

# 自由回忆和线索回忆测验中的系列位置效应<sup>①</sup>

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**摘要** 本文以96个中国汉字为材料,使用自由回忆和线索回忆测验方法,对20名被试进行6组分测验和最后所有汉字的总测验。发现自由回忆分测验中存在明显的系列位置效应,总测验出现负近因现象;线索回忆分测验也表现出明显的系列位置效应,但最后的总测验没有出现负近因现象。上述结果验证了Bjork和Whitten(1974)提出的顺序或情景理论。

**关键词:**系列位置效应 首因效应 近因效应 负近因 顺序或情景理论

## 1 前言

系列位置效应是指在用自由回忆法进行实验时,被试对字单中的头几个项目再现得很好(首因效应, primacy effect),字单中部的项目再现不好,最后几个项目也再现得很好(近因效应, recency effect)<sup>[1]</sup>。系列位置效应最早由Nipher(1878)报告,而且,系列位置效应可能是实验室研究的第一种记忆现象<sup>[2]</sup>。系列位置效应可以在不同方法的实验中,不同种系,不同年龄,实验室或日常生活中观察到<sup>[3]</sup>。

本世纪60年代,系列位置效应,特别是近因效应引起心理学工作者的极大兴趣和理论关注,并成为当时心理学教科书的重要内容。当时研究者普遍接受Glanzwr(1972)提出的观点,认为首因效应表征次级记忆(Secondary memory)存储的内容,而近因效应表征初级记忆(primary memory)存储的内容。因而系列位置效应成为两种记忆过程理论的强有力的支持证据。而且这种观点在当时得到大量实验证据的支持<sup>[4]</sup>。

其中之一为1970年由 Craik 首次发现的负近因现象(negative recency effect)<sup>[5]</sup>。在 Craik 的实验中,要求被试学习并自由回忆10个词单,结果表现出传统的系列位置效应。在学完全部10个词单之后,在被试不知道的情况下,要求被试回忆实验中呈现过的所有10个词单中的单词。结果发现最后对全部单词的回忆仍保留首因效应,但未发现近因效应。事实上,被试对最后几个单词的回忆成绩是最差的,这就是负近因现象。当时对于负近因现象的解释与用初级记忆理论对近因效应的解释是一致的。

以往对负近因现象的研究大多采用自由回忆的方法,除此之外1971年Madigan和McCabe使用对偶联合探测词测验,也证明负近因现象的存在<sup>[6]</sup>。

然而,用初级记忆理论对自由回忆中近因效应及负近因现象的解释受到Bjork和Whitten(1974)等人的实验结果的强烈挑战。Bjork和Whitten(1974)<sup>[7]</sup>以及Tzeng(1973)<sup>[8]</sup>使用Liu和Ma(1970)<sup>[9]</sup>首先提出的连续分心实验范式(continuous-distractor paradigm)发现,长时记忆中同样存在系列位置效应。Baddeley和Hitch(1977)以及Rundus(1980)在不随意(incidental)学习实验中也观察到长时记忆中的近因效应<sup>[10]</sup>。这些发现都和以往用初级记忆理论对近因效应的解释产生矛盾。因而,Bjork和Whitten(1974)<sup>[7]</sup>提出顺序(ordinal)或情景(contextual)理论来解释近因效应和负近因现象。认为导致负近因现象的原因有两个:①被试对于最后几个项目复述和注意较少,因此

① 与此文有关的交流请与吴艳红(100871 北京大学心理系)联系。

很难提取。②被试对于最后几个项目在分测验和最后总测验时使用的提取策略有所改变。即时回忆时,最后几个项目是通过使用顺序或情景线索来提取的,也就是说,此时的近因效应是由于系列项目之间记忆痕迹的差异造成的,最后几个项目和前面几个项目比中间项目易于分辨;而前面几个项目主要是通过使用在复述过程中建立的项目之间的联系线索来提取的。但是,最后总测验时,即对全部项目再次进行自由回忆时,顺序或情景线索不再有效,迫使被试只能依赖于项目之间的联系线索或其他线索,既使对最后几个项目的提取也是如此。最后总测验时,前面几个项目可以利用联系线索进行回忆,后面几个项目既没有联系线索也没有顺序或情景线索可以利用,因而,出现首因效应和负近因现象。

