllables (BADITZNE, 2020a, 36-37).

Sosa (1999) describes the final inflection of the Spanish of Buenos Aires as a tautosyllabic falling from a stressed syllable, which can cause vowel elongation. According to Kaisse (2001), it is a long descending inflection. Baditzné (2020) also affirms that in general a change in pitch is also associated with vowel lengthening. The same vowel elongation characterizes the intonation of the Neapolitan dialect, which is particularly marked in the case of the last stressed open syllables (CANEPARI, 1980, 70).

In the present study, I compare the Herz values of the stressed syllables at the end of sentences with the ones of syllables before and after them. According to the initial hypothesis of the study, there are similarities in the rate of rise from the unstressed syllable to the stressed syllable and in the rate of fall from the stressed syllable to the following post-tonic syllable in the final inflection of the two language variants.

2. Methodology

This research is based on the *Melodic Analyses of Speech* (MAS) methodology in order to analyse the spontaneous speech samples. The method was developed by researchers affiliated with the Phonetics Laboratory of the University of Barcelona in 2009, and an extended version was published in 2019 (CANTERO 2019). The model works with standardized melodies and devotes an important role to detecting the magnitude of a given melodic movement in relation to its context, since the extent of melodic movement can carry different meanings. The essence of the method lies in identifying the tonal segments that are formed by vowels. Consonants are ignored because they play a marginal role and rather just obstruct the free flow of vowels, which can be stressed or unstressed. Stressed vowels can form syllable nuclei or word nuclei, or they can be the nucleus of a phonetic group, which forms the inflection at the end of a sentence. In contrast, unstressed vowels can only be syllable nuclei, which can be neutralized or even disappear completely (CANTERO, 2019, 489).

Standardisation is important because the absolute value of the tones (denoted by F0 and measured in Hertz) is influenced by the physiological characteristics of the speakers (such as the thickness of the vocal cords), and it is therefore difficult to compare the utterances of speakers of different ages and genders because the tone curve will be different, even though the melody is very similar. In melodic analysis, it is therefore necessary to depart from the absolute values given in Hertz, in order to focus on the relationships between tonal values in intervals. A melody is defined by determining its intervals (CANTERO, 2019, 489).

Therefore, the values 220, 250 and 200 (between which the difference in Hertz is +30 and -50) are exactly the same as the values 440, 500, 400 (between which the difference in Hertz is +60 and -100). Thus, although the absolute values differ, the melody of a sentence is the same because the interval between them is the same (+25% and -50%) (CANTERO, 2019, 489).

In the study, the intonation of each utterance (the alternation of frequency values) was analysed using the sound analysis software *Praat* (BOERSMA-WEENINK, 2019) and a frequency

value was assigned to the tonal syllable of the final inflection and to the preceding and following syllable. The analysis did not take into account irrelevant micromelodic fluctuations, in other words, the differences below 10% that are not noticeable to the human ear (HERRAIZ-CANTERO, 2014, 133). The obtained frequency values were then standardized along the melody using a formula on graphs in an Excel worksheet, so that the successive variation of frequency values could be compared even if they came from different speakers. The frequency values of each syllable in relation to the other were measured in percentages: the first one gets the number 100, and the next one the percentage in relation to it, less if the value decreases, more if it increases in relation to the previous syllable. The following figure shows the sonogram of the Porteño utterance “veo uno solo” (‘I see only one’) extracted by the *Praat* software.

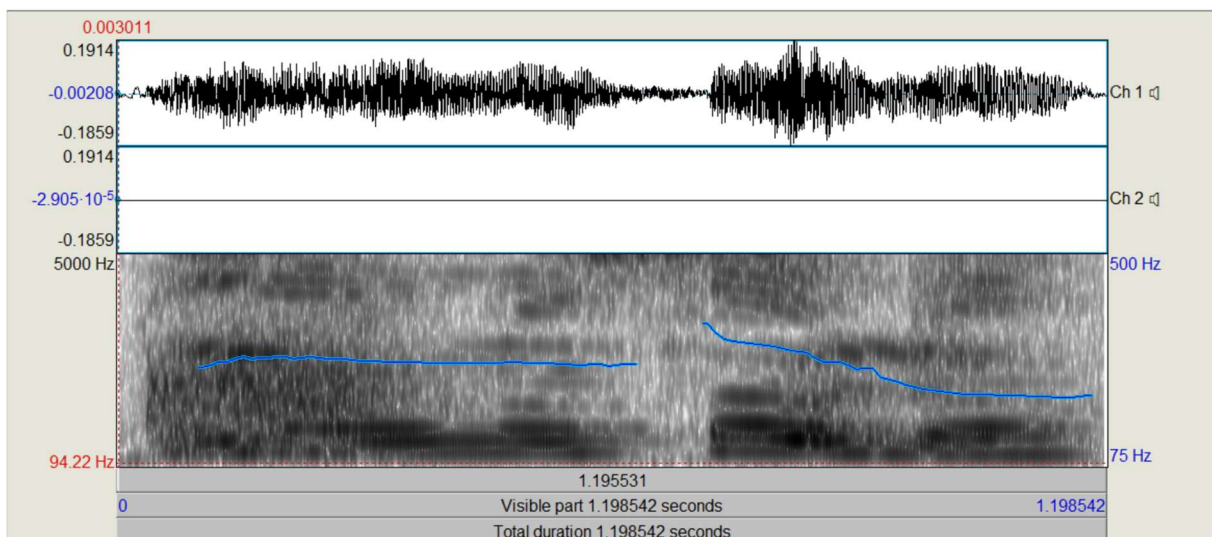


Figure 2: Sonogram of the Porteño utterance “Veo uno solo” (‘I see only one’)

After the enunciation was segmented, it was graphed on an Excel worksheet and standardized using a formula. It can be seen that the frequency value measured for the first -ve- syllable is 295 Hz and for the second -o- is 283 Hz, which represents a 4.07% decrease between the first and second syllable; if we assign the number 100 as a relative value to the first syllable, we assign the rounded 96 to the second.

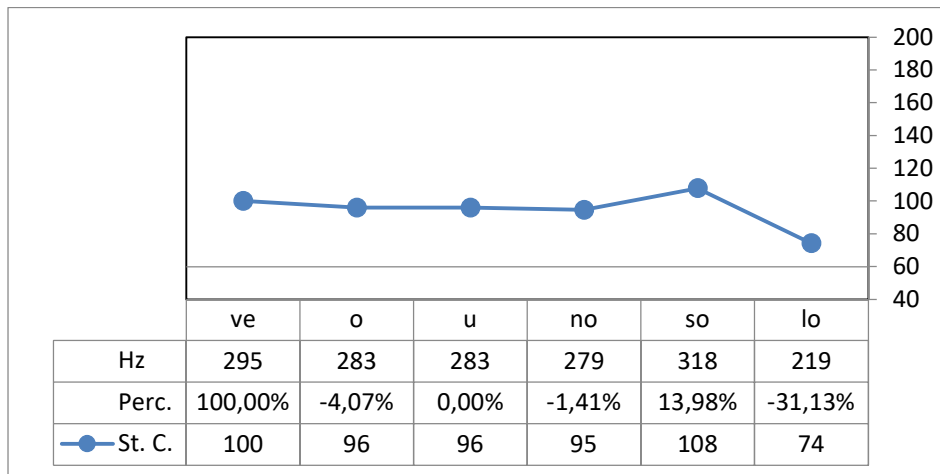


Figure 3: Standardized melodic curve of the Porteño utterance „veo uno solo” (‘I see only one’)

3. Corpus

In the research, spontaneous speech samples were analysed, extracted from interviews uploaded on YouTube and from the *Interactive Atlas of Romance Intonation* (PRIETO ET AL., 2010-2014). In compiling the corpus, adult speakers of different genders and ages were selected, in order to draw general conclusions. The informants are scalarized public figures from the middle-high social strata aged between 22 and 78. I analysed 30 utterances of Italian speakers from Naples and 30 utterances of Porteño speakers from Buenos Aires, ranging from 4 to 20 syllables. In the following table I illustrate the aggregated data of the informants.

Table 1: The Neapolitan informants’ data

	name	sex	age	profession	Utterances
1	SA	F	22	student	10
2	AM	M	34	football player	7
3	CP	F	78	actress	5
4	PD	M	50	musician	8

Table 2: The Porteño informants' data

	name	sex	age	profession	Utterances
1	IBE	F	32	clerk	5
2	RD	M	55	actor	10
3	FC	F	60	actress	10
4	JB	M	66	archbishop	5

4. Melodic similarities in the two language variants and results of the study

In contrast to the Spanish dialects, in which the internal inflections of the melodic body are characterized by melodic peaks culminating on the next unstressed syllable, in the Italian and Argentine intonation we can speak of melodic peaks occurring within the stressed syllables in most, but not all cases. The Porteño melodic body is characterized, as already mentioned, by tautosyllabic inflections, meaning a fall from a high peak, which can result in the effect of vowel elongation (COLANTONI - GURLEKIAN 2004).

There is little information about the intonation of the Neapolitan dialect, and even less about the Italian spoken by Neapolitans but it is known that both differ from standard Italian. Ledegway (2009) underlines that while the latter is mainly characterized by a gradual descent after the first melodic peak, the Neapolitan dialect and the Italian spoken by Neapolitans can be described as a body of melodies alternating between descending and ascending. Among the speakers of lower social strata in Naples, who tend to mix the dialect with standard Italian, we often observe the deletion of the last syllable, in the case where the stress falls on the penultimate syllable. After the deletion, the syllable remains stressed and generates a rising inflection. In the melody curve of the utterance “*facete parla' la signo'*” ('let the lady speak'), pronounced by an Italian speaker from Naples (Figure 4) it can be seen that the final word of the enunciation *signora* loses the last syllable -*ra*-, which would generate a descent, so that the utterance ends with the nuclear -*gno*- syllable, generating an 8.51% rise. It

should be noted, that the speaker tries to speak in standard Italian from a grammatical and syntactical point of view, but from a prosodic aspect it is closer to the dialect's prosody. Deleting the last syllable leads us to believe that the informant is from the lower social strata. In this reserach I only analyse utterances of informants of middle-high social strata.

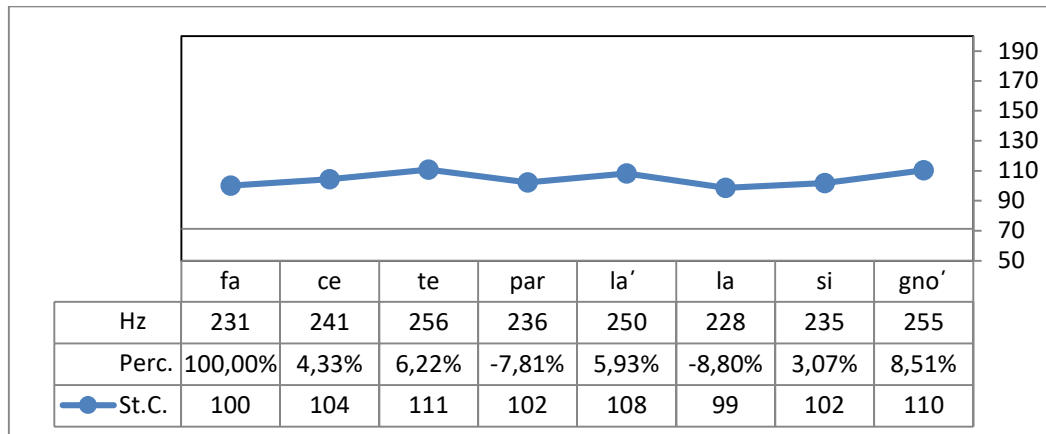


Figure 4: Standardized melodic curve of the utterance “facete parla’ la signo’” (‘let the lady speak’) pronounced by a Neapolitan speaker

It is important to point out once again that in the this paper I am not analysing the Neapolitan dialect, but a refined version of it, the actual grammatically standard Italian spoken in Naples, on which the intonational features of the dialect have an impact. This transfer can therefore be observed in the intonational contour of standard Italian utterances spoken by Neapolitans, in that the last syllable is not deleted, but the tone of the penultimate stressed syllable is raised, elongated, as it represents the curve of the utterance “ma io sto da sopra” (‘but I am on top’) pronounced by a speaker from middle-high social strata (Figure 5). The penultimate stressed open -sop- syllable, where the melodic peak is realized, shows a significant 24.51% rise compared to the pretonic (syllable before stressed syllable) -da- syllable, and the syllable nucleus is followed by a steep descent of 27.17% to the post-tonic syllable (syllable after stressed syllable). This melodic movement generates a marked rising-falling inflection.

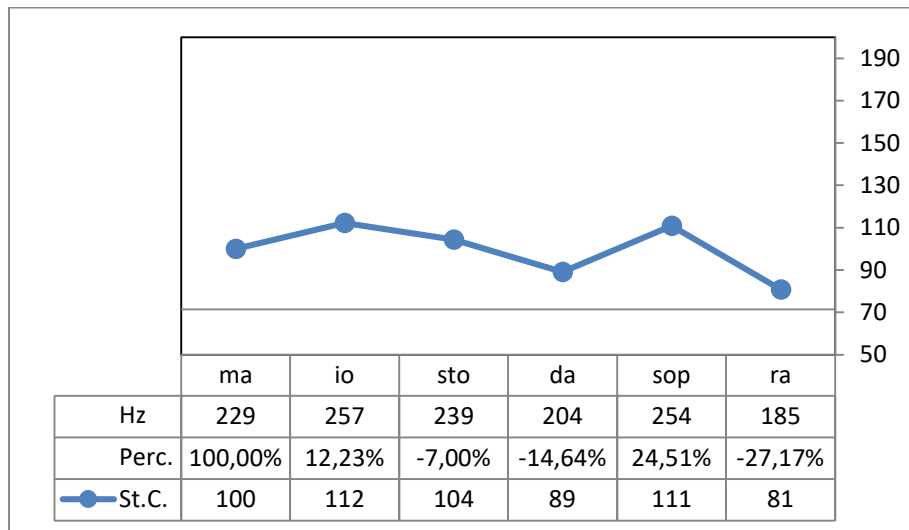


Figure 5: Standardized melodic curve of the utterance “ma io sto da sopra” (‘but I am on top’) pronounced by a Neapolitan speaker

The same rising-falling melodic pattern can be observed in the final inflection of the Porteño utterance “me dan besos en la cara” (‘they give kisses on my face’). In the lexeme *cara* the stressed vowel is the -ca- syllable which shows a rise of 69,33% from the previous unstressed syllable -la-, and a very significant 40,94% high fall is measured on the last, post-nuclear syllable ra-, as represented in Figure 6.

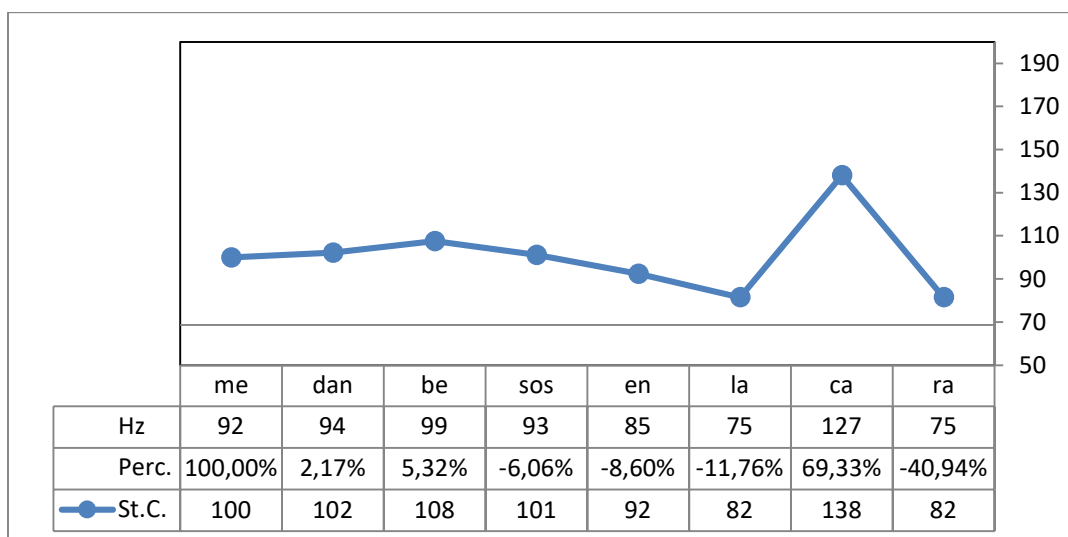


Figure 6: Standardized melodic curve of the utterance “me dan besos en la cara” (‘they give kisses on my face’)

In this research, therefore the tonal value of the stressed vowels in the final inflection of the utterance was investigated and compared to the previous unstressed vowel and the post-nuclear unstressed vowel. The results are presented in the form of a diagram in Figure 7. The first graph shows the rate of rise and the second the rate of fall in the two language variants. It can be seen that, based on the data extracted from the 60 utterances analysed, the rise from unstressed syllable to stressed syllable is steeper in Porteño, and the fall from stressed syllable to the post-stressed syllable it is also steeper in comparison to the Italian spoken in Naples.

