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QUALITIES OF NEURODYNAMIC AND MENTAL FUNCTIONS OF ATHLETES

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Abstract

Relevance. The research on the correlation between individual-typological qualities of higher nervous activity, sensomotor reaction, memory and attention functions and the achievements in sports could serve a scientific basis for carrying out theoretical and practical tasks for sports orientation and selection. ***The purpose of the research*** is to study the correlation between sports achievements and the qualities of neurodynamic and mental functions of athletes of various qualifications and orientations. ***The Results of the Work.*** It was found out that the qualities of the basic nervous processes correlated with the nature of athlete's sports activity. The highest indices to both functional lability and nervous processes force were observed in the groups of wrestlers and gymnasts, and the lowest indices were in the beginner's group. It was stated that the students with the best skills of the sensomotor reaction of various difficulty, memory and attention functions were those who had masters of sports or masters for sports. The analysis of the indices to the sensomotor reaction in groups of athletes in different sports revealed that the wrestlers were characterized by shorter latent periods of a simple visual-motor reaction while the fighters and representatives of game sports were characterized by complex visual-motor reactions. Due to regular trainings and competitions the athletes of high qualification keep necessary coordination, preserve and improve the level of correlation between different nervous processes that cause the increase in neurodynamic and mental functions. Taking into account the high determination of typological qualities of higher nervous system it is necessary to consider that the high level of the qualities in question of athletes of high qualification may be a result of natural selection that can be typical. ***Conclusions.*** Individual-typological qualities (functional mobility and basic nervous processes force) and the qualities of sensomotor reactivity together with individual mental functions constitute the neurophysiologic basis for the effectiveness of sports activity.

Key words: neurodynamic functions, mental functions, sports qualification.

Микола Макаренко, Сергій Голяка. Властивості нейродинамічних та психічних функцій у спортсменів. ***Актуальність.*** Дослідження залежності між індивідуально-типологічними властивостями вищої нервової діяльності, сенсомоторним реагуванням, функціями пам'яті та уваги з результативністю досягнень у спорті могло б слугувати науковою основою для обґрунтування й розробки теоретичних і практичних завдань спортивної орієнтації та відбору. ***Мета дослідження*** – вивчення зв'язку результативності спортивної діяльності з властивостями нейродинамічних та психічних функцій у спортсменів різної кваліфікації й спрямованості. ***Результати роботи.*** Виявлено, що властивості основних нервових процесів перебувають у відповідному зв'язку з характером спортивної діяльності, у якій тренується спортсмен. Найвищі показники як функціональної рухливості, так і сили нервових процесів виявлено в групах борців і гімнастів, а найнижчі – у групі новачків. Показано, що достовірно кращими показниками сенсомоторного реагування різної складності, функцій пам'яті та уваги характеризувалися студенти, які мали спортивну кваліфікацію майстра чи кандидата в майстри спорту. Під час аналізу показників сенсомоторного реагування в групах спортсменів різної спрямованості з'ясовано, що коротшими латентними періодами простої зорово-моторної реакції характеризувалися борці, а щодо складних зорово-моторних реакцій – борці й представники ігрових видів спорту. У висококваліфікованих спортсменів систематичні тренування та регулярні змагання зберігають необхідну координацію, утримують і підвищують рівень узгодженості різних ланок нервової системи, що виявляється в підвищенні стану властивостей нейродинамічних та психічних функцій. Зважаючи на високу детермінованість типологічних властивостей вищої нервової діяльності і їхньої роль у формуванні нейродинамічних та психічних функцій, слід ураховувати й той факт, що високий рівень досліджуваних властивостей у висококваліфікованих спортсменів може стати результатом природного добору, що також є закономірним. ***Висновки.*** Індивідуально-типологічні властивості (функціональна рухливість і сила основних нервових процесів) та властивості сенсомоторної реактивності разом з окремими психічними функціями становлять нейрофізіологічну основу результативності спортивної діяльності.

Ключові слова: нейродинамічні функції, психічні функції, спортивна кваліфікація.