因此我们认为,用两种记忆过程理论来解释系列位置效应,尤其是用初级记忆过程来解释近因效应和负近因现象具有很大局限性。有必要在更宽泛的理论框架下,结合当代心理学记忆领域中新的研究成果,重新考察系列位置效应,特别是近因效应的性质。

本实验我们采用 Craik(1970)关于负近因现象的实验程序,用自由回忆法进行分测验和总测验,以期建立一个首因效应和负近因现象的基线模式,同时用线索回忆(cued-recall)测验,在提供线索的情况下,考察是否存在负近因现象,并验证 Bjork 和 Whitten(1974)提出的顺序或情景理论。

## 2 实验方法

### 2.1 被试

20名北京大学本科生。实验后付给报酬。所有被试均没有本类心理学实验的经验。视力或校正视力正常,颜色辨别能力正常。

### 2.2 实验设计和材料

本实验采用  $2 \times 2 \times 16$  因素混合设计。自变量是测验方式(自由回忆、线索回忆)、回忆方式(分测验、总测验)和系列位置。测验方式采用组间设计,回忆方式和系列位置采用组内设计。

通过预实验,挑选 96 个汉字作为实验材料。在线索回忆测验中,用作补笔的每个汉字偏旁在 96 个汉字中是唯一的。每个汉字偏旁至少有 10 种补笔结果。根据预实验中每个汉字的补笔率和该汉字的频率(《现代汉语频率词典》,北京语言学院语言教研室编著,1988 年),把 96 个汉字平均分为 6 组,每组 16 个汉字。每组平均补笔率为 12%(5%—29%),平均频率为 0.0284%(0.0001%—0.5745%)。

### 2.3 实验程序

所有实验材料和指示语都用计算机呈现。实验材料用宋体字呈现在计算机屏幕中央,字体大小为 56%56 像素,每次呈现一个汉字,呈现时间为一秒,时间间隔为一秒。20 名被试中,12 人进行自由回忆,其余 8 人进行线索回忆测验。自由回忆测验时,告知被试这是一个记忆实验,并要求被试尽量记住计算机屏幕上出现的每一个汉字,当屏幕上出现“请开始回忆”时,要求他们尽量多地写出呈现过的汉字,顺序不限,时间为一分钟。然后开始呈现下一组汉字,一共 6 组,每组 16 个汉字,要求相。每组汉字有 4 种呈现顺序,每种顺序 3 人。全部 6 组汉字回忆结束后,在事先未告知的情况下要求被试回忆刚才呈现过的所有汉字,顺序不限。线索回忆测验中,呈现每组 16 个汉字时,要求被试通过北京大学心理系实验心理学实验室设计的 PES 系统进行反应,即通过按 PES 系统反应盒上相应的红、绿、黄三种反应键来判断计算机屏幕中央呈现汉字的颜色是红色、绿色,还是黄色。反应时要求又快又准。汉字只有红、绿、黄三种颜色,并且每次呈现汉字的颜色是随机的。每组材料有 4 种呈现顺序,每种顺序 2 人同时进行实验。正式实验之前给被试呈现 10 个红、绿、黄三种颜色随机出现的英语单词,向被试讲解实验要求和反应方法。待被试掌握之后,开始正式实验。作为线索回忆线索的每一个汉字的偏旁以 2 号宋体字分别打印在每张小卡片上。每一组 16 个汉字呈现后,

立即要求被试以每张卡片上的汉字偏旁为线索,尽量多地回忆刚才屏幕呈现过的汉字。测验卡片的排列顺序与每组汉字呈现的顺序相反,以10秒每个的速率进行测验。6组实验要求相同。全部6组实验完成后,要求被试按相同的实验要求对所有的偏旁再次测验。偏旁排列的顺序与6组汉字呈现的顺序相反。