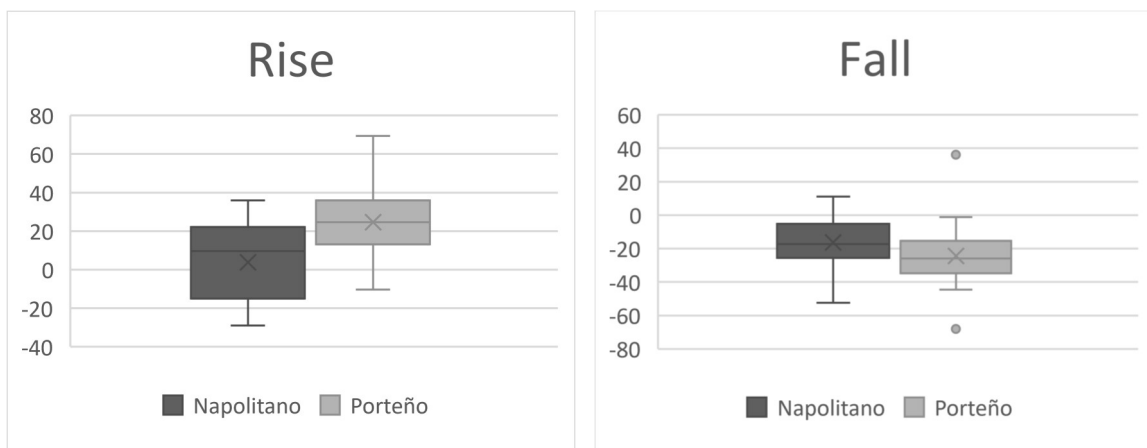


Figure 7: Boxplot of tonal movements in percentage ((boxplots are generated by Excel 365 pro plus).

5. Conclusion

The aim of this research was to present, after a brief historical overview, the intonational similarities between the Spanish spoken in Buenos Aires and the Italian spoken in Naples, because I believe that the mass emigration from Naples and its surroundings at the end of the 19th and the beginning of the 20th century could left a strong mark not only in the field of gastronomy and culture, but also in the local Spanish language, and within it, at the phonetic level, in the melodic structure.

The results of this study confirm the hypothesis that both Porteño and Italian spoken in Naples, bears similar intonational features in the final inflection of unmarked declarative utterances, despite the fact that the Porteño shows steeper rises and falls.

In this work, I have only highlighted the defining features that are specific to both variants, and have ignored the features that characterize standard Italian as well as European Spanish.

References:

- BOERSMA, P.–WEENINK, D. (2019). Praat: Doing phonetics by computer (version 6.0.49): [online]: <http://www.praat.org/>.
- BADITZSNÉ PÁLVÖLGYI, K. (2020). “El español porteño Y El Italiano Meridional”, *Acta Hispanica*, n.º II (octubre), 773-83. <https://ojs.bibl.uszeged.hu/index.php/acthisp/article/view/32996/33152>.
- CACOPARDO, M. C. - MORENO J. L. (2000): “Características regionales demográficas y ocupacionales de la inmigración italiana a la Argentina (1880-1930)”, in Devoto, F. *La inmigración italiana en la Argentina*. Buenos Aires: Editorial Biblos.
- CANEPARI, L. (1980): *Italiano standard e pronunce regionalí*. Padova, Cooperativa Libreria Editrice degli Studenti dell’Università di Padova (CLEUP), 70.
- CANTERO SERENA, F. J. (2019): “Análisis prosódico del habla: más allá de la melodía”, in María Rosa Álvarez Silva; Alex Muñoz Alvarado & Leonel Ruiz Miyares (eds.): *Comunicación Social: Lingüística, Medios Masivos, Arte, Etnología, Folclor y otras ciencias afines*. Volumen II. Santiago de Cuba: Ediciones Centro de Lingüística Aplicada, 485-498.
- COLANTONI, L. - GURLEKIAN, J. (2004): “Convergence and intonation: historical evidence from Buenos Aires Spanish”, *Bilingualism. Language and Cognition* 7, 107-119.
- D’IMPERIO, M. (2002): “Italian Intonation: An Overview and Some Questions”, *Probus* 14 37-69.
- DEVOTO, F. J. (2009): *Historia de la inmigración en la Argentina*. Buenos Aires: Editorial Sudamericana
- GÓSY, M. (2004): *Fonetika, a beszéd tudománya*, Budapest, Osiris Kiadó, 182-243.
- Herraiz, E. D.-Cantero, J. S. (2014): *The intonation of mitigating politeness in Catalan*: *Journal of Politeness Research*, Doi 10.1515/pr-2014-006, 127-149.
- HUALDE, J. I. (2014), *Los sonidos del español*. Cambridge University Press.



- KAISSE, E. M. (2001): "The long fall: An intonational melody of Argentinian Spanish". In: Herschensohn, Julia et al. (eds.): *Features and Interfaces in Romance*. Amsterdam: Benjamins:148-160.
- LEDGEWAY, A. (2009): 'La *grammatica diacronica del napoletano*: Problemi e metodi', *Bollettino linguistico campano* 15/16:1-72.
- LIPSKI, J. M. (2004): "El español de América y los contactos bilingües recientes: apuntes microdialectológicos" *Revista Internacional de Lingüística Iberoamericana* 2, 89-103.
- Laura Martorell-Dolors Font-Rotchés (2015): *Intonation analysis of Spanish spoken by Swedish speakers: declarative utterances*, Research project Analysis of Speech and Teaching Models, ref. FFI2013-41915-P, Universitat de Barcelona.
- PRIETO, P.-ROSEANO, P.: *Atlas interactivo de la entonación del español*. <http://prosodia.upf.edu/atlasentonacion/>.
- SOSA, J. M. (1999): *La entonación del español. Su estructura fónica, variabilidad y dialectología*. Madrid: Cátedra.

POSSIBILITIES FOR FURTHER DEVELOPMENT OF THE DISASTER MANAGEMENT AUTHORITY SYSTEM

Bence Roland Lakatos – Gyula Vass – László Teknős

Abstract

Transparent, accessible and stable public administration is essential for the internal and external security of all countries. The author seeks to define the path to success for the disaster management organisational system and, more broadly, for public administration itself. Particular attention is paid to both the role of the service state and the characteristics of the systems used. By analysing the data obtained from the research methods to be implemented, the author intends to draw conclusions that will help to improve effectiveness and efficiency. The author intends to measure the costs per case based on the methods he applies and to make public administration more efficient through his proposals.

Keywords: e-governance, disaster management, Industrial 4.0, IoT, efficiency

Introduction

During our research, we aimed to examine the possible methods of increasing the efficiency of tasks carried out by official disaster management systems in Hungary. The methods of increasing efficiency are examined through the applicability of smart services. On the one hand, the official side, while on the other hand, the residential side is analysed.

The objectives of the research include the need to increase security and to research the sustainability of the existing levels, as the increase in the number of facilities posing a potential threat, as well as the constantly emerging new challenges (climate change, migration, pandemic, shortage of raw materials, war, energy crisis, and so on) increase the demand for quality work of the authorities and the examination of continuous improvement opportunities. The examination of systemic resilience is prioritised in the professional disaster management organisation system, as our ability to withstand the ever-changing modern world must be properly adapted to new challenges, as a unified safety net.

The way to e-administration within the service provider country through industry 4.0

People of our time can see the rapid digital development, which is due to the 4th Industrial Revolution, and even, according to some research, the 5th Industrial Revolution due to robotics. *'[...] the technological development agents of Industry 4.0 are an integral part of all sectors of a well-functioning state, whether public, corporate or private, paying particular attention to the search for continuous innovations aimed at creating security and making existing ones more efficient.'* [1] In this wave of development, it is also essential that the provision of State tasks itself undergoes a kind of development, which has

resulted in the completion of electronic, i.e. e-public administration.

The role of the state in the expansion during Industry 4.0 development and development opportunities is essential, since it is involved in the process at all levels, from the legislative process to the implementation side, and can promote but also hinder positive changes, as the state has to stand behind and not in front of innovations from the service and private sectors in such situations. A well-functioning public administration system must inevitably perform service tasks as well. The following figure shows the relationship between the participants of the public administration system and the client.

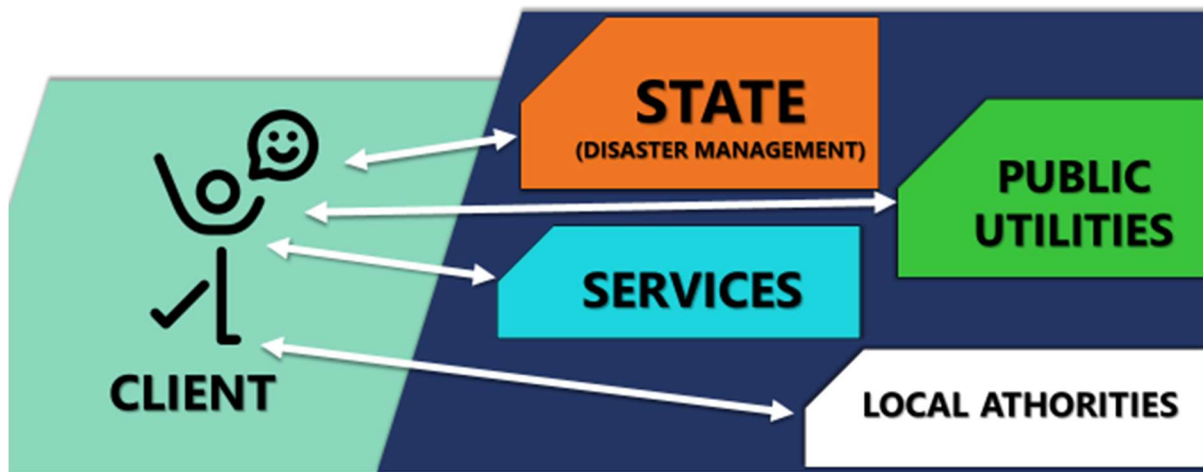


Figure 1. The relationship between the client and other participants (created by authors)

Figure 1 shows the client in contact with the state, local authorities, utilities and service sectors. Although the place of disaster management was shown in the figure in an organisational approach, we can say that considering the scope and tasks, we cannot only include it here since in the case of Public Utilities, the temporary provision of the public service of providing waste management, the administrative tasks of water protection, including water quality protection, or damage prevention tasks are also included. Further analysing the case of local governments, let us think about the public safety representatives who assist the mayors in the fields of civil protection, Industrial Security, and even fire protection. In particular, to ensure the public's safety, the competent Department of Disaster Management carries out market surveillance procedures in relation to construction products, fire-technical products and carbon monoxide equipment. A complex system requires a complex approach. All segments of public administration penetrate our lives, which is why e-public administration needs to be efficient and sustainable. [2] The development of e-public administration has also brought along technologies, processes, regulations, and conditions affecting the work of the organisation used so far in the field of disaster management to undergo a continuous wave of changes. The impressions and expectations of the e-administration on both the public and the client's side were examined with questionnaires. The following figure summarises the results and lists the most significant advantages and disadvantages.



Figure 2. Advantages and disadvantages of E-administration (created by authors)

Advantages include increasing efficiency, cost-effectiveness, quickness, permanent access and simplicity. Increasing efficiency also comes from ensuring that information is shared and accessed immediately. By expanding efficiency, it does not equal effectiveness, since in the case of efficiency it is necessary to examine the results and the costs in parallel since it is possible to examine both sides (achieving a specific goal with the minimum energy expended, achieving the highest results) in this way. Cost-effectiveness, as an indicator of efficiency, means public savings resulting from paperless processes (it is free of printing and paper producing costs) and meeting clients in person (human resources: administrative and security personnel salary costs, operating costs of buildings used), is reflected on the benefits side. Quickness refers to the immediate use of available services (broadband, reliable and fast optical wires are also crucial in this area). Permanent access was also highlighted in the conducted questionnaires, as the system, in the case of automated systems, is accompanied by an immediate administration opportunity. Simplicity, as another key advantage e-public administration systems should have, means the system can be used on a transparent interface, conveniently, without having to go anywhere. As for disadvantages, it was indicated several times that the surface feels inconvenient and distracting, cumbersome, overcrowded, and non-transparent. This is due to what is called the lack of white space surface, i.e. the lack of transparency and looseness. The lack of physical connections also appeared as a problem, since during the application of these systems the direction of connection fades into the background, and in many cases, it is completely lost. Another disadvantage is the lack of consistency and responsiveness, which is the guarantee of the neutral surfaces of the used device, i.e. everywhere (PC, mobile [iOS, Android, Windows Mobile OS, Blackberry Mobile OS], tablet, etc.). A uniform user and authority management interface, and a uniform image should be available.

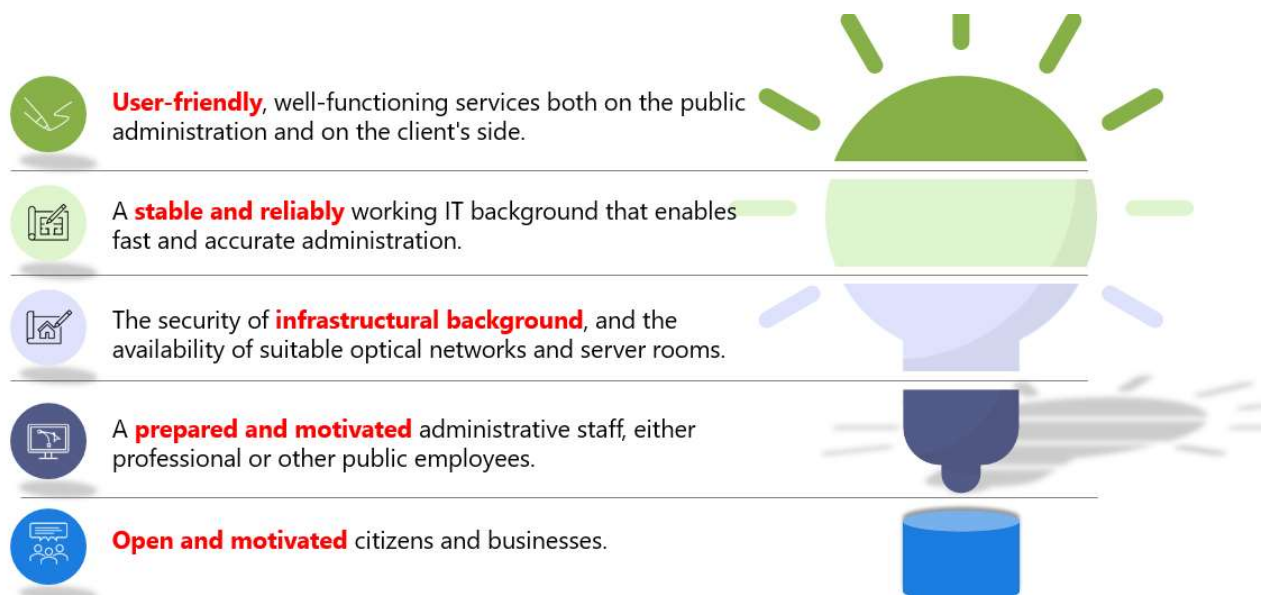


Figure 3. Successful and Efficient E-administration (created by authors)

In addition to reducing the above-listed disadvantages for the operation of public administration, the aim is to increase the number of advantages. What is, however, needed for an electronic administration system to be efficient and successful? First of all, there is a need for software and application with a user-friendly interface, which takes into account, from the side of those performing authority tasks, that it should be transparent, reduce administrative burdens, and at the same time help clients to access the necessary data while guaranteeing the transparency of business processes without IT knowledge. Stability and reliability are also important characteristics since accessibility and reliability must be guaranteed both on the authority and on the client's side, and for this, an appropriate infrastructure background is also required. The infrastructural background includes the use of a set of electronic, electromechanical and mechanical equipment, i.e. computers, laptops, and phones (hardware), both on the user's and authority's side, which is capable of running a program or application (software) that appears as an intellectual product performing the function of a defined e-administration. Among the theses developed by John von Neumann in 1946 was the universality of computers as a principle.