Николай Макаренко, Сергей Голяка. Свойства нейродинамических и психических функций в спортсменов. ***Актуальность.*** Исследование зависимости между индивидуально-типологическими свойствами

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высшей нервной деятельности, сенсомоторного реагирования, функциями памяти и внимания с результативностью достижений в спорте могло бы служить научной основой для обоснования и разработки теоретических и практических задач спортивной ориентации и отбора. ***Цель исследования*** – изучение связи результативности спортивной деятельности из свойствами нейродинамических и психических функций у спортсменов различной квалификации и направленности. ***Результаты работы.*** Обнаружено, что свойства основных нервных процессов находятся в соответствующей связи с характером спортивной деятельности, в которой тренируется спортсмен. Самые высокие показатели как функциональной подвижности, так и силы нервных процессов обнаружены в группах борцов и гимнастов, а самые низкие – в группе новичков. Показано, что достоверно лучшими показателями сенсомоторного реагирования различной сложности, функций памяти и внимания характеризовались студенты, которые имели спортивную квалификацию мастера или кандидата в мастера спорта. При анализе показателей сенсомоторного реагирования в группах спортсменов различной направленности определили, что коротшими латентными периодами простой зрительно-моторной реакции характеризовались борцы, а относительно сложных зрительно-моторных реакций – борцы и представители игровых видов спорта. У высококвалифицированных спортсменов систематические тренировки и регулярные соревнования сохраняют необходимую координацию, удерживают и повышают уровень согласованности различных звеньев нервной системы, что проявляется в повышении состояния свойств нейродинамических и психических функций. Учитывая высокую детерминированность типологических свойств высшей нервной деятельности и их роль в формировании нейродинамических и психических функций, следует обращать внимание и на тот факт, что высокий уровень исследуемых свойств у высококвалифицированных спортсменов может быть также закономерным результатом естественного отбора. ***Выводы.*** Индивидуально-типологические свойства (функциональная подвижность и сила основных нервных процессов) и свойства сенсомоторной реактивности вместе с отдельными психическими функциями составляют нейрофизиологическую основу результативности спортивной деятельности.

Ключевые слова: нейродинамические функции, психические функции, спортивная квалификация.

Introduction. The study on the correlation between sports achievements and the level of main nervous processes, the nature of the sensomotor reaction, mental functions, etc. is a relevant scientifically-applied problem that is in need of further research [5]. Genetically determined qualities of higher nervous activity (HNA) such as functional lability and nervous processes force are known to play a major role in selecting youth for doing sports in sports clubs [1; 2; 5; 6]. But as a rule, it is done by coach's intuition or questionnaire which does not meet requirements and is invalid. Equipment is of less importance and even those people, who want to apply it, do not have the necessary equipment at their disposal. The determined correlation between individual-typological qualities of HNA, sensomotor reaction, memory and attention functions and sports achievements could be a scientific basis for substantiation and working out theoretical and practical exercises for different sports and selection, etc.

The purpose of the research is to study the correlation between sports achievements and the qualities of neurodynamic and mental functions of athletes for various qualifications and sports.

Materials and Methods of the Research. 96 (ninety-six) students of physical training and sport faculty at Kherson State University and students of Kherson Higher College of Physical Culture participated in the research. They were divided into three groups: the first group included 29 (twenty-nine) athletes who hade a qualification of Master of Sports (MS) or Candidate for Master of Sports (CMS); the second one consisted of 37 (thirty-seven) persons who had I or II classes (the first and the second class athletes); the third one included 30 (thirty) students who started to do sports recently – beginners (B). Besides all qualified athletes of various sports were divided into four groups: the first group consisted of 16 (sixteen) students who practiced gymnastics and trampoline &tumbling (G); the second one consisted of 18 (eighteen) persons who practiced different kinds of wrestling (W); the third one consisted of 15 athletes who did those kinds of sport which required high athletes' endurance (further in the charts it is given as endurance exercises); the fourth one consisted of 17 students who played game sports (GS) – basketball, handball, football. The age of the respondents was 17–19 years old.

The qualities of neurodynamic functions such as lability (L), nervous processes force (NPF) and sensomotor reactions of various difficulty : simple sensory-motor reaction (SSMR), one (CR_{1-3}) and two (CR_{2-3}) choice reaction from three stimuli were studied according to the methodical approaches of professor M. V. Makarenko [3; 4]. Computer programme «Diahnost-1», questionnaire methods were used to determine the short-term memory (STM) span and attention qualities.