### 3 结果和分析

#### 3.1 自由回忆测验中分测验和最后总测验的系列位置效应的比较

图1表示自由回忆测验中6个分测验平均结果和最后总测验系列位置曲线的差异。纵坐标表示能够正确回忆出汉字的百分数,横坐标表示字单中汉字的系列位置。

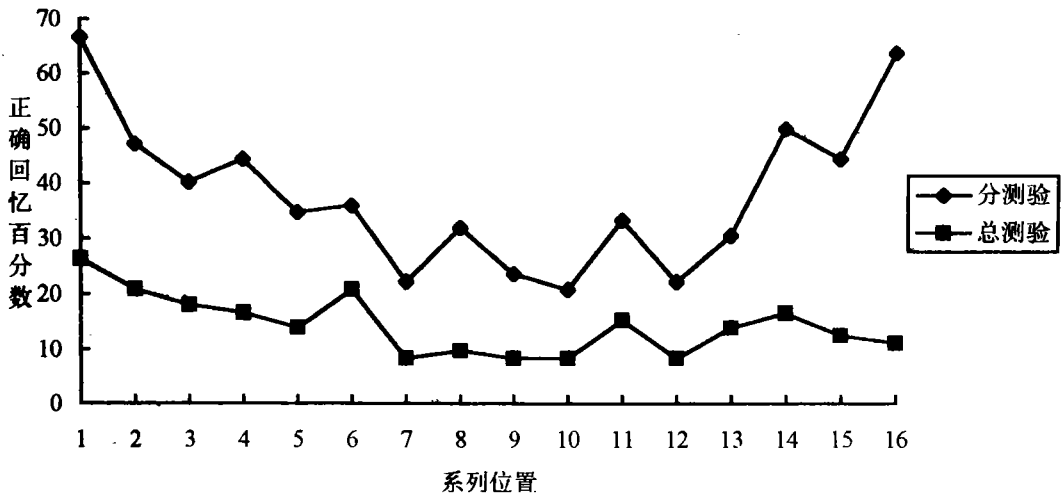


图1:自由回忆分测验和总测验系列位置曲线

使用 SPSS 统计软件包对所有结果进行处理。根据 MANOVA 的分析结果表明,自由回忆测验分测验存在明显的系列位置主效应( $F(1,11)=356.37, P<0.001$ ),而且系列位置曲线各与系列位置曲线的其它所有点均无显著差异。根据图1可以看到总测验系列位置曲线的最后一点正确回忆百分数的平均数之间也存在明显差异( $F(15,165)=6.12, P<0.001$ )。

自由回忆测验最后总测验的结果与分测验的结果相同,即总测验存在明显的系列位置主效应( $F(1,11)=76.03, P<0.001$ ),而且系列位置曲线各点正确回忆百分数的平均数之间也存在明显差异( $F(15,165)=1.99, P<0.05$ )。

自由回忆测验分测验系列位置曲线各点与总测验系列位置曲线各点正确回忆百分数的平均数之间均有显著差异( $F(1,22)=84.28, P<0.001$ )。分测验和总测验之间存在交互作用( $F(15,330)=2.66, P=0.001$ )。

根据 t 检验,总测验系列位置曲线的第1点与系列位置曲线的大多数点(系列位置曲线的第1点与第3点、第4点( $P<0.05$ )、第5点、第7点( $P<0.01$ )、第8点( $P<0.05$ )、第9点、第10点( $P<0.01$ )、第12点、第13点( $P<0.05$ )、第15点( $P<0.01$ )、第16点( $P<0.05$ ))的正确回忆百分数的平均数之间有显著差异。而总测验系列位置曲线的最后一点正确回忆百分数的平均数低于系列位置曲线的大多数点的正确回忆百分数的平均数。因而说明总测验中存在负近因现象。

总之,以汉字为材料的自由回忆测验的分测验中存在明显的系列位置效应,即存在着首因和近因效应。而最后总测验表现出首因效应和负近因效应。

#### 3.2 线索回忆测验中分测验和最后总测验系列位置效应的比较

图2表示线索回忆测验6个分测验的平均结果与最后总测验系列位置曲线差异。纵坐标表示

以汉字偏旁为线索,正确回忆呈现汉字的百分数。横坐标表示字单中汉字的系列位置。

根据 MANOVA 的分析结果,线索回忆分测验存在明显的系列位置主效应( $F(1,7)=171.69, P<0.001$ ),而且系列位置曲线各点正确回忆百分数的平均数之间存在明显差异( $F(15,105)=4.50, P<0.001$ )。

线索回忆测验总测验也存在明显的系列位置主效应( $F(1,7)=69.65, P<0.001$ ),但