No special equipment should be required to perform the tasks, but the most widely available configurations should be able to run smoothly and without obstacles on operating systems. [3] In fact, for every organisation-level change, it is essential to prepare and train the workforce, in this case, the public administration staff, at the appropriate level, and to ensure motivation for the application of the new system. Once these are obtained, the last element becomes absolutely necessary, which can be considered one of the most important ones, namely, the existence of openness and motivation for the application of the new system on the part of citizens and businesses. The grassroots structure of these is essential for an innovative process improvement system to contribute to

successful and efficient e-administration. [4]

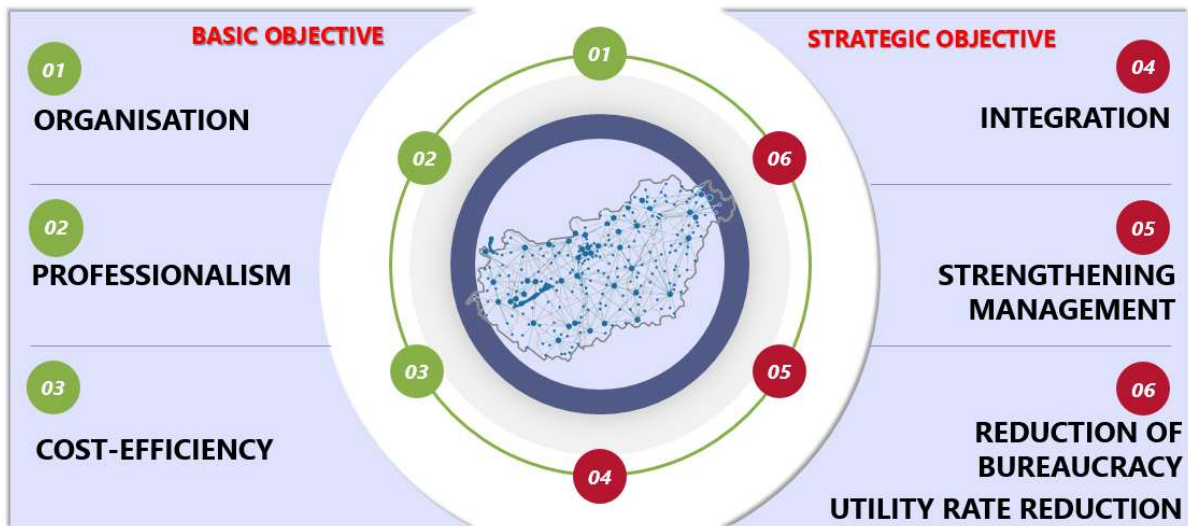


Figure 4. Basic and strategic objectives of the service state (created by authors)

As could be seen in the relationship between clients and other participants, in terms of location and in order to increase trust in public administration itself, there is a need for authorities located within the state administration, which are not only marked as ‘service providers’, but also a service provider state structure. The client is in the centre of the state system of providing services, and the state must play a role in eliminating all obstacles, be they physical, electronic, long-distance, digital, etc. Figure 4 depicts the basic and strategic goals that are broadly related to the state and in a much narrower sense can be also used to analyse the organisation of disaster management in Hungary. Organisation is put as the first basic objective since it is crucial to share tasks, powers and competencies as rationally as possible, and to this end, it is necessary to carry out centralisation and decentralisation in the departments of public administration.

In this case, the structure can be divided into central, regional, and local levels and other organisational units which is a well-established system in terms of competence. Professionalism is also a priority goal, as professionals working in public administration must have a national dedication for what they do, professional and up-to-date knowledge, and carry out their work along ethical and motivated goals. Cost-effectiveness as a basic objective means that organisations should do the work with the lowest possible administrative burden, minimum service fees and shortening of administrative deadlines. As for strategic goals, three should be highlighted, which are strengthening management, reducing bureaucracy and the related reduction of public utilities. Integration is of paramount importance since the integrated approach of authorities brings special advantages at the systemic level, and based on this, an effectively organised state administration system becomes feasible. In order to increase efficiency, strengthening the management approach is also considered strategically important, since with the

appropriate level of task-oriented sharing of the human resources available to us, a manager-oriented structure becomes available, in which the application of brainstorming is also a priority task. [5] The third objective is the reduction of bureaucracy and the reduction of utility costs since it is essential to implement deregulation in the procedural and material environment of public administration, as well as in the legal environment of organisations. The state-level reduction of public utility costs is also an important aspect since the public sector has significant dimensions, so the goal is to minimise the energy consumption of the tools, machines, technologies and processes used, and with possible innovative investments, footprints can be reduced at a realistic rate of return. Providing and establishing e-public administration as an employed service provider task may be assured at an appropriate level by the end of the second decade after the turn of the millennium. The goal is to implement these systems and solutions that speed up and facilitate administration in accordance with arising new challenges. [6] In the course of this research, the analysis of the properties of the systems was carried out, and during the examination of the possibility of developing an application called Intelligent Control, the found requirements for the applied systems are simplicity, quickness, being up-to-date, accuracy, transparency, and efficiency. [7] However, as a result of the events that have taken place in the world in a short period of time, a new approach can be introduced from a new point of view. The seventh most important feature, namely, cost-effectiveness means the system used must be cost-effective and sustainable.

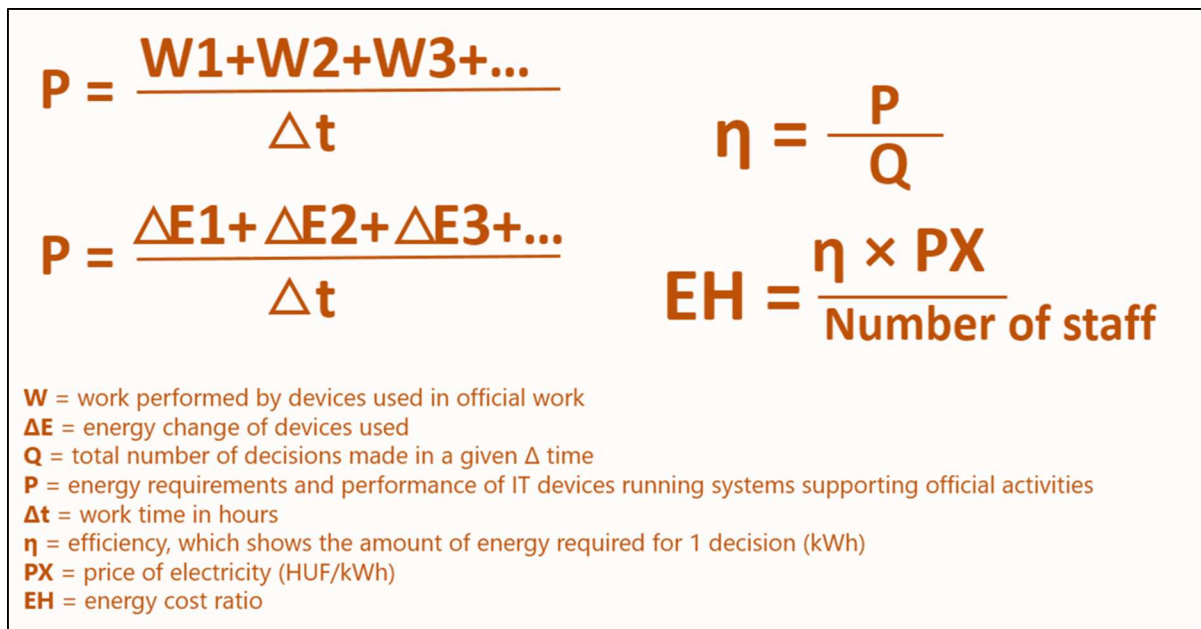
In the 1990s, Mathis Wackernagel and William Rees defined the conceptual elements of the ecological footprint and developed a method for calculating the load. [8] These metrics were the basis of the analysis of resource and energy requirements during the examination of sustainable development. These principles and methods can also be applied during the examination of public administration in the applied systems, devices and workstations.

Cost-effectiveness in the context of the operation of the applied specialist systems means that their function can be fully fulfilled even with minimal energy requirements, which means minimising the ecological footprint of public administration. This should be a priority objective of all research and examination related to official activities. The other one is sustainability, which means that by the choice of the systems and methods used, while minimising the resources to be spent on a case, security can be guaranteed while taking into account the needs and interests of the client so that the characteristics of providing a service can prevail. This suggestion can be viewed as the greening process of public administration.

Proportion of energy costs of administration

Galileo Galilei, an Italian philosopher of the 16th century, whose work has produced significant results in the fields of physics, astronomy, mathematics, and natural sciences, said and wrote 'measure what can be measured, and make measurable what cannot be'. Implementing this idea, the research touched upon the task of determining the proportion of energy costs of administration in the performance of official tasks of professional disaster management bodies, since almost everything in our world can be measured, and what cannot, can also be measured

in the end. This provides an appropriate basis for comparison to draw certain conclusions. It is possible to measure what tools are used by staff performing official activities, how long they run per working day, and the amount of official work itself can be measured as well. Based on this, the unit fraction of working capacity can be calculated. In order to calculate the energy cost ratio of the administration, it is necessary to sum up the data of all workstations serving authority activities powered by electricity, divided by the delta value of the working time expressed in hours. The energy demand, power, and thus the value of P can be obtained by dividing the sum of the energy changes and the change of time. Eta, i.e. efficiency, is obtained by dividing the value of P by the value of Q, i.e. how many decisions were made during a given work time. EH, as the energy cost ratio indicator is obtained by dividing eta and the electricity price by the number of staff. The formula for the calculation method, alongside an explanation of the related abbreviations, is shown in Figure 5.


$$P = \frac{W1+W2+W3+...}{\Delta t}$$
$$P = \frac{\Delta E1 + \Delta E2 + \Delta E3 + ...}{\Delta t}$$
$$\eta = \frac{P}{Q}$$
$$EH = \frac{\eta \times PX}{\text{Number of staff}}$$

W = work performed by devices used in official work
ΔE = energy change of devices used
Q = total number of decisions made in a given Δ time
P = energy requirements and performance of IT devices running systems supporting official activities
Δt = work time in hours
η = efficiency, which shows the amount of energy required for 1 decision (kWh)
PX = price of electricity (HUF/kWh)
EH = energy cost ratio

Figure 5. The formula of energy cost fraction of the administration (created by author)

Collection of data for the application of the above calculation method was carried out between 20 September - 28 October 2022 (30 working days and 9 legal holidays) and took place at the workstations of the Disaster Management Authority Department of the Szabolcs-Szatmár-Bereg County Directorate in Nyíregyháza. For the research, Gosound EP2 smart sockets were applied to each workstation in order to collect data. Each workstation is equipped with a PC with two monitors. During the research, a database was created, as a significant amount of data had been recorded, from which the correlations are being drawn, and the results are expected by early 2023.

Summary

In conclusion, in the system of professional disaster management organisations, authority tasks play a prominent role in the protection of the safety and protection of the population. The correlation between the participants of

the service-providing state and the clients was presented, as were the advantages and disadvantages of e-administration based on the data analyses carried out. In the case of the properties of the systems used, another property was defined, with two sub-properties, which were introduced as the concept of the greening process and the ecological footprint of public administration. Furthermore, the essentiality of ensuring resilience at the organisational level in order to make a difference and adapt was also brought to attention. The tools, applications, methods, and practices that can be developed, with minimal costs, with which efficiency, security, and stability can be further increased need to be found. Through the analyses of the data obtained during the research, the aim is to develop a work organisation methodology, the application of which in practice makes it possible to reduce the expenditure costs of the staff performing official tasks, however, the efficiency increase can be maintained, thereby reducing the ecological footprint of the administration itself.

References

- [1] Lakatos, B (2020): A lakosság önvédelmi képességét javító tűzvédelmi applikáció vizsgálata, in: Hausner Gábor (szerk): Szemelvények a katonai műszaki tudományok eredményeiből II., Ludovika Egyetemi Kiadó, Budapest, p. 233.
- [2] Cimer, Zs., Vass, Gy., Zsitnyányi, A. and Kátai-Urbán L. (2021): Application of Chemical Monitoring and Public Alarm Systems to Reduce Public Vulnerability to Major Accidents Involving Dangerous Substances, *Symmetry*, 13 (8). pp. 1-16.
- [3] Hábermayer, T. (2020): Az ár- és belvíz elleni katasztrófavédelmi feladatok korszerű megoldásának lehetőségei, PhD dissertation, Nemzeti Közszolgálati Egyetem Hadtudományi és Honvédtisztképző Kar KMDI, Budapest, 239. p.
- [4] Vass, Gy. (2017): Industrial Safety Training in Disaster Management Higher Education In Hungary. *Pozhary i Chrezvychnye Situacii: Predotvrashenie Likvidacia*, 8: (2), pp. 80–84.
- [5] Lakatos, B. (2021): Investigation of Smart Tools in Order to Improve the Effectiveness of the Administration of Disaster Management I. *Belügyi Szemle*, 69 (1). pp. 142–157.
- [6] Teknős, L. (2020): Az éghajlatváltozás és a rendkívüli időjárás hatásaiból adódó katasztrófavédelmi feladatok kockázatalapú megközelítése. Nemzeti Közszolgálati Egyetem Közigazgatási Továbbképzési Intézet, Budapest, 76. p.
- [7] Lakatos, B. (2021): Presentation of the General Industrial Safety Authority Tasks and Powers, *Belügyi Szemle*, 69 (4). pp. 8-20.
- [8] Wackernagel, M. and Gall, A. (2007): An overview on ecological footprint and sustainable development: A chat with Mathis Wackernagel, *International Journal of Ecodynamics*. 2 (1). pp. 1-9.



Dr. Bence R. Lakatos ff. major

head of department

Szabolcs-Szatmár-Bereg Country Disaster Management Directorate,

Nyíregyházi Disaster Management Office, Disaster Management Authority Department

Email: dr.lakatos.bence@katved.gov.hu

ORCID ID: 0000-0002-4934-3608

Dr. Gyula Vass

associate professor

University of Public Service, Faculty of Law Enforcement, Institute of Disaster management

Email: vass.gyula@uni-nke.hu

ORCID ID: 0000-0002-1845-2027

Dr. László Teknős ff. captain

senior lecturer

University of Public Service, Faculty of Law Enforcement, Institute of Disaster management

Email: teknos.laszlo@uni-nke.hu

ORCID ID: 0000-0003-0759-5871

Z. Klink; J.Tóth Jr.;J.Tóth ;L. Prukner

**Energy demand of ATP resynthesis, its effect on energy supply processes
and training theory**

Abstract

We have a fairly clear picture of the biochemical processes that take place in human cells. However, our hypothetical answers about the constantly changing energy supply conditions that occur during movement. In the course of research, there is no possibility for immediate, in-process, invasive diagnostic analysis, especially for non-humanoid sampling. Otherwise, the generalization diagrams do not apply to special values during sports. In the absence of these, kicking off their general order, a research hypothesis should be set up to measure the results and conclusions drawn. There may also be one that provides feasible and understandable processes for coaches who work with athletes and aim to develop them. We need to be able to separate general training theory questions from special sports and elite sports questions. We must try to give the right answer to development and possible alternatives to development. The possible variables of the energy gain process have decisive effects on training planning. The sources of ATP production (S.Törnroth-Horsefield and Mts.2008) and their operational hierarchy have a decisive influence on the training methodology used. Improper interpretation will negatively affect the desired goal.

Keywords: ATP, training theory, energy supply

Foreword

As we know, all muscle work requires energy and the magnitude of the energy requirement depends crucially on intensity and extent. Overlaps between side-by-side and overlapping processes ensure continuity, however, the maximum energy release capacity of the initial phase is limited in time as a function of stored ATP. (Radák, 2016.) The temporal resynthesis of this provides an opportunity for the sustainability and prolongation of the process. Energy is required to rebuild and break down chemical and biological bonds, such as creatine phosphate for ADP-ATP resynthesis, creatine kinase as a catalyst, and the energy requirement for this process is 12.6 KJ / mol. This energy, in turn, is provided by the enzyme hexokinase as a catalyst through glycolysis. In the first step of glucose breakdown, the reaction requires ATP breakdown, however, the amount of energy used (13.8 KJ) is 16.7 KJ less than the 30.5 KJ released (Adam 2016.) This free enthalpy provides energy for the ADP-ATP conversion in the cytoplasm. The question arises as to how to interpret these parallel processes.

Preliminary study

Based on what we have learned so far, we are talking about successive processes that build on each other and rely on each other. Anaerobic lactactide-Anaerobic lactacid- (Glycolysis) - Szentgyörgy-Krebs cycle-Terminal oxidation (Dubecz J.2009). However, the question arises as to what the organization decides on. The human body is a collection of cells organized according to the most precise and logical principle in existence, it will meet only the minimum necessary, but in the most optimal way. Is it conceivable for an athlete to perform a maximum intensity movement without warming up? It is conceivable, but not logical. You need to warm up your muscles and joints so that you can perform any maximum intensity exercise without injury. During the warm-up, depending on the progressivity and the scope, the energy supply processes start. If this is done within the normal planned range with a continuously increasing intensity from 0 to 70-80% of the load index, it will happen over an extended period of time.

At the beginning of the movement, the body senses the energy demand caused by the increasing load and initiates the breakdown of the primary energy source ATP (Ádám 2016). However, since it senses the principle of gradation, it turns on glycolysis first and then the aerobic circuit with rapid shifts (Dubecz J.2009). So far we are talking about linear processes. However, neither ATP resynthesis nor glycolysis is stopped during the process, as the economics of the conversion require the production

of Acetyl-Co-A (Adam 2016) from pyruvate, which can be most economically covered by glucose. However, the cyclical nature of warm-up prepares the body for the next level of strain, which brings with it the attainment of a minimum level of oxygen debt from time to time. Accumulated lactic acid in the Cori cycle is converted to glycogen again at the expense of -6 ATP / mol, $2 \text{ Lactate} + 6\text{ATP} \rightarrow 1\text{Glucose} + 6\text{ADP} + 6\text{Pi}$ (Adam 2016) regeneration. The main source of ATP is thus ATP recovered from terminal oxidation (Maria Ahmad et al., 2021), but ancillary mechanisms, in this case CP and glycolysis, balance the need for excess energy, and this excess loss of energy is reduced to zero by terminal oxidation to him. Thus, processes that build on each other result in side-by-side simultaneous processes (Jamieson, 2017).

Hypothesis

I am looking for the answer to the effect of this concomitant, multi-gear process on the energy storage system, and through this, questions arise about the training methods used so far, especially in connection with sprint exercises performed at maximum intensity. There are also further questions about the training practices and periodization of my own sport (Football).