Results of the Research. Discussion. The achieved results in lability claim that the respondents who had MS and CMS qualification levels showed higher indices. That group had average index 63,9±0,7 c ($p<0,05–0,01$). The lower sports qualification (SQ) is, the lower lability is. The beginners had the average index 67,8±0,8 c. These results prove that students with higher level of sports qualification have higher level of lability.

Table 1

Average Indices of Lability and NPF for Students with Various Sport Qualifications

Respondents Groups	Lability(s)		%	NPF, Signals/ in 5 min		%
	M±m	σ		M±m	Σ	
MS, KMS (n=29)	63,9±0,7	3,25	100	699,0±9,6	50,8	100
1st, 2nd (1–2) (n=37)	65,8±0,4*	3,34	97,1	670,2±6,8*	48,1	95,8
Beginners (B) (n=30)	67,8±0,8**	3,98	94,1	650,4±10,7*	55,0	92,8

Note. *,**- *p<0,05-0,01 – the difference is accurate as to MS and CMS.*

If the average indices of lability in MS and CMS groups are taken as 100 %, then in the beginners' group they will be 94,1% and in the 1st, 2nd class sportsmen they will be – 97,1 % (tabl. 1).

The analysis of the data of the research on the lability of athletes with various qualifications makes it possible to testify that the persons who do sports and achieve high sports results have better index of lability comparing to the athletes with lower qualifications. It is proved that individual-typological qualities of HNA and namely, lability play an important role in achieving sports results.

The highest indices to NPF, as well as lability indices, were made in MS and CMS groups. The average index for this group was 699,0±9,6 signals/5 min (p<0,05). The lower SQ is the lower NPF is. The beginners had an average index 650,4±10,7 signals/5 min. The difference in NPF of the students with various SQ can be demonstrated by percentage changes of the given parameter (chart 1). The analysis of the results allows making a conclusion that the athletes with a high level of SQ have a higher level of NPF. The persons with a lower level of SQ have a bit lower level of NFP correspondently.

To obtain qualitative and quantitative data of the athletes' qualities in question in five groups by means of a standard deviation method the students were divided into three groups: with «high», «middle», «low» level of lability. The results of such distribution are given in table 2.

Table 2

Distribution and Average Value of Lability for Athletes of Various Sports

Kinds of Sport Orientation	Lability Average Rates	Lability Levels (Seconds)		
		High	Average	Low
		Respondents' Distribution (%)		
Gymnasts (G) (n=16)	64,3±1,1	37,5	37,5	25,0
Wrestlers (W) (n=18)	63,8±0,6	33,3	38,9	27,8
Endurance exercises (E) (n=15)	64,8±1,2	26,7	40,0	33,3
Game sports (GS) (n=17)	65,4±0,9	23,5	35,3	41,2
Beginners (B) (n=30)	67,8±0,8**	13,3	43,3	43,4

Note. *,**- *p<0,05-0,01 – the difference is accurate as to wrestlers, gymnasts, game sports athletes and representatives of endurance sports.*

Due to Chart 2 the majority of the respondents in each group are characterized by the average level of lability. The greater amount of the persons with the high level are among the gymnasts (37,5 %) and wrestlers (33,3 %) and the least – are among the representatives of game sports (23,5 %) and beginners (13,3 %).

We also analyzed the average values of lability in the groups of the respondents with different sports. The best result of lability was achieved among the wrestlers and gymnasts. These respondents had lability indices 63,8±0,6 s and 64,3±0,8 s correspondently.

As far as the average values of NPF qualities are concerned the following results were received. While doing the test the wrestlers handled 690,0±8,5 signals/5 min. A bit fewer signals and hence the lower level of NPF were demonstrated by the gymnasts (672,9±10,8 signals/5min) and the game sports athletes (670,8±8,7 signals/5min). The athletes who practiced the endurance sports were at the level of 668,5±7,4 signals/5min. Making numeric distribution of the athletes according to the level of NPF (standard deviation method was used) it was found out that the greatest amount of the persons with the high level were among the gymnasts (35,3 %) and wrestlers (44,5 %) and the least – among the representatives of the endurance sports (26,7 %) (tabl. 3).