The relationship between energy production and sport

According to one of the oldest theoretical models taught, energy gain always starts from the origin (Dubecz J.2009) and gets the right amount of ATP with time-varying alternatives

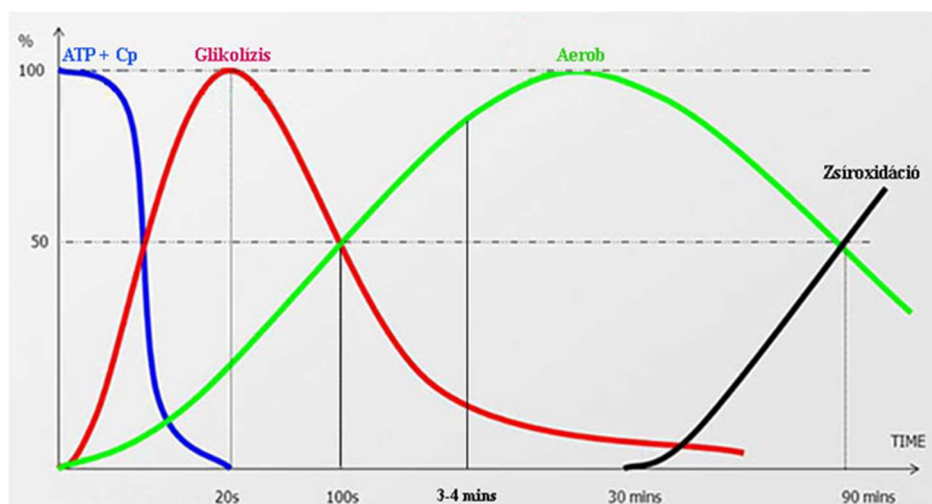


Figure 1. Energy supply systems (Dubecz, 2009)

As I mentioned in the preliminary study chapter, there is no moment during sports that a 100% intensity work starts from the beginning. Proper warm-up is required, which in turn starts the

processes shown in the figure. The question arises as to where the training work at the right level of adaptation still draws its energy from. To understand the alternative assessment, I created the following diagram:

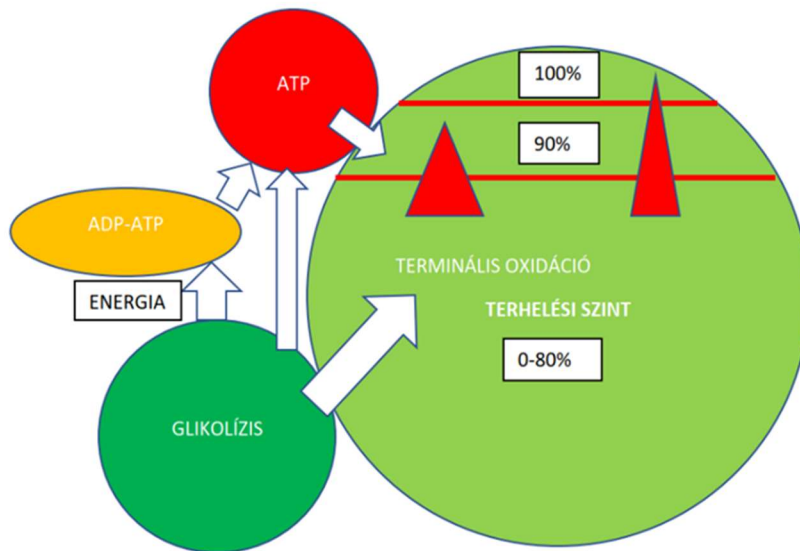


Figure 2. process model (Klink, 2022)

The first stage of movement (warm-up) initiates glycolysis and any ATP resynthesis associated with it, and then the process continues with the aerobic circuit. The primary task for the body is to manage the appropriate loss. The continuous ATP production of the aerobic cycle through the terminal oxidation chain covers the potential losses caused by the substrate-level synthesis of the Cori circle (Adam 2016) and ATP (Adam 2016). As long as steady-state is maintained, no intervention is required. However, if the increase in load reaches or exceeds the submaximal limit and we move towards the aerobic breakpoint (Asok Kumar Ghosh, 2004), then these systems struggle to maintain balance. However, they are only able to deal with the deficit for a certain period of time, after which they are forced to either expect a reduction in workload or a deterioration in performance.

This delicate balance, or the tipping out of it, can bring the adjustment trend we expect from our athletes. Progressivity also causes a change in the energy system, both physiologically and centrally. I started developing this training method in 2007 and have been using it since 2010 for elite athletes. I kept two basic things in mind:

1. The pace and periods of preparation should be generalizable regardless of the sport

2. Be aware that progressiveness is limited only by biological-genetic ability.

Based on this, feedback should be evaluated based on sympathetic-parasympathetic responses and prioritized during monitoring. The science of analytics classifies HRV analysis as a “young discipline” (Quintana 2017). Few are concerned with evaluating the response impulses given by the brain and analyzing the data obtained. So a healthy heart responds at all times to the current expectations of the environment. The variability and variability of the heart rate accurately reflects the responsiveness of a healthy heart and the general health of a person. Consequently, it can be accurately detected if there are symptoms of sympathetic or parasympathetic overtraining based on the response to the current load. If the goal is to increase the athlete's $VO_2\text{Max}$ as much as possible, how long should it be? Is it possible to compensate during a microcycle or does it require a macrocycle? Can this training method be used as an additional development or even homologated to sports work?

As the monitoring database covers a period of more than 10 years, I am also able to present the measured results of cyclical individual (kayak-canoe) and acyclical team sports (water polo). My measurement database also includes sports results from swimming, boxing and football. The most important parameter is the ability to achieve the athlete's goal. Athletes who have adequate mental strength and want to belong to the world's elite in their sport are able to subordinate everything to achieve their goals. Adhere to the protocols, rest cycles, dietary rules that are essential for progressive development. I would like to emphasize that if any of these conditions are not met, the level of expected results will decrease significantly.

In order for the work of the heart to meet the requirements of the ever-increasing ramp load, I determined the medium-term load interval. Three minutes of progressively increasing workload is sufficient to attack the breaking point pulse, leading to a morphological change in the central system in the long run. The amount is also adequate to accommodate the peripheral system. As the muscles of the foot are the largest oxygen-absorbing organ and by monitoring sports, they are a significant target area almost everywhere, we can say that we are benefiting our athletes with their development.

Following the principle of progressivity, the athlete is continuously loaded in 48-hour cycles above the aerobic threshold. The interval of the sum should be determined by assessing its current state. For this we have to perform a load test with spiroergometry gas analysis (Dr.Balogh, 2015)

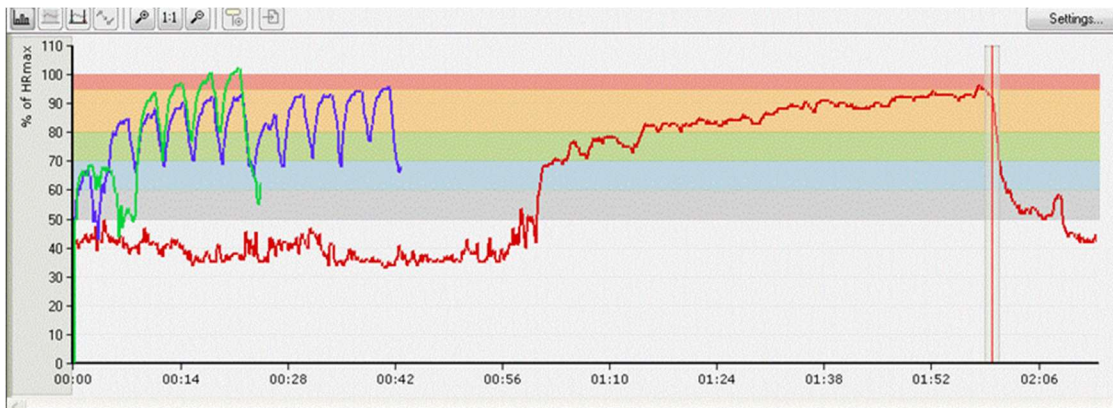


Figure 3. Aggregate analysis consequence of Red Zone-Aerob (Klink, 2018)

In the diagram, I show the results of a 3-month systematic work, where the work was 100% stair-ready, preparing for a 7 km running race.

After the tests, you can follow the workouts under continuous control on the online interface by specifying the appropriate parameters, ensuring that the correct load level is reached and that the maximum planned workout value is not exceeded.

The basic principle is that long-term work in a steady state develops basic endurance. This work should be done during the sensitive period between the ages of 9-12. In this age, physical developments about individual development go hand in hand with the continuous growth of organs. Adaptation is bidirectional, with an increase in central organs leading to adaptation of peripheral tissues.

The constantly changing conditions and intensity rates characteristic of competitive sports, the constant attack of the aerobic threshold around the age of 14 (depending on biological maturity), appropriately develops both steady state and VO²Max values. The mixed method I use hasn't been paired with sports science yet. There is an interval and there is a fartlek method (Dubecz J.2009). The interval method is about intermittent rest time, while the fartlek method is about intensity reduction. The use of resistance is common, but if we rely on the laws of physics, we can work with constant values. This resistance is gravity, in this case the 40 ° rise of the stairs. Biomechanically, the range of motion of the knees and hips is at an angle similar to a quarter squat, allowing for continuous loading. Moving your own weight on the incline provides increasing resistance. If the sub-distances and the changes in overcoming speed are analyzed, they correspond to sprint runs of 10-20-30-50-80 meters

on horizontal ground. Together, they provide a ramp load that extends the steady state during development, increases $VO_2\text{Max}$, and improves the blood supply to peripheral tissues. Only this one method triggers workout plans that require long-term adaptation, speed endurance, explosiveness, and endurance work.

Peripheral adaptation optimizes energy recovery systems, and I hypothesize that ATP formation in this environment will be primarily supported by terminal oxidation and thus oxidative phosphorylation by substrate-level phosphorylation of glycolysis (Kristopher A. Hunt, 2010). This effect is associated with the continuous replenishment and recycling of glycogen stores along with increased working capacity.

I named this training method Red Zone for its red color above the critical 90% intensity.

Physiological changes due to training can be assessed by control measurements every 3 months. It is primarily the growth of $VO_2\text{Max}$ (Andrew P. Bacon and Mtsi, 2013) that determines the magnitude of development. The change in relative oxygen uptake values relative to body weight is what demonstrates that the amount of exercise performed is effective. The body adapts continuously to the limit load, so the resting heart rate decreases and the upper dead center of the load also changes. In parallel, it adjusts the minute volume and stroke volume to the rate of the existing load, which will result in the load curves becoming flatter and the resting sections becoming steeper.

So what will change? The time interval a player takes to approach the breakpoint is therefore the comfort zone. We can progress from several directions at the same time, remember that the maximum load depends mostly on psychological factors, the more you know about the pain, the better you will adapt to it.

Based on the measured results, it can be stated that there is a significant positive development during the duration of the macrocycle (3 months).

However, it is also important to look at a comparison between a 1-week cycle and working in sports.

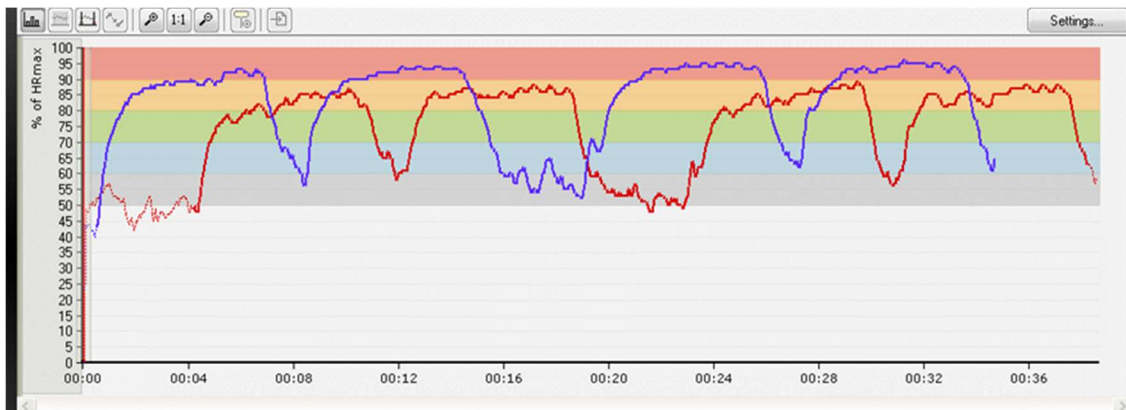


Figure 4. 48-Hour Workout Comparison Red Zone (Klink, 2019)

All load parameters were identical during the compared measurements. The difference between the charts was given by the sport-specific load time. In the case of water polo, I used the playing time of 4 * 7 minutes and adjusted the load time accordingly. A change in the function of the central organs within 48 hours can be well seen in Figure 4. The pulse drop at the top of the load curves is a clear sign of the response. The difference is close to 8%.

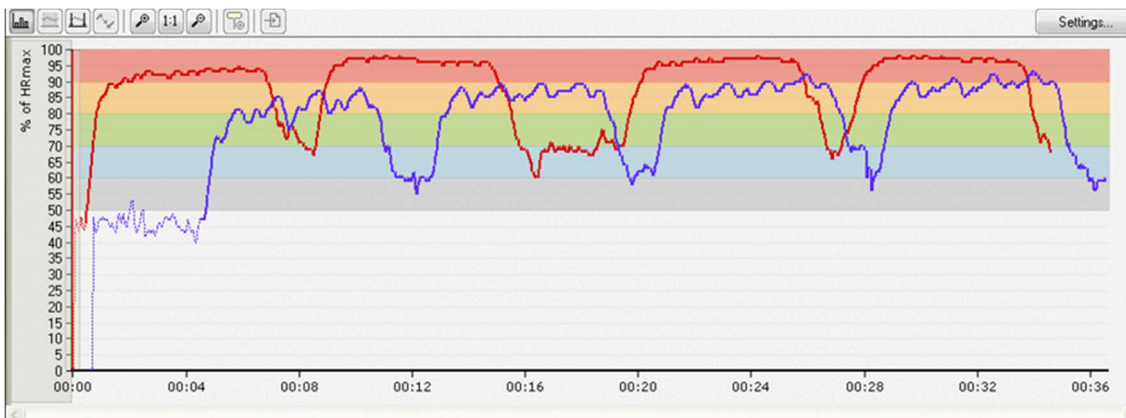


Figure 5. 3-week workout comparison Red Zone (Klink, 2019)

The same type of work in the 20-day interval, taking into account the above parameters, exceeds 15% and the degree of rest periods also varies. The response rate continued to increase.

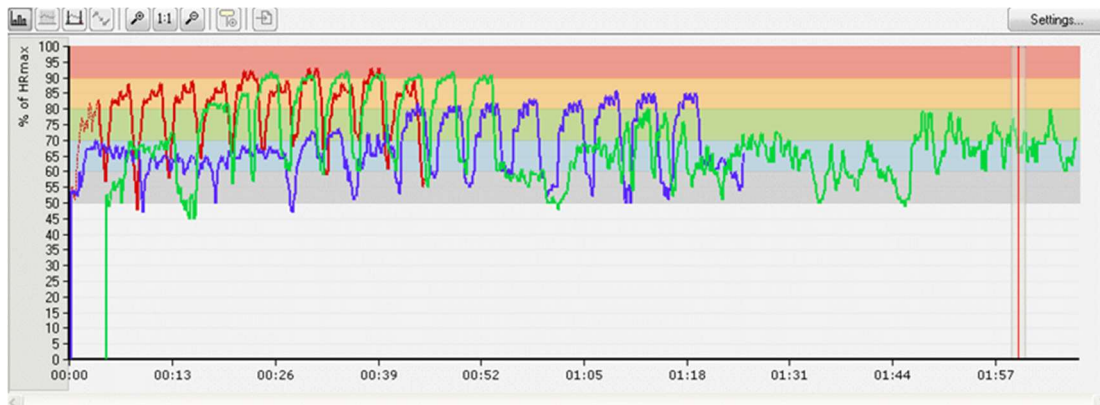


Figure 6. Red Zone-Sports Comparison 1. (Klink, 2019)

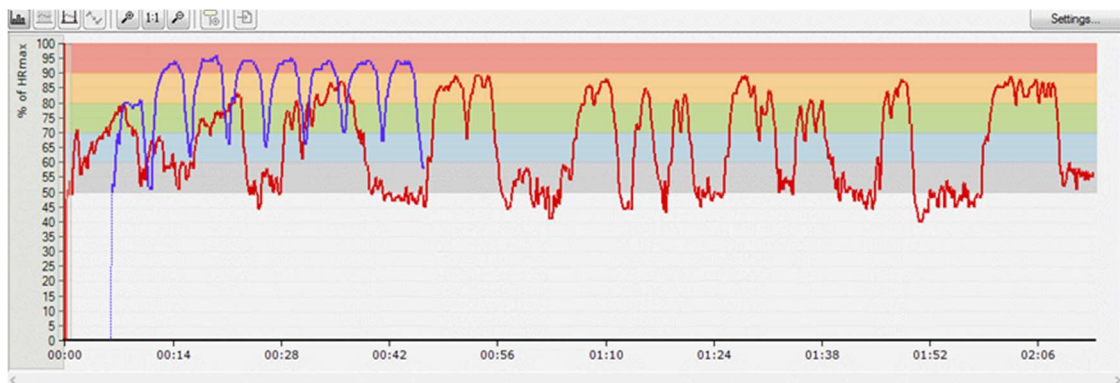


Figure 7. Red Zone-Sports Comparison 2. (Klink, 2019)

While planning a training, it is always a question of how much more effective the intensity of sport-specific movement is compared to a training material designed for individual purposes. Considering that the movements performed in our own environment always provide a kind of stress-free environment due to the habit; we can say that although the rate of development gives a positive pattern, if we focus only on sports movements, the intensity of the Red Zone training method exceeds it. At the same time, it can help that the variables in the original motion pattern change dynamically in a positive direction.



Figure 8. 1st load training Red Zone (Klink, 2019)



Figure 9. Week 6 Exercise Red Zone (Klink, 2019)

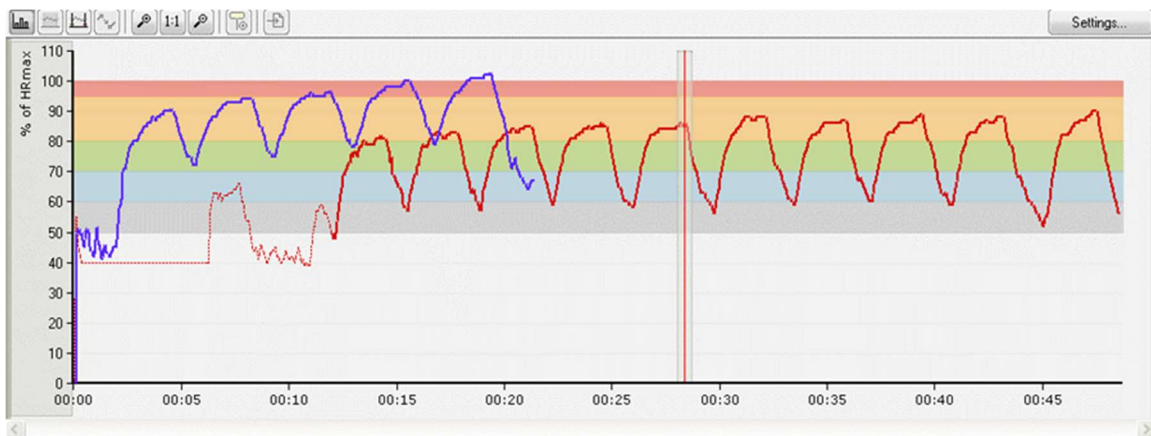


Figure 10. Aggregate 12-week workout Red Zone (Klink, 2019)

The result of the first load training after determining the Zero point load time faithfully reflects the need for improvement, and in the present case, the 6-week and 12-week control measurements show the extent of change under constant load conditions. During the 3-month mesocycle, exercise time indicates a difference of more than 200%, while maximal exercise pulse indicates an 8% decrease. Analysis of the values obtained means that work with oxygen debt above the breaking point has ceased and the steady state has been achieved continuously (Eugene E. Wolfel, 1990). This allows the athlete to create a safe working environment while achieving the desired goal.

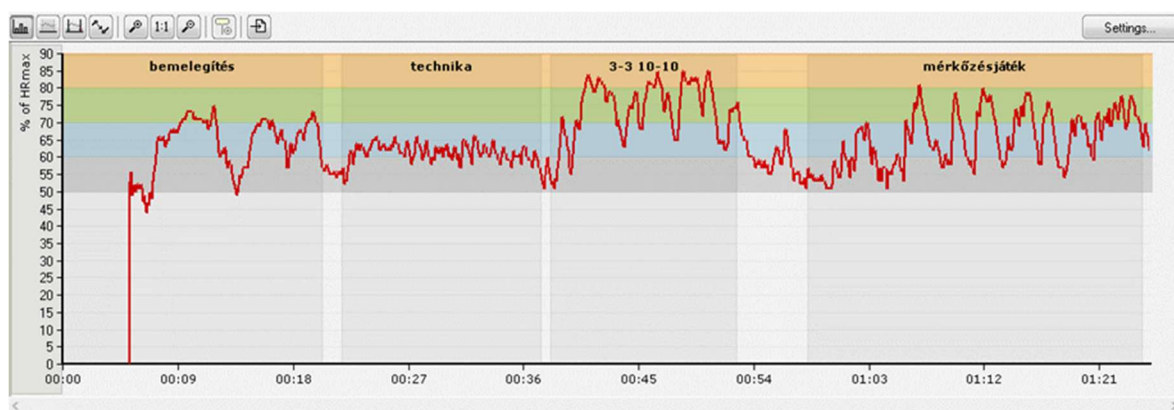


Figure 11. Sport specific analysis (Klink 2019)

In the course of alternative exercises typical of my own sport (football), I came to the conclusion that the sport medium is not suitable for achieving the load threshold designed for well-designed play situations. Just like swimming and water polo, the comfort zone for a given form of movement also appears in small-game football. Similar results were achieved for several teams, for several age groups, from national team levels to youth. For this reason, I have come to the conclusion that I need to divide the amount of load units between sport-specific and Red Zone loads, relying predominantly on the latter.

Summary

To the question posed in the hypothesis that I am looking for the effect of this co-running, multi-gear process on the energy storage system, I found that the load capacity of the organization always finds a suitable alternative for the production of ATP, but does so as a collaborative system, meeting the needs and making up for the loss. The other question that arose in connection with the training methods used so far, especially in connection with the sprint exercises performed at the maximum intensity, to which the answer can be easily interpreted. If the exercise phase is followed by a good

quality warm-up, several skills can be developed within the same workout using the appropriate training method. Additional questions also arose about the training practices of my own sport (football), its and its periodization. We can state that the load rate of intense exercises performed in one's own movement environment will be lower compared to special workouts due to comfort and the use of “memory” of the muscles.

After analyzes of data collection lasting more than 10 years, based on the evaluated results, the effectiveness of the Red Zone training method is unquestionable, its development rate in micro-, meso-, and macro-cycles is well characterized, and its energy gain protocols are based on the bases outlined above.

Bibliography:

- [1] S.Törnroth-Horsefield&R.Neutze:Opening and closing the metabolite gate
Proceedings of the National Academy of Sciences, 2008.
december, 105 (50) 19565-19566; DOI: 10.1073/pnas.0810654106
<https://www.pnas.org/content/105/50/19565.long>
- [2] Radák Zsolt: Edzésélettan Budapest, 2016.
- [3] Ádám Veronika: Orvosi biokémia Semmelweis Kiadó, Budapest 2016.
- [4] Dubecz J: Általános edzéselmélet és módszertan Önkorm. Miniszt. Sport
Szakállamtitkárság 2009.
- [5] Maria Ahmad et al.:Biochemistry, Electron Transport Chain 2021,
StatPearls Publishing LLC. <https://www.ncbi.nlm.nih.gov/books/NBK526105/>
- [6] Jamieson, J.: Tökéletes MMA-edzés. Jaffa Kiadó és Kereskedelmi Kft., Budapest
2007.
- [7] Asok Kumar Ghosh: Anaerobic Threshold, 2004, Malays J Med Sci. 2004 jan.11. (1): 24–36.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3438148/>
- [8] Abraham Otero Quintana, et al: Heart Rate Variability Analysis Springer., 2017.
- [9] Dr.Balogh L.: Bevezetés a sportdiagnosztikába Campus Kiadó, Debrecen., 2015.
- [10] Négyesi Imre: Tragbare und feldinformatik-geräte I. Hadmérnök, (1788-1919), IV. évf. 2. sz.
pp. 333-339, 2009, http://www.hadmernok.hu/2009_2_negyesi.pdf

- [11] Négyesi Imre: Tragbare und feldinformatik-geräte II. Hadmérnök, (1788-1919), IV. évf. 3. sz. pp. 355-362, 2009, http://www.hadmernok.hu/2009_3_negyesi.pdf
- [12] Kristopher A. Hunt et al.: Substrate-Level Phosphorylation Is the Primary Source of Energy Conservation during Anaerobic Respiration, American Society for Microbiology, 2010.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2897674/>
- [13] Andrew P. Bacon et al.: VO₂max Trainability and High Intensity Interval Training, 16.09.2013. DOI: [10.1371/journal.pone.0073182](https://doi.org/10.1371/journal.pone.0073182),
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3774727/>
- [14] Eugene E. Wolfel et.al.: Oxygen transport during steady-state submaximal exercise in chronic hypoxia, Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology, April 1991 DOI: 10.1152/jappl.1991.70.3.1129·Source: PubMed,
https://www.researchgate.net/profile/George-Brooks-10/publication/21122989_Oxygen_transport_during_steady-state_submaximal_exercise_in_chronic_hypoxia/links/5410b3910cf2df04e75d6536/Oxygen-transport-during-steady-state-submaximal-exercise-in-chronic-hypoxia.pdf



Dr. habil. NÉGYESI Imre PhD. egyetemi docens¹
Nemzeti Közszolgálati Egyetem, Informatikai Tanszék

e-mail: Negyesi.Imre@UNI-NKE.HU

**MILITARY COGNITIVE INTELLIGENCE AND ARTIFICIAL INTELLIGENCE I.
(PLANS AND INITIAL STEPS.)**

Abstract:

Next-generation artificial intelligence must already understand the workings of the human mind, including human emotions, and convince users that they are capable of doing so. This requires an artificial emotional intelligence that is capable of appropriate and believable behavior in social emotional interactions. This article is about the possible military use of these artificial intelligences.

Keywords:

ARTIFICIAL INTELLIGENCE, SOCIETY, COGNITIVE INTELLIGENCE, MILITARY RESEARCH

¹ ORCID: 0000-0003-1144-1912

INTRODUCTION

It is not an exaggeration to say that nowadays the field of artificial intelligence (hereinafter referred to as AI) has become the most important area of research. Its growing popularity is primarily due to new machine learning techniques and new computational capabilities that enable previously unimaginable capabilities. Yet, something much bigger is expected in the near future. Challenges that were only dreams until now have become understandable and solvable. After I have already dealt with the topic of the applicability of artificial intelligence in several articles,²³⁴⁵ now cognitive intelligence has been examined. The field of applicability examined was the army, and the basis of the study was a publicly available research summary of the American army, which is available as an open material.⁶

THE RELATIONSHIP BETWEEN HUMAN INTELLIGENCE AND ARTIFICIAL INTELLIGENCE

In this article, we are therefore dealing with cognitive intelligence, primarily the possibilities of increasing military cognitive performance and the relationship between AI. First, let's take a look at the main challenges researchers were concerned with in 2021-22, which can be expected to be solved in the coming years and thus affect the development possibilities of military cognitive abilities. The starting point is human intelligence, as this will be the "model" for AI. By default, we can distinguish three levels of intelligence:

- level of computational intelligence (the ability to quickly calculate and remember);
- the level of perceptual intelligence (perception of sight, hearing and touch, including computer vision, speech recognition, language and translation);
- the level of cognitive intelligence (the ability to understand, react, reason and make decisions).

² Imre Négyesi: Social issues of the military use of artificial intelligence, *Honvédségi Szemle: The central journal of the Hungarian Armed Forces*, vol. 149. *Hungarian Defence Review: The central journal of the Hungarian Armed Forces*, vol. 149. 2021/1. number, <https://doi.org/10.35926/HSZ.2021.1.10>

³ Imre Négyesi – Imre Porkoláb: Researching the application possibilities of artificial intelligence in the military, *Hungarian Defence Review the central journal of the Hungarian Armed Forces*, vol. 147. 2019/5. number, <https://honvedelem.hu/images/media/5f2bd1646eeb8298912683.pdf> (Download time: 05.06.2022)

⁴ Imre Négyesi: Artificial intelligence and the army, *Military Science: Journal of the Hungarian Military Society*, 2019/3. http://mhht.eu/hadtudomany/2019/2019_3/2019eA%20mesterséges%20intelligencia%20és%20a%20hadseregek_Négyesi%20Imre.pdf (Download time: 05.05.2022)

⁵ Imre Négyesi: Artificial intelligence and ethics, *Military Science: Journal of the Hungarian Military Society*, 2020/1. http://mhht.eu/hadtudomany/2020/2020_1szam/Hadtudomany_2020-1-szam.pdf (Download time: 05.06.2022)

⁶ <https://link.springer.com/article/10.1007/s41465-020-00167-3#ref-CR15> (Download time: 05.05.2022)

In this article, we examine the level of cognitive intelligence from the point of view of military intelligence. First, let's look at the challenges of creating human-level artificial emotional intelligence. According to the first challenge, the goal is that machines interacting with humans also use emotions to make decisions and generate behavior. This ability allows AIs to establish long-term social relationships with people, with all the legal and ethical consequences that deserve more and more attention today, just like human relationships. At the same time, it also allows them to motivate their actions and decisions, to choose goals and learning objectives. **Therefore, emotional intelligence is the key to meeting other challenges.** This lies not only in the ability to recognize and express emotions, which is the question that most research, including military research, is currently focusing on. Although both skills are needed, the connecting part, emotional intelligence, is much more important and difficult to understand on its own.

The second challenge can be defined as a goal to understand the context of events. In practice, this means that, based on the available information, AIs must independently process and continuously update the events of the past and future, determine their role in them, then set specific goals and develop plans based on them to achieve the goals.⁷

The third challenge is the implementation of human-like active learning. AI is like a person who or what develops a value system that motivates its learning process. This value system helps the learner choose tools such as experiments to test hypotheses, search for available resources online, or interview a person. The AI seeks these tools on its own initiative to achieve its learning goals. In this case, the AI will be able to grow autonomously, starting from the level of a child to the level of a human adult and beyond. This ability can be called "human-level learning intelligence" - as distinguished from "deep learning" and other forms of machine learning that are popular today.

The initial assumption was that a robot could do all this. Accordingly, the main question is what is missing from the robot compared to the human? First, the ability to manage human-like free will, emotionality and social relationships at an appropriate level. Furthermore, the ability for the robot to develop intellectually and emotionally without limitations is lacking. But most importantly, he lacks a "human soul" that can think of others, live in dreams and memories, see himself from the outside, and rise above the hustle and bustle of everyday tasks. This faculty is at the apex of the structure of the human mind, managing human capacities and determining voluntary behavior. If we want the

⁷ This ability is called „narrative intelligence“.

robot to be like a human, then the robot must have a "soul" that is responsible for its cognitive and intellectual abilities.

As a summary of what was written in the chapter, we can say that so far, during AI research, they have been busy looking for solutions that can enable AI to solve problems and make decisions, analyze data, learn specific things, understand and use natural language, learn about the world accumulation of knowledge. So see, hear, control movements, develop scenarios, imitate creativity, independently set new goals or indicate that you are not willing to follow orders. So the main question is how to achieve this level of "humanization" of the robot. According to the researchers, the main key is general-purpose human-level social-emotional intelligence. Developing a theory of this phenomenon and empirically validating it is vital and inevitable if we want to build a strong "human-like" artificial intelligence.

DEVELOPMENT OF MILITARY COGNITIVE SKILLS

After clarifying the theoretical parts, in this chapter, let's review what steps have been taken so far in the field of developing military cognitive abilities. I looked to the United States Department of Defense, including the Army, Air Force, and Navy, as a leading example. The activities of the Defense Advanced Research Projects Agency (DARPA) are also worth considering, because they have been engaged in cognitive development research and development for more than a century, and have developed new pharmaceutical, dietary, neuroscience, educational, technological and sleep-related development strategies. The overarching goal of ongoing research is to define safe, reliable, and robust strategies and technologies that help military personnel achieve dominance through enhanced skill acquisition, alertness and threat detection, situational awareness, decision making, teamwork, and emotional control. through.

So let's look at an overview of recent and current research by the US military looking at several approaches to cognitive development. These include approaches that specifically target the neural mechanisms and processes directly responsible for enhanced task performance, and include transcranial electrostimulation (tES), augmented reality (AR), and targeted skill development.

In the United States, research and development aimed at enhancing human cognitive performance is a priority area for many Department of Defense (DoD) services and agencies, including the Army, Air Force, Navy, and the aforementioned Defense Advanced Research Projects Agency (DARPA). Within the US military, cognitive development research is primarily managed by organizations under the Headquarters Department of the Army (HQDA) and the Army Futures Command (AFC). These organizations include the Army's Behavioral and Social Sciences Research Institute (ARI),

Combat Capabilities Development Command Center (CCDC SC), Data and Analysis Center (CCDC DAC), Army Research Laboratory (CCDC ARL), and the Armaments Center (CCDC AC). It also includes Medical Research and Development Command (MRDC) laboratories, including the United States Army Research Institute of Environmental Medicine (USARIEM), the US Army Aeronautical Research Laboratory (USAARL), and the Walter Reed Army Institute of Research (WRAIR).

Together, these various organizations have more than 15,000 scientists and engineers, many of whom create, integrate and deliver solutions aimed at enhancing the soldier's cognitive performance. The overall goal of this research and development is to increase the ability to achieve and maintain military superiority through accelerated training and skill acquisition, targeted assessment and feedback, and increased alertness, threat perception, situational awareness, decision making, teamwork, and emotional control. Given the diversity and complexity of these research topics, most defense research groups are inherently multidisciplinary, spanning the cognitive, affective, social, and behavioral sciences, and utilizing expertise in robotics, informatics, and biomedical engineering. While a significant portion of the U.S. military's research and development is conducted by defense scientists and engineers, each organization makes annual or semiannual requests to academic organizations and industry to assist in their work.