Table 3

Distribution and Average Value of NPF Among Athletes of Different Sports

Nature of Sport Activity	NPF Average Rates	NPF level (Signals /5 min)		
		High	Average	Low
		Respondents' Distribution (%)		
Gymnasts (n=17)	672,9±10,8	35,3	35,3	29,4
Wrestlers (n=18)	690,0±8,5	44,5	33,3	22,2
Endurance exercises (n=15)	668,5±7,4	26,7	40,0	33,3
Game sports (n=17)	670,8±8,7	29,4	35,3	35,3

Note. *,**- *p<0,05 – the difference is accurate as to wrestlers.*

Such phenomena of the qualities of main nervous processes in sports activity are in line with the researches of other authors [2; 5] which show that there is a correlation between these variables. The results of our research have proved that the high level of NPF corresponds to the high sports results in gymnastics and wrestling. The respondents with the high NPF achieve the high sports results in these sports which demand higher standards of speed and coordination (wrestling).

The results of the research of the latent period (LP) on sensory-motor reaction (SMR), while processing the information of various difficulty among the students of different SQ, allow stating that their duration grows depending on the difficulty of the given load in all groups of the respondents (tabl. 4).

The analysis of LP SSMR values showed the absence of accurate differences between these indices in the student groups of various SQ excluding LP SSMR values for the 1st and 2nd class sportsmen and for the beginners where it was longer (worse time) comparing to the MS and CMS groups (p<0,05-0,01). Absolute values of average indices to LP SSMR in the beginners' group were 220,3±4,4 ms, in the 1st and 2nd class sportsmen's group – 215,3±2,5 ms, in MS and CMS – 198,9±5,7 ms (Chart 4).

Studying LP CR_{1-3} values for the respondents of various SQ levels gave the following results. In the MS and CMS groups this index was on average 316,7±4,4 ms, in the 1st and 2nd class sportsmen's group – 341,1±3,4 ms. In the beginners' group LP CR_{1-3} values were equal to 343,9±5,6 ms that was accurately different from the MS and CMS indices (t=3,82, p<0,01) (tabl. 4).

Table 4

LP Average Indices of SMR of Different Difficulty for Students of Various Qualification and Sports (M±m)

Respondents' Groups	Latent Periods of Sensory-Motor Reaction(ms)		
	SSMR	CR_{1-3}	CR_{2-3}
Sport Qualification			
MS and CMS	198,9±5,7	316,7±4,4	399,5±5,2
1st and 2nd class sportsmen's (1–2)	215,3±2,5*	341,1±3,4**	408,9±7,4
Beginners (B)	220,3±4,4**	343,9±5,6**	428,5±6,7**
Sport orientation			
Gymnasts (n=17)	208,6±3,6	333,5±4,9	399,7±5,9
Wrestlers (n=18)	201,8±3,8	322,6±4,9	402,0±5,0
Endurance exercises(n=15)	202,5±5,1	331,9±4,5	406,2±8,9
Game sports (n=17)	205,4±3,4	333,6±4,4	398,2±6,8

Note. * - *p<0,05, **- p<0,01 – the difference is accurate as to MS, CMS.*

The analysis of the research results in LP CR_{2-3} indices allows us to confirm that this index has the similar trends as LP SSMR. Thus the shortest time of reaction was shown by the MS and CMS groups – 399,5±5,2 ms. In the 1st and 2nd class sportsmen's group, the average value of LP CR_{2-3} was 408,9±7,4 ms and the beginners have 428,5±6,7 ms, that is accurately higher (p<0,01) than the MS and CMS indices (tabl. 4).

The analysis of average indices of attention switch shows that the respondents of all groups have increased attention (that is reduced time for processing of a necessary task): B group had 312,9±9,4 s, the 1st and 2nd class sportsmen's group had lower results (became better) up to 303,4±8,7 s, the MS and CMS group had the result equal to 271,0±6,6 s (p<0,01) (tabl. 5).