The importance of research is indicated not only by the many listed organizations and the large number of research staff, but also by the diversity of the research topics. The diversity of research topics leads to a wide variety of basic and applied research programs funded by the US military. I would like to highlight some of the research topics that place primary emphasis on cognitive development:

- Measuring and Advancing Soldier Tactical Readiness and Effectiveness (MASTR-E) (Set goals: Measuring and promoting the tactical readiness and efficiency of soldiers. Improving the use of weapons, movement, communication and decision-making abilities of soldiers.)
- Biomedical Performance Enhancement. (Set goals: Biomedical performance enhancement, development, validation and dissemination of biomedical strategies to improve the health and readiness of individual warriors, including cognitive functions.)
- Team Overmatch Program (Set goals: Prevent unhealthy stress levels that negatively affect cognitive performance. Improve resilience and situational awareness.)

- Continuous Multi-faced Soldier Characterization for Adaptive Technologies (CMSCAT) (Set goals: The influence of external factors on the performance of soldiers. Using analytical techniques to develop real-time adaptive technologies in order to increase performance.)
- Restorative Sleep for Performance and Health (RSPH) (Set goals: Understanding and anticipating the restorative benefits of sleep and facilitating restorative sleep to improve performance.)
- Physiological Basis of Resilience (Set goals: (Determining physiological indicators that predict soldiers' stress levels and enhance physical, emotional, and behavioral functions.)

These topics focus on enhancing cognitive performance, but it is important to distinguish performance enhancement from optimization. Performance optimization in militaries often involves the use of technologies and techniques designed to maintain peak performance for individuals and teams despite environmental or task-related perturbations. Cognitive performance optimization strategies can achieve the same goals in the short and long term with precise control, combination and application. For example, providing real-time location updates to hard-to-detect targets can help military personnel optimize marksmanship performance while maintaining accuracy and efficiency under stress, strain, and uncertainty.

In contrast, performance enhancement involves accelerating or amplifying individual and team performance beyond existing peak capabilities, in effect changing the distribution of performance. This definition is consistent with the definition proposed by Bostrom and Sandberg⁸, who defined cognitive development as "enhancement or expansion of the basic capacities of the mind through the development or expansion of internal or external information processing systems." Each new level of performance achieved through cognitive development becomes a new personal high point for individuals, raising the standard of future performance. It is important that both optimization and development realize the performance advantages of individuals, but only in the latter case do the advantages exceed existing human capabilities.

Another possible distinction is between relatively direct or indirect approaches to cognitive development. We consider methodologies and technologies direct if they directly target the structural or functional mechanisms and processes underlying learning, perception, cognition, or emotion. Direct development approaches include targeted training technologies and methods. Indirect remedial

⁸ Bostrom, N., Sandberg, A. Cognitive development: Methods, ethics, regulatory challenges. *Science and Engineering Ethics*, 15, 311–341, 2009, <https://doi.org/10.1007/s11948-009-9142-5> (Download time: 06.05.2022)

approaches include nutritional and dietary interventions, resilience and teamwork training, peripheral nerve stimulation, exercise interventions, and sleep modification.

SUMMARY AND CONCLUSIONS

For more than a century, the US military has been pursuing cognitive performance enhancing techniques and technologies in pharmaceutical, diet, neuroscience, education, technology, and sleep-related fields. In the course of the research, they also started using AI as a new tool. Most research to date has shown that it is possible to optimize performance. The main question of current research is whether special approaches or new technologies, primarily AI, can help soldiers maintain their performance in the event of stress, fatigue, or lack of sleep. Of course, many drugs are already available that effectively reduce the negative effects on cognitive performance. In order to increase performance, with the help of AI and continuous research, we can attempt to measure the peak performance of individuals and teams, and then develop development strategies above the new reference value obtained. Promising future techniques include multimodal, adaptive, and personalized approaches that leverage advances in artificial intelligence and biomedical engineering. The symbiotic relationship between these areas and human performance-enhancing research can support the importance of collaborative, multidisciplinary research and development. The results of this research pave the way for increasingly accepted, reliable, and powerful cognitive development methods that accelerate the acquisition of knowledge and skills, improve situational awareness and decision-making under stress, and can help future soldiers gain a competitive advantage over adversaries. In the next part of the article series, we will review some of the results already achieved by the United States Army and outline what further research challenges they see in the field of developing military cognitive intelligence.

USED LITERATURE

1. Blankenbeckler, P. N., Graves, T. R., & Wampler, R. L. (2014). Designing interactive multimedia instruction to address soldiers' learning needs. Alexandria, VA, ARI research report #1979.
2. Brunyé, T. T., Smith, A. M., Hendel, D., Gardony, A. L., Martis, S. B., & Taylor, H. A. (2020). Retrieval practice enhances near but not far transfer of spatial memory. *Journal of Experimental Psychology: Learning Memory and Cognition*, 46, 24–45.
3. Brunyé, T. T., Smith, A. M., Horner, C. B., & Thomas, A. K. (2018b). Verbal long-term memory is enhanced by retrieval practice but impaired by prefrontal direct current stimulation. *Brain and Cognition*, 128, 80–88.
4. Campbell, C., Cantrell, G., Generalao, T., Sawyer, A., & Takitch, J. (2006). Interactive multimedia instruction for US Army training. In *E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* (pp. 1105–1110). Waynesville, NC: Association for the Advancement of computing in education (AACE).
5. Dr. Négyesi Imre: A mesteres intelligencia katonai felhasználásának társadalmi kérdései, *Honvédségi Szemle: A Magyar Honvédség központi folyóirata*, 149. évf. 2021/1. szám, <https://doi.org/10.35926/HSZ.2021.1.10>
6. Dr. Négyesi Imre: A mesterséges intelligencia és a hadseregek. *Hadtudomány*, 2019/3. http://mhtt.eu/hadtudomany/2019/2019_3/2019eA%20mesterséges%20intelligencia%20és%20a%20hadseregek_Négyesi%20Imre.pdf
7. Dr. Négyesi Imre: A mesterséges intelligencia és az etika, *Hadtudomány: A Magyar Hadtudományi Társaság folyóirata*, 2020/1. http://mhtt.eu/hadtudomany/2020/2020_1szam/Hadtudomany_2020-1-szam.pdf
8. <https://link.springer.com/article/10.1007/s41465-020-00167-3#ref-CR15>
9. Lackey, S. J., Salcedo, J. N., Matthews, G., & Maxwell, D. B. (2014). Virtual world room clearing: A study in training effectiveness In *Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC)*. Orlando, FL.
10. McDaniel, M. A., & Einstein, G. O. (2006). Material appropriate difficulty: A framework for determining when difficulty is desirable for improving learning. In A. F. Healy (Ed.), *Decades of behavior. Experimental cognitive psychology and its applications* (pp. 73–85). Washington, D.C.: American Psychological Association.

11. Porkoláb Imre – Négyesi Imre: A mesterséges intelligencia alkalmazási lehetőségeinek kutatása a haderőben. *Honvédségi Szemle*, 2019/5.
<https://honvedelem.hu/images/media/5f2bd1646eeb8298912683.pdf>
12. Spain, R. D., Priest, H. A., & Murphy, J. S. (2012). Current trends in adaptive training with military applications: An introduction. *Military Psychology*, 24(2), 87–95.
13. Swets, J. A., & Bjork, R. A. (1990). Enhancing human performance: An evaluation of “new age” techniques considered by the U.S. Army. *Psychological Science*, 1(2), 85–96.

Dr. habil. NÉGYESI Imre PhD. egyetemi docens⁹
Nemzeti Közzolgálati Egyetem, Informatikai Tanszék

e-mail: Negyesi.Imre@UNI-NKE.HU

MILITARY COGNITIVE INTELLIGENCE AND ARTIFICIAL INTELLIGENCE II. (RESEARCH RESULTS AND IMPLEMENTATION.)

Abstract:

As already stated in the first part of the series of articles, artificial intelligences to be used in the future must interact with users in such a way that users accept the fact that artificial intelligences are capable of understanding human minds, including emotions. As a continuation of the first part, This requires an artificial emotional intelligence capable of appropriate and believable behavior in social relationships. In the first part, we accordingly reviewed some results, so now the analyzes of the challenges and further developments can follow.

Keywords:

ARTIFICIAL INTELLIGENCE, SOCIETY, COGNITIVE INTELLIGENCE, MILITARY RESEARCH

INTRODUCTION

The popularity of artificial intelligence, as I described in the first part of this article series, is primarily due to new machine learning techniques and new computing capabilities. In this part, based on the first part of the series, on the open materials made public by the US Army and on those published in my previous publications,¹⁰¹¹¹²¹³ let's review what results have been achieved so far in the field of military cognitive intelligence development.¹⁴

Soldiers' cognitive activity and AI

⁹ ORCID: 0000-0003-1144-1912

¹⁰ Imre Négyesi: Social issues of the military use of artificial intelligence, Honvédségi Szemle: The central journal of the Hungarian Armed Forces, vol. 149. Hungarian Defence Review: The central journal of the Hungarian Armed Forces, vol. 149. 2021/1. number, <https://doi.org/10.35926/HSZ.2021.1.10>

¹¹ Imre Négyesi – Imre Porkoláb: Researching the application possibilities of artificial intelligence in the military, Hungarian Defence Review the central journal of the Hungarian Armed Forces, vol. 147. 2019/5. number, <https://honvedelem.hu/images/media/5f2bd1646ceb8298912683.pdf> (Download time: 05.01.2021)

¹² Imre Négyesi: Artificial intelligence and the army, Military Science: Journal of the Hungarian Military Society, 2019/3. http://mhtt.eu/hadtudomany/2019/2019_3/2019eA%20mesterséges%20intelligencia%20és%20a%20hadseregek_Negyesi%20Imre.pdf (Download time: 05.01.2021)

¹³ Imre Négyesi: Artificial intelligence and ethics, Military Science: Journal of the Hungarian Military Society, 2020/1. http://mhtt.eu/hadtudomany/2020/2020_1szam/Hadtudomany_2020-1-szam.pdf (Download time: 05.01.2021)

¹⁴ <https://link.springer.com/article/10.1007/s41465-020-00167-3#ref-CR15> (Download time: 05.01.2021)

The US military has decades of success in research and development directly aimed at enhancing cognitive performance, seeking to enhance processes and states such as alertness, situational awareness, decision-making, and emotion regulation. Let's examine three areas that have received significant attention in military research and training contexts. These will be the investigated areas for which we will later review the possibilities of applying AI:

- targeted training technologies and methods;
- issues of electrical brain stimulation and augmented reality;
- an overview of related cognitive rehabilitation research.

The idea of targeted training is to directly affect the degree to which knowledge or skills are acquired in a specific area, such as learning how to fit a cargo bag, maintain a weapon, check a parachute, program a radio, etc. Various literatures are already available for the acquisition and practice of cognitive and procedural skills and their use for learning in special areas, which can also be used in military training.

Some of these are examples of direct approach methods:

- Rich multimedia learning experiences that increase the realism and vibrancy of learning materials, integrate multiple sensory modalities, build more comprehensive and flexible mental models, and offer more potential avenues for retrieval.¹⁵¹⁶
- Validated instructional strategies to promote memory consolidation and development, including retrieval practice, learning to master, distributed learning, and introducing difficulty into learning to improve long-term memory.¹⁷¹⁸¹⁹

¹⁵ Blankenbeckler, P. N., Graves, T. R., & Wampler, R. L. (2014). Designing interactive multimedia instruction to address soldiers' learning needs. Alexandria, VA, ARI research report #1979. (Download time: 06.05.2022)

¹⁶ Campbell, C., Cantrell, G., Generalao, T., Sawyer, A., & Takitch, J. (2006). Interactive multimedia instruction for US Army training. In *E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* (pp. 1105–1110). Waynesville, NC: Association for the Advancement of computing in education (AACE) (Download time: 06.05.2022)

¹⁷ Brunyé, T. T., Smith, A. M., Horner, C. B., & Thomas, A. K. (2018b). Verbal long-term memory is enhanced by retrieval practice but impaired by prefrontal direct current stimulation. *Brain and Cognition*, 128, 80–88 (Download time: 06.05.2022)

¹⁸ Brunyé, T. T., Smith, A. M., Hendel, D., Gardony, A. L., Martis, S. B., & Taylor, H. A. (2020). Retrieval practice enhances near but not far transfer of spatial memory. *Journal of Experimental Psychology: Learning Memory and Cognition*, 46, 24–45 (Download time: 06.05.2022))

¹⁹ Spain, R. D., Priest, H. A., & Murphy, J. S. (2012). Current trends in adaptive training with military applications: An introduction. *Military Psychology*, 24(2), 87–95 (Download time: 06.06.2022)

- Simulation-based training that emulates real-world training tasks and environments to increase realism, fidelity and user engagement in specialized training experiences and facilitate knowledge transfer.²⁰
- Feedback methods (including biofeedback,²¹ neurofeedback,²² and eye movement modeling) that encourage critical self-reflection and growth, error recognition and correction, and deeper understanding.²³²⁴

While targeted training approaches have been used by the US military for decades, emerging multimedia, instructional strategy, and feedback approaches are gradually being incorporated into basic and advanced training contexts as they become available and validated. The aforementioned CCDC SC MASTR-E program includes an applied research project that brings the best principles of the learning and instructional sciences directly to Army training sites.

The aim of non-invasive brain stimulation (NIBS) is to directly target and change the activity of specific brain regions involved in enhancing cognitive performance during various tasks and processes. Several NIBS modalities have been identified and investigated by the US military for their performance-enhancing properties, particularly transcranial direct current stimulation (tDCS) and transcranial alternating current stimulation (tACS). These two techniques involve the delivery of low-intensity (direct or alternating) electrical current to the cortical areas of the brain using two or more electrodes placed on the surface of the scalp. Among the brain regions and mental processes being studied by the U.S. military is the dorsolateral prefrontal cortex,²⁵ for example, to enhance memory. Further research directions include stimulating the right medial temporal lobe to enhance navigation and spatial memory, the right fusiform gyrus to improve face memory, and the left frontopolar region to enhance creative problem solving.

²⁰ Lackey, S. J., Salcedo, J. N., Matthews, G., & Maxwell, D. B. (2014). Virtual world room clearing: A study in training effectiveness In Interservice/Industry Training, Simulation, and Education Conference (IITSEC). Orlando, FL (Download time: 06.06.2022)

²¹ Biofeedback refers to methods aimed at raising awareness of physiological functions - primarily with devices that provide information about the functioning of these physiological systems - with the aim of gaining the ability to influence voluntarily.

²² NeuroFeedback is a non-invasive, painless brain exercise technique. The method was developed by NASA to eliminate negative stress effects and improve the psyche and performance.

²³ McDaniel, M. A., & Einstein, G. O. (2006). Material appropriate difficulty: A framework for determining when difficulty is desirable for improving learning. In A. F. Healy (Ed.), *Decades of behavior. Experimental cognitive psychology and its applications* (pp. 73–85). Washington, D.C.: American Psychological Association (Download time: 06.07.2022)

²⁴ Swets, J. A., & Bjork, R. A. (1990). Enhancing human performance: An evaluation of “new age” techniques considered by the U.S. Army. *Psychological Science*, 1(2), 85–96 (Download time: 06.07.2022)

²⁵ Primarily the place of reception of pathways in the brain that provide short-term spatial memory functions coming from the parietal cortex.

Reality Augmentation aims to provide soldiers with context-specific and task-relevant information in a way that integrates unobtrusively and intuitively into existing equipment. Augmenting visual and multimodal sensing with relevant, timely, and actionable information can directly impact multiple aspects of a soldier's task performance. Let's look at two examples to see how this goal can be realized during military tasks.

In order to increase spatial awareness, augmented reality systems can provide spatial information that directly aids localization, orientation, route planning and navigation. Enhanced localization is achieved by updating real-time grid coordinates or minimap markers using graphical overlays. Enhanced orientation can be achieved by using "floating" beacons to show the direction and distance of salient landmarks, as well as known friendly and enemy units, which can have the positive effect of reducing uncertainty and anxiety, as well as increasing accuracy and speed of decision-making during. Enhanced route planning is achieved by providing interactive, three-dimensional terrain representations that can be studied and manipulated by individuals and collaborative teams.

Augmented reality can also improve the ability to detect, classify and successfully deal with threats. Enhanced threat detection is offered by systems that can indicate and direct the user to possible potential threats. Advanced classification is offered by systems that can detect target characteristics and help classify the existence and magnitude of an emerging threat, typically using machine vision and artificial intelligence. Targeted target engagement can be realized with real-time information about the environment and the center of mass of the targets can be marked. Augmented reality holds great promise for improving visual and multisensory perception and decision-making, but challenges include examining the short- and long-term risks of distraction, mental strain, and visual "blocking". Cognitive skills rehabilitation includes therapeutic approaches that militaries have invested heavily in testing. For example, decades of research have examined the prevention, assessment, and treatment of mild and moderate traumatic brain injury (TBI), which are associated with short- and long-term cognitive impairments such as attention, memory, language, and problem-solving abilities.

In addition to the direct approach, the US military has also researched a number of indirect cognitive performance enhancement techniques. Indirect techniques typically use broad cognitive and social-emotional skill development and interactive connections between biological systems such as the gut, brain, and peripheral nervous system. Here, in a broader sense, we can consider five indirect improvement categories:

- nutrition and dietary intervention;
- resilience and teamwork;

- peripheral nerve stimulation;
- exercise;
- and sleep modification.

Nutritional and dietary intervention involves short- or long-term modification of dietary or dietary habits to indirectly alter arousal, alertness, executive function, creative problem-solving, and/or emotion regulation. Consumption of the psychostimulant in the form of caffeine is extremely common among military personnel and is an example of supplements designed to alter central and peripheral nervous system activity.

The US military has examined the effects of several stimulants, including caffeine, amphetamine, modafinil, nicotine, and deprenyl, on cognitive performance. Several of these promise to provide temporary excitement and alertness and may improve cognitive performance in soldiers under conditions of sleep restriction and deprivation. Caffeine can enhance visual alertness and aspects of executive control in soldiers with low or high drinking habits. The mechanism underlying the cognitive effects of caffeine is generally considered to be increased central and peripheral nervous system arousal through modulation of one or more neurotransmitter systems (e.g., adenosine, dopamine, and norepinephrine).

The US Army is leading a Defense Health Program initiative that manipulates soldiers' gut microbiomes (the microbes that live in our guts) through polyphenol (antioxidant) nutrition and measures cognitive and physical performance at high altitude (in their simulated environment). High-altitude environments pose particular challenges to soldier performance due to adverse effects on sleep, emotions, cognition, and physical performance. Research findings have the potential to define the gut microbiome and metabolite profiles required for real-world performance in real-world tactical environments and guide nutrition or supplementation needed to indirectly alter cognitive performance. There are clear effects of prebiotic (indigestible plant fibers that stimulate the growth of gut bacteria) and probiotic (live bacterial strains intended to change the composition of the gut microbiota) supplementation on the human gut microbiome, and possibly to a lesser extent, impact on human cognitive performance.

Resilience, cognitive and team work skills training includes general skill development of domain general cognitive skills capable of enhancing cognitive performance as part of a team and under stress. The U.S. military has a long history of researching, developing, and implementing resilience and alertness training. The Comprehensive Soldier and Family Fitness (CSF2) program, as part of Master's Resilience Training (MRT), aims to increase Soldiers' mental, physical, emotional and

behavioral capabilities to face and cope with adversity, adapt to change, recover quickly and let them learn. Formal resilience training includes learning and practicing the core competencies of MRT. The goal of the training is to increase mental fitness, the ability to maintain optimal performance under stress, effectively lead others and achieve challenging goals. The US military has also explored mindfulness-based exercises, including Mindfulness-Based Mind Fitness Training (MMFT) and Positive Emotion Resilience Training (P-ERT).

The U.S. Army has also developed the Squad Overmatch program to enhance readiness and resilience through classroom, virtual and live exercises, enabling Soldiers and leaders to optimize personal readiness and performance in an uncertain and sustained threat environment. Enhanced performance and flexibility training enables effective tactical decision-making and combats casualty care under stressful conditions, maximizing squad success and reducing preventable combat deaths. Part of the Army's campaign is to prevent unhealthy stress from affecting performance. In response to this campaign, the Squad Overmatch program conducted a field trial to test the effectiveness of an innovative, integrated training approach to improve teamwork, resilience, situational awareness and reduce stress while performing tactical combat casualty care. Participants received training in a traditional classroom (stand-up presentation), virtual environment simulation-based team training (Virtual Battlespace III) and live training exercises (with actors and state-of-the-art simulation techniques).

CHALLENGES FOR MILITARY RESEARCH

The US military and joint services are constantly striving to gain a competitive advantage over potential adversaries and are considering a number of cognitive development strategies to improve soldier-specific outcomes such as threat perception, decision making, situational awareness, and emotion regulation. AI is increasingly being used to gain a competitive advantage. Many of these strategies are developed in defense laboratories and validated in field training exercises, resulting in internal reports to military units and stakeholders without disseminating the scientific literature. Therefore, it is challenging to understand the specific methodologies investigated and the specificity, reliability, and robustness of the resulting performance gains. However, the existing scientific literature provides a solid foundation for relatively basic mechanistic understandings and examines the effectiveness of direct and indirect enhancement strategies in relatively limited laboratory settings and tasks. While these research findings may or may not generalize to highly complex military contexts and tasks, they provide a strong foundation for applying emerging technologies and methods

to enhance performance in applied contexts such as school learning, specialized skill development, mission planning and rehearsals, and operations.

Americans use very diverse methods to enhance cognitive performance and already have results. Each approach aims to target a subset of perceptual, cognitive, and affective processes and thus has specific limitations and challenges for implementation. Several additional challenges that affect the effectiveness and ultimate application of development techniques in the military context are worth considering.

First, it is currently unknown what the trade-offs are between improving performances and at the same time potentially reducing other performances. This may be particularly true for brain stimulation approaches that alter the demands on metabolic resources in certain brain regions, possibly reducing their availability to other brain regions that may be relied upon to perform tasks. This fact can be critical for mission tasks. In addition to compromises at the level of individuals, it is also worth considering performance compromises at the level of teams. For example, it is possible that increasing the performance of some team members may inadvertently and negatively affect the performance of other team members due to increased expectations. Conversely, it is possible that relatively inferior group members may experience increased motivation in relation to high-performing team members. Future research at the intersection of social and cognitive psychology should consider the complex team dynamics that can unfold in the context of individualized development approaches.

The military typically focuses on the costs associated with the use of enhancement techniques, but the community must also consider other short- and long-term costs to the soldier's performance, health, and well-being. For example, the long-term consequences of brain stimulation and certain nutritional supplements are relatively unknown and may have adverse effects on health and well-being. Some emerging developmental techniques are controversial from a regulatory perspective, including brain and peripheral nerve stimulation and pharmaceutical supplementation, which limits the effectiveness of research and the potential widespread adoption of identified techniques. Outside of mindfulness and teamwork training, most developmental techniques are examined at the level of specific tasks (i.e., domain-specific) and individual performance, limiting understanding of how such techniques can change performance in the more complex general-general context of tasks undertaken by teams. While military personnel are expected to acquire proficiency in certain tasks and this knowledge is not required for other tasks, future military operations will require complex cognitive processes (situational awareness, decision making, problem solving). Targeted training methods show high efficiency, but there is relatively little research and convincing results that examine the

training of general cognitive skills in the field. This may be an area of future research that the Army should pursue, and due to the team-level organization and complex collective task execution of military units, more emphasis should be placed on team-level developments. Group characteristics are likely to prove a valuable parameter in predicting the real-world outcomes of development techniques in a military environment.

At the same time, emerging development research proves that no development technique provides the same results for everyone, in all contexts and tasks. True performance enhancement must exceed aspects of human cognitive ability, highlighting the importance of achieving accurate baseline peak performance measurements as a basis for comparison; without such measures, it is difficult to ensure the effectiveness of development programs and to distinguish between optimization and further development, which encourage further research. Finally, choosing to use development techniques in training and operations presents a number of challenges that guide and constrain the design and application of tools. These include unique training needs for proper device use and maintenance, network requirements for field devices, and interaction and integration with existing hardware and software on or around portable and wearable devices. Considering the challenges and the possibilities of emerging technologies and techniques, research is possible in several directions.²⁶

SUMMARY, CONCLUSIONS

The US military has also started using AI as a new tool to aid its research that has been going on for more than a century. After most of their previous research has already proven that it is possible to optimize the performance of soldiers, the main question of the current research is whether special approaches or new technologies, especially AI, can help soldiers maintain their performance in the event of stress, fatigue, or lack of sleep. . Of course, they do not want to discard the many drugs already available that effectively reduce the negative effects on cognitive performance. In this second part of the series of articles, an outlook was made on specific and continuous research, the results of which can lead to performance enhancement with the help of AI, and continuous research can be used to attempt to measure the peak performance of individuals and teams, and then to develop development strategies above the new reference value obtained. The results of the described research can pave the way for increasingly accepted, reliable and powerful cognitive development methods that can accelerate the acquisition of knowledge and skills, improve situational awareness and

²⁶ The US Army's research in this area, which is used as an example throughout this article, also focuses on several goals that may guide other militaries as well.

decision-making under stress, and help future soldiers gain a competitive advantage over their opponents.

USED LITERATURE

1. Blankenbeckler, P. N., Graves, T. R., & Wampler, R. L. (2014). Designing interactive multimedia instruction to address soldiers' learning needs. Alexandria, VA, ARI research report #1979.
2. Brunyé, T. T., Smith, A. M., Hendel, D., Gardony, A. L., Martis, S. B., & Taylor, H. A. (2020). Retrieval practice enhances near but not far transfer of spatial memory. *Journal of Experimental Psychology: Learning Memory and Cognition*, 46, 24–45.
3. Brunyé, T. T., Smith, A. M., Horner, C. B., & Thomas, A. K. (2018b). Verbal long-term memory is enhanced by retrieval practice but impaired by prefrontal direct current stimulation. *Brain and Cognition*, 128, 80–88.
4. Campbell, C., Cantrell, G., Generalao, T., Sawyer, A., & Takitch, J. (2006). Interactive multimedia instruction for US Army training. In *E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* (pp. 1105–1110). Waynesville, NC: Association for the Advancement of computing in education (AACCE).
5. Dr. Négyesi Imre: A mesteréges intelligencia katonai felhasználásának társadalmi kérdései, *Honvédségi Szemle: A Magyar Honvédség központi folyóirata*, 149. évf. 2021/1. szám, <https://doi.org/10.35926/HSZ.2021.1.10>
6. Dr. Négyesi Imre: A mesterséges intelligencia és a hadseregek. *Hadtudomány*, 2019/3. http://mhht.eu/hadtudomany/2019/2019_3/2019eA%20mesterséges%20intelligencia%20és%20a%20hadseregek_Négyesi%20Imre.pdf
7. Dr. Négyesi Imre: A mesterséges intelligencia és az etika, *Hadtudomány: A Magyar Hadtudományi Társaság folyóirata*, 2020/1. http://mhht.eu/hadtudomany/2020/2020_1szam/Hadtudomany_2020-1-szam.pdf
8. <https://link.springer.com/article/10.1007/s41465-020-00167-3#ref-CR15>
9. Lackey, S. J., Salcedo, J. N., Matthews, G., & Maxwell, D. B. (2014). Virtual world room clearing: A study in training effectiveness In *Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC)*. Orlando, FL.
10. McDaniel, M. A., & Einstein, G. O. (2006). Material appropriate difficulty: A framework for determining when difficulty is desirable for improving learning. In A. F. Healy (Ed.),

- Decades of behavior. Experimental cognitive psychology and its applications (pp. 73–85).
Washington, D.C.: American Psychological Association.
11. Porkoláb Imre – Négyesi Imre: A mesterséges intelligencia alkalmazási lehetőségeinek kutatása a haderőben. Honvédségi Szemle, 2019/5.
<https://honvedelem.hu/images/media/5f2bd1646eeb8298912683.pdf>
 12. Spain, R. D., Priest, H. A., & Murphy, J. S. (2012). Current trends in adaptive training with military applications: An introduction. *Military Psychology*, 24(2), 87–95.
 13. Swets, J. A., & Bjork, R. A. (1990). Enhancing human performance: An evaluation of “new age” techniques considered by the U.S. Army. *Psychological Science*, 1(2), 85–96.

Examination of the physiological effects of functional foods pilot study

Géza Horváth, Doctoral School of Military Engineering, NUPS

ABSTRACT

We examined the physiological effects of functional foods in a load physiology laboratory. Based on the results, the expected performance improvement in the anaerobic range is at the expense of the time spent in the aerobic range. There was a one-way change in the cortisol level.

KEYWORDS: functional food, spiroergometry, cortisol

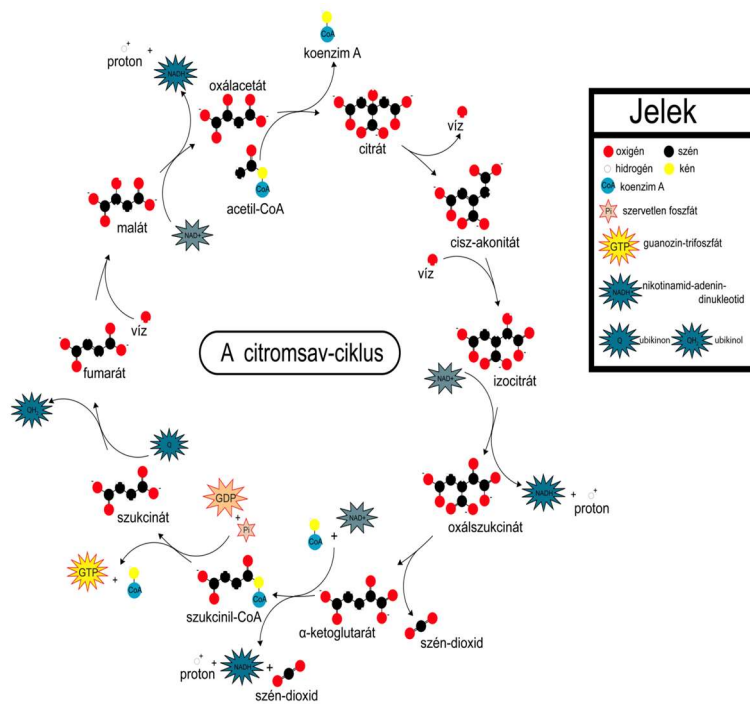
INTRODUCTION

Examining the simplest conceptual definition of "explosive motor machine" as a concept, based on the content meaning only as an analogy, it seems that from a functional point of view the human body can also be considered and interpreted as a model of an exploding motor machine.

On the input side, fuel - food and drink - and oxygen intake - breathing - take place, the fuel produces energy during a closed system process, and on the output side the human body performs 1. work - in the form of the continuous daily physical, mental and emotional routine -, 2 .takes care of its self-maintenance - "greasing, oiling": the functions of biological, biochemical, biophysical life - and 3. exhausts: removes and discharges input materials that can no longer be used on the output side during and after use (evaporation, feces, urine) .

In addition to some of its other tasks, energy is produced from fuel - food and drink - and from air - oxygen - by the Cori cycle, also known as the Szent-Györgyi - Krebs or citric acid cycle:

"The **citric acid cycle** (also known as the **Szent-györgyi-Krebs cycle**, **Krebs cycle**, **tricarboxylic acid cycle**, **citrate cycle**) is an essential metabolic process in all living cells that use oxygen in the process of cellular respiration. In these aerobic organisms, the citric acid cycle is part of a metabolic pathway in which carbohydrates, fats, and proteins are converted to carbon dioxide and water while energy is produced." [1]



Source of illustration: Wikipedia

The approach of the technical analogy to the human body as a means of use can be said to be novel.

In general, the performance, service life and quality of life of the machines depend significantly on the quality and quantity of the fuel consumed - food and drinks -, the cleanliness of the air, as well as technically optimal and intended use and regular planned maintenance. Just as the human body depends on all of these.

The main causes leading to the development of diseases are generally known. At the same time, which areas are important to pay attention to when maintaining physical health is the main goal?

The lack of quality food, the development of the resulting deficiency states. The consequences of eating too much are obesity, joint disorders, diabetes, and circulatory diseases. What practical everyday advice can be given to initiate changes?

Health problems caused by a sedentary, "sedentary" lifestyle. What are some easy-to-incorporate tips to change this?

The role of the right amount and quality of sleep for our health. Explanation of relaxation techniques.

The effects of long-term stress on our body. Possible workarounds to deal with this.

Conditions and their treatment due to the lack of intake of adequate quantity and quality of water.

In the course of our lives, from birth through kindergarten and elementary school to the challenges of the teenage years, and later under the burden of the very significant pressure of the university years, how can the individual survive if we help his body with the tools of functional foods?

And later, is it the changing age and the old age where we can significantly improve the quality of life of individuals by applying prevention?

The primary goal of our research was to identify the areas where successful and effective further investigations can be conducted. Among these areas, the topic of "fuel" intake and food was given priority by arbitrary selection. This is given relevance by the fact that in the last 20 years or so, a new branch of science has emerged in relation to the topic, the science of functional foods.

In our time, the sciences are specialized to a significant degree, but at the same time, high-intensity interoperability can be experienced.

Can, for example, technical, engineering, economics and business sciences provide guidance on the topic of improving our physical condition and abilities, keeping in mind the fact that we live life as human sentient beings?

The answer is yes.

METHODS:

1.