Table 5

Indices of Psychological Functions in Students with Different Level of SQ and Sports

Sports	Numbers	Switch (s)	Distribution (n)
MS, CMS	7,75±0,17	271,0±6,6	19,6±0,2
1st and 2nd class sportsmen	6,95±0,19**	303,4±8,7**	18,2±0,4**
Beginners (B)	6,59±0,26**	312,9±9,4**	18,9±0,5
Sports			
Gymnastics	7,22±0,33	287,9±7,9	19,3±0,8
Wrestlers	7,09±0,30	290,0±12,2	19,2±0,5
Endurance exercises	7,31±0,21	304,4±9,3	18,8±0,5
Game sports	7,78±0,25	292,9±8,7	18,3±0,5

Note * *– p<0,05,* **- *p<0,01 – the difference is valid to MS, CMS.*

The same picture is observed while analyzing attention allocation qualities: the highest rate is among MS and CMS respondents – 19,6±0,2 signs, the lowest in 1st and 2nd class sportsmen's group – 18,2±0,4 signs (p<0,01) (table 5).

Thus obtained data allow concluding that attention function qualities of the athletes are connected with SQ level: as a rule the higher the level of sports qualification is the better attention qualities are.

According to Chart 5 the highest STM indices are seen in the respondents of game sports – 7,78±0,25 the relative value unit (RVU), in the respondents who practice endurance ports – 7,31±0,21 RVU, in the gymnasts – 7,22±0,33 RVU, among the wrestlers – 7,09±0,30 RVU, and we can observe the lowest results – 6,59±0,26 RVU in the beginners.

The analysis of the results in attention switch qualities has showed that the athletes of the sports where the high level of endurance is typical, had average index 304,4±9,3 s, the game sports respondents had 292,9±8,7c, the wrestlers – 290,0±12,2 s, the gymnasts – 287,9±7,9 s. Analyzing attention allocation indices the highest rate was found out among the respondents of the gymnast's group – 19,3±0,8 signs, the lowest – among the respondents in game sports group – 18,3±0,5 signs. But there is no accurate difference among the results of attention allocation qualities in all groups (table 5).

Thus obtained results show that there are differences between specific qualities of attention and between specific types of memorizing information among the respondents with various sports.

Besides we studied correlation between the lability values and LP SMR; among lability, memory and attention functions of athletes. The correlation analysis didn't show any connection between LP SSMR and lability in all the respondents' groups except the beginners. The correlation analysis proved the relationship between the qualities of main nervous processes and LP $CR_{2\text{-}3}$ in all groups of SQ and sports.

Such a correlation between typological qualities of the nervous system and LP $CR_{2\text{-}3}$ points out that high brain divisions are involved in performing a difficult task. The correlation between them is provided by lability and nervous processes force.

Carrying out the correlation analysis for studying the dependence between lability indices, STM span and attention qualities indices we found out that only in the beginner's group there was some accurate correlation between main nervous processes qualities on the one hand and memory span for numbers on the other hand (p<0,05). No correlation was observed in other groups. There was a correlation between attention allocation indices and lability in the MS and CMS group and in the 1st and 2nd class sportsmen group (p<0,05–0,01). We also found out accurate correlation between the lability indices on the one hand and attention allocation indices on the other hand (p<0,05).

Summarizing obtained experimental data it is necessary to point out the important role of the qualities of neurodynamic and mental functions for achieving high sports results. Regular trainings and competitions help the athletes of high qualification keep necessary coordination, preserve and improve the level of coordination inside one division of the nervous system, between some divisions of the nervous system and in the peripheral divisions of the nervous systems that are revealed in increasing neurodynamic and mental functions. The athletes who have low qualification are likely to have poor sequence and coherence of different divisions of the central nervous system and as a result – the low level of sports perfection and hence relatively low level of the qualities of neurodynamic and mental functions.

Taking into account the high determination of typological qualities of the high nervous activity and its role in forming neurodynamic and mental functions it is necessary to take into consideration that the high level of qualities in question which the athletes of high qualification possess, may be a result of natural selection that is typical [5].

Conclusions and Prospects for Future Research. It is found out that the qualities of main nervous processes are in line with an athlete's sports activity. The highest indices, both NRF and SDR, are found in the groups of wrestlers and gymnasts, and the lowest in the group of beginners. The valid indices of sensory-motor reaction of various difficulties, mental functions are typical of the students who have a master of sport or a candidate for master qualifications. The analysis of the indices of sensory-motor reaction in sports groups of different sports has revealed that the shortest latent periods of simple sensory-motor reaction are typical of the wrestlers; and complex sensory-motor reaction – for the wrestlers and game sports athletes. The individual typological qualities (lability and main nervous processes force) and the qualities of sensory-motor reaction together with some specific mental functions form the neurophysiologic background for sports activity.