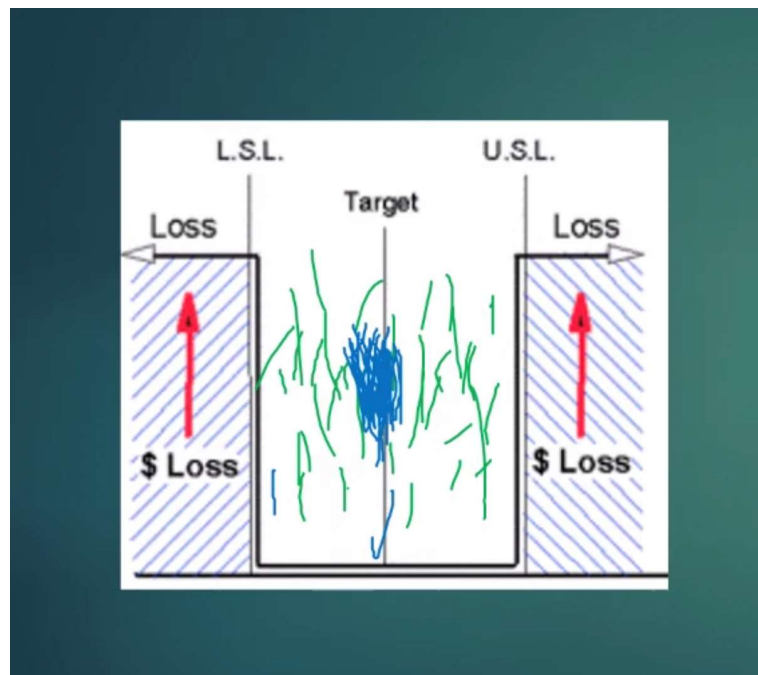
William Edwards Demming's (1900-1993) mathematician, physicist, statistician, company management researcher and consultant's research and test observations have proven that the extent and pattern of deviations within the error limits have a significant impact on the customer and user experience. [2]

A well-known case study of the topic in the automotive industry and the manufacturing sector, which also highlighted the greatness of Eastern and Western thinking that can complement each other:

At the turn of the 1970s and 1980s, the Ford Motor Company produced car models for which transmissions were simultaneously produced in Japan and the United States. Shortly after it was on the market, customers specifically asked for the Japanese transmission model over the ones made in the USA, and were even willing to wait in line for the Japanese transmission model.

Since the gearboxes were made on the same machine line with the same parameters, the engineers did not understand the reason for the trend. Finally, they took apart gearboxes of both types and began to examine, analyze and interpret

the properties and data based on Demming's suggestions and recommendations. The obtained result (green: USA, blue: Japanese switch):



In other words: the data of both relays were within the tolerance limit - i.e. everyone from both sides was healthy - but the Japanese relays were practically identical to each other. Thus, Japanese cars with a gearbox ran better, customers experienced fewer problems. [3]

Bill Smith and Mikel Harry, engineers from Motorola's military and aerospace business (Motorola Inc, Government Electronics Group), came to a similar conclusion, on the basis of which they created one of the world's benchmark production management systems, in addition to Lean Thinking, Six Sigma. What is Six Sigma? Six Sigma = Variance reduction. [4]

These two engineering products formulate the hypothesis according to which, even in the case of the human body as a precision instrument, deviation tests within healthy value limits are absolutely relevant. For this reason, we specifically included subjects known to be healthy in the research.

2.

Although HKO (Traditional Chinese Medicine) has known the Ganotherapy procedure in connection with functional foods for about 4000 years as a preventive medicine, clinical research measurement results on the subject are still not available. [5]

As a result of this fact, it was first necessary to introduce the KPI (Key Performance Indicators) method used by the company's economics, and to determine for which key parameters we expect measured, quantifiable changes as a hypothesis, in the first approach. [6]

For this. based on stress as a key factor, we decided to examine the cortisol level and prioritize oxygen utilization.

3.

The persons included in the research consumed functional food for 4 weeks. No other lifestyle changes were made during the study. Before and after the start of the experiment, they took part in a body composition and spiroergometric test.

Overall, the following physiological parameters were recorded: resting heart rate, maximum heart rate, VO₂max, time spent at full load, time to anaerobic breaking point, breaking point heart rate, time spent in aerobic and anaerobic range, and the change in the cortisol level of a saliva sample was examined.

5 persons with a health condition corresponding to their age were included in the study.

Due to the low number of items and the large standard deviations of the individual indicators, we did not examine averages and the authenticity of the differences between the groups, we only looked for physiologically relevant changes in the same direction for everyone, based on the data measured and recorded before and after 1 month of therapy.

Note: the subjects were intentionally selected this way (male-female, trained-untrained, young-old).

RESULTS

1. resting heart rate

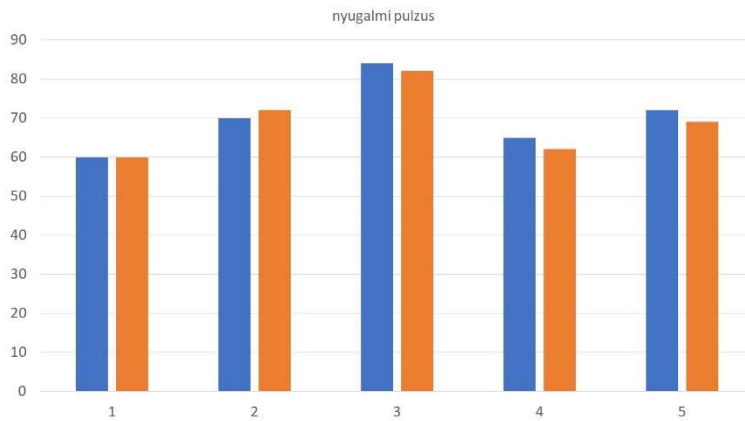


Figure 1. resting heart rate source: edited by author

Either there was no change or we experienced a numerical change within the margin of error of 1-2 units, which is not relevant from a physiological point of view.

2. maximum heart rate

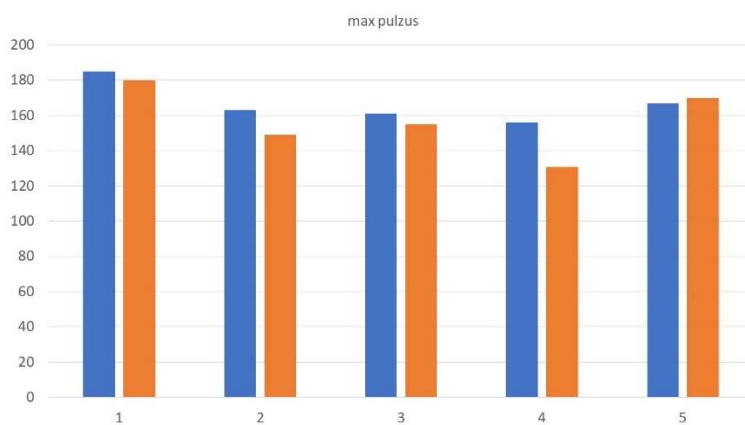


Figure 2. maximum heart rate (source: edited by author)

Changes of varying degrees per individual (between -3% and 16%), with the exception of one within the margin of error, physiologically irrelevant changes.

3. VO₂max

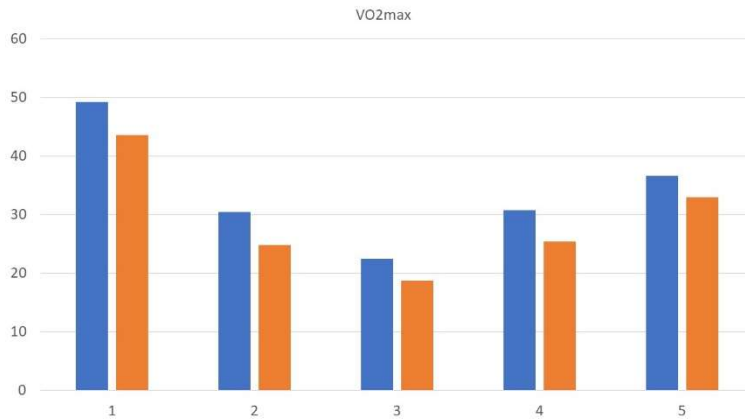


Figure 3. VO₂max (source: edited by author)

We experienced a uniform, significant deterioration (between 10-20%) for everyone. The extent of the deterioration is shown even more vividly by the fact that, from the severely overweight, untrained subject to the elite athlete at the selected level, there was a category change in the direction of deterioration (excellent->good, adequate->poor, etc.).

The extent of the phenomenon is also remarkable because during the study, a VO₂max deterioration of around ~2% was observed in the "control person" who only abandoned regular daily training (6km running).

A physiological explanation of the phenomenon awaits.

4. time to threshold point

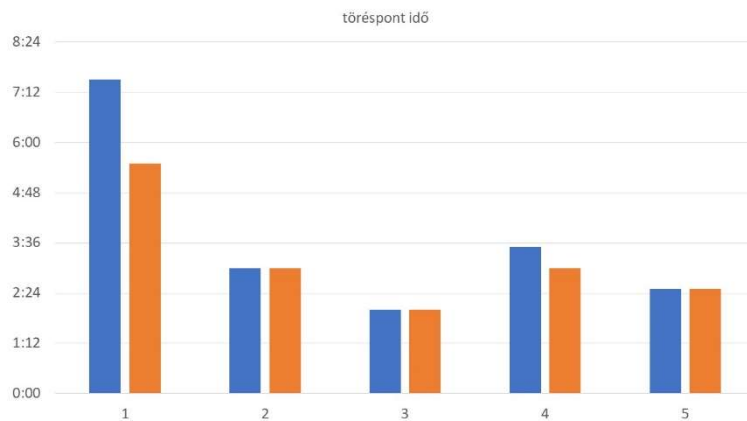


Figure 4. time to threshold point (source: edited by author)

With one exception, only a numerical change, then the signal value is that the aerobic-anaerobic transition occurs earlier for everyone.

5. heart rate at threshold point

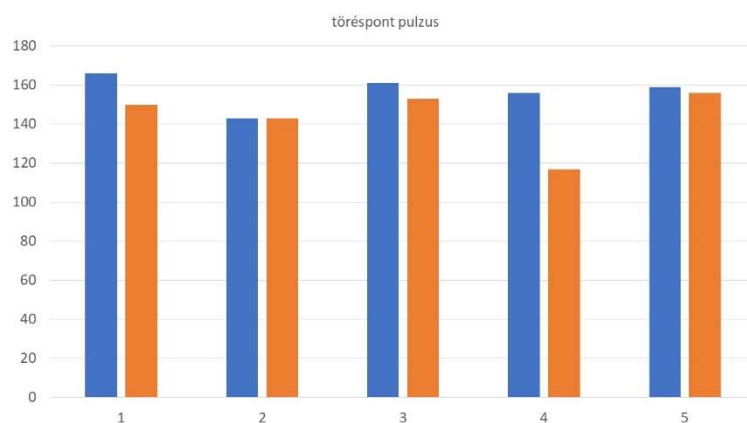


Figure 5. heart rate at threshold point (source: edited by author)

By definition, everyone's heart rate is also lower than the breaking point.

6. total time spent under load

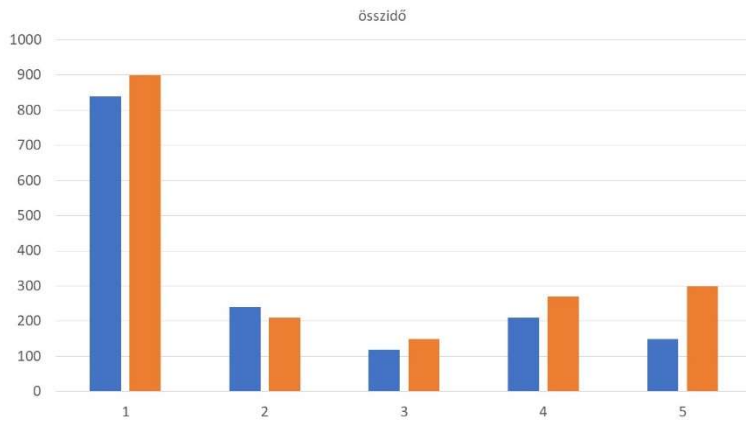


Figure 6. total time spent under load (source: edited by author)

With one exception, the time spent with the load increased significantly and relevantly.

7. time spent in aerob range

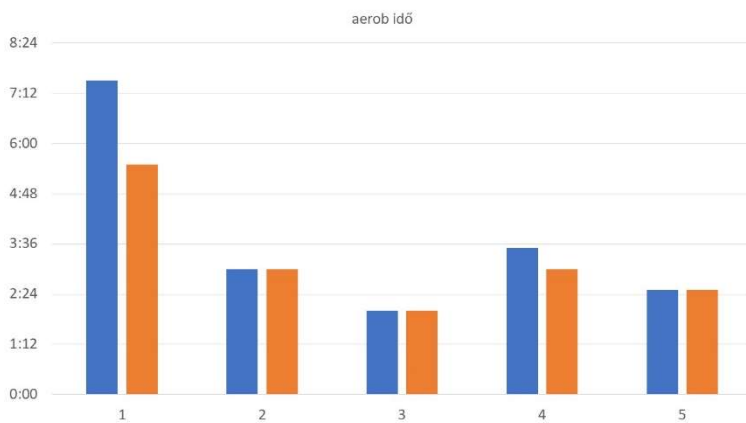


Figure 7. time spent in aerob range (source: edited by author)

It is noteworthy that the time spent in the aerobic range did not increase for anyone, and even decreased by almost 30% for some.

8. time spent in the anaerob region

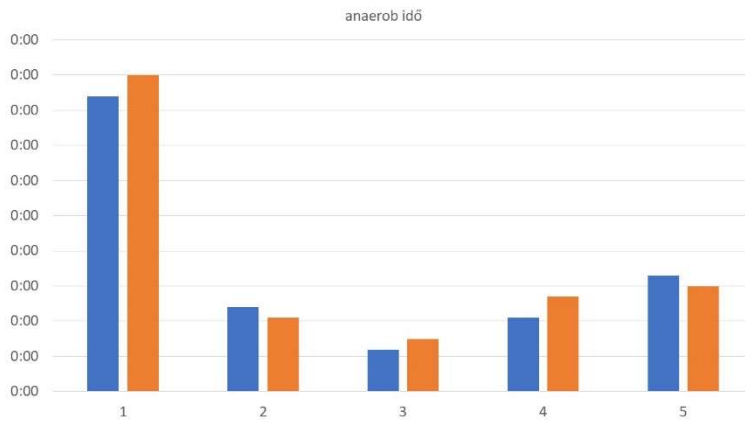


Figure 8. time spent in the anaerob region (source: edited by author)

By definition, since the time spent in the aerobic range did not change or decreased, at the same time the time spent with full load definitely increased (for some, the rate of change was 100%), so the time of anaerobic load clearly increased.

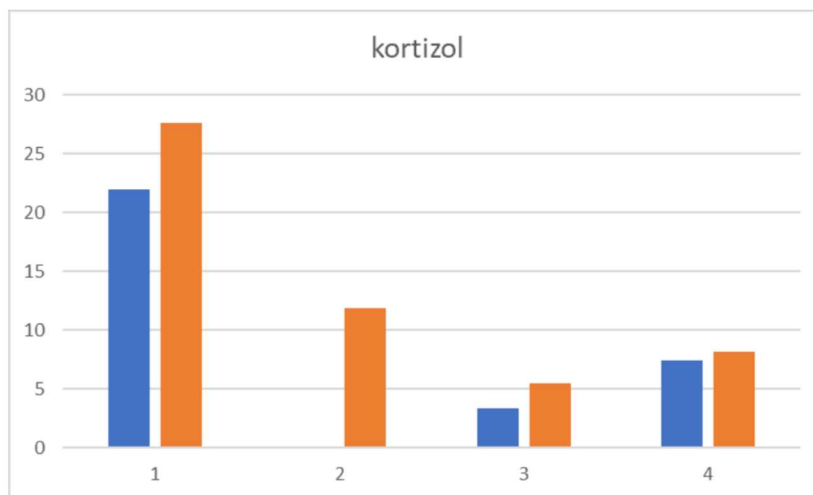
DISCUSSION

One of the attention-grabbing results of the study is that (apparently at the expense of aerobic capacity) the time spent in the anaerobic range showed an improvement for everyone.

In the group, the measured VO_{2max} decrease and the decrease in aerobic capacity may indeed correspond to the result (in tendency) of a Mexican Olympic race, but it is unlikely that the prolongation of anaerobic performance would substantially compensate for this in real conditions. For this, in addition to the heart rate breaking point, a capnograph (+actual oxygen consumption?), lactic acid level/pH should be measured, it is rather a negative effect that after a month of consuming functional food as a cure, the VO_{2max} decreases so much (negative inotropic effect, can it cause decompensation?)

As an explanation, we can also think of the improvement of the ability to tolerate lactic acid, that is, the acidification that occurs later. The reason for this can perhaps be found in the more efficient lactate resynthesis (Cori cycle) taking place in the liver. The shift in total time, late acidification/improvement of lactic acid tolerance can only really be suggested based on the graphs, but then this should be verified based on lactic acid/pH/etCO₂/possibly muscle NIRS ((myoglobin, mitochondrial density, etc. as a change in cell metabolism)). A possible alternative explanation would be offered by examining changes in muscle creatine phosphate storage.

The one-way change in the cortisol level also suggests the need for further studies.



REFERENCES

- [1] <https://hu.wikipedia.org/wiki/Citromsavciklus>
- [2] <https://www.bl.uk/people/w-edwards-deming>
- [3] Aguayo, Rafael (1991). Dr. Deming: The American Who Taught the Japanese About Quality. Fireside edition. ISBN 0-671-74621-9. OCLC 229201675. page 40-41.
- [4] https://en.wikipedia.org/wiki/Six_Sigma
- [5] Datuk Dr. Lim Siow Jin Ph.D: Ganotherapy, the miraculous king of herbs. <https://dxnproducts.com/ganotherapy-book/>
- [6] https://en.wikipedia.org/wiki/Performance_indicator

RED



72345610 33

ISSN 7234561-6