The research done does not cover all the problems of psychophysiology in sports activity. The prospects for future research lie in implementing the achieved results in the system of sports selection, in preventing negative psychophysiological states and their corrections in athletes.

Sources and Literature

1. Коробейніков Г., Приступа Є., Коробейнікова Л., Бріскін Ю. Оцінювання психофізіологічних станів у спорті. Львів: ЛДУФК, 2013. 312 с.
2. Лизогуб В. С., Безкопильний О. П. Зв'язок спортивної кваліфікації з індивідуально-типологічними властивостями нервової системи. *Матеріали науково-практичної конференції*. Черкаси: Черкас. нац. ун-т, 2004. – С. 169–174.
3. Макаренко М. В. Методика проведення обстежень та оцінки індивідуальних нейродинамічних властивостей вищої нервової діяльності людини. Фізіологіний журнал. 1999. Т. 45, № 4. С. 125–131.
4. Макаренко М. В., Лизогуб В. С., Безкопильний О. П. Методичні вказівки до практикуму з диференціальної психофізіології та фізіології вищої нервової діяльності людини. Черкаси: Вертикаль, Вид. Кандич С. Г., 2014. 102 с.
5. Макаренко М. В., Лизогуб В. С., Голяка С. К., Безкопильний О. П., Спринь О. Б. Особливості властивостей психофізіологічних функцій у спортсменів із різним рівнем спортивної кваліфікації. *Спортивна медицина*. 2008. №1. С. 174–180.
6. Скиба О. Особливості становлення нейродинамічних та сенсомоторних функцій у юних спортсменів різної спеціалізації. *Молода спортивна наука України*. Львів, 2015. Вип. 19, Т. 3. С. 159–163.

References

1. Korobeinikov, H., Prystupa, Ye., Korobeinikova, L. & Briskin, Yu. (2013). Otsiniuvannia psykhofiziolohichnykh staniv u sporti [Assessment of psychophysiological conditions in sport]. L., LDUFK, 312 .
2. Lyzohub, V. S. & Bezkopylnyi, O. P. (2004). Zviazok sportyvnoi kvalifikatsii z indyvidualno-typolohichnymy vlastyvostiamy nervovoi systemy [Relation of sports qualification with individual-typological properties of the nervous system]. Materialy naukovo-praktychnoi konferentsii. Cherkasy, Cherkaskyi natsionalnyi universytet, 169–174.
3. Makarenko, M. V. (1999). Metodyka provedennia obstezhen ta otsinky indyvidualnykh neirodynamichnykh vlastyvostei vyshchoi nervovoi diialnosti liudyny [Examination procedure and assessment of the individual neurodynamic properties of human higher nervous activity]. Fiziol. zhurn. , t. 45, no. 4, 125–131.
4. Makarenko, M. V., Lyzohub, V. S. & Bezkopylnyi, O. P. (2014). Metodychni vkazivky do praktykumu z dyferentsialnoi psykhofiziolohii ta fiziolohii vyshchoi nervovoi diialnosti liudyny [Methodical instructionsto the workshop on differential psychophysiology and physiology of higher human nervous activity]. Cherkasy, «Vertykal», vydavets Kandych S. H., 102.
5. Makarenko, M. V., Lyzohub, V. S., Holiaka, S.K., Bezkopylnyi, O. P. & Spryn, O. B. (2008). Osoblyvosti vlastyvostei psykhofiziolohichnykh funktsii u sportsmeniv iz riznym rivnem sportyvnoi [Features of the properties of psychophysiological functions at athletes with different levels of sports qualification]. *Sportyvna medytsyna*, no. 1, 174–180.
6. Skyba, O. (2015). Osoblyvosti stanovlennia neirodynamichnykh ta sensomotornykh funktsii u yunykh sportsmeniv riznoi spetsializatsii [Peculiarities the formation of neurodynamic and sensorimotor functions in young athletes of different specializations]. *Moloda sportyvna nauka Ukrainy*. L., vyp. 19, t. 3, 159–163.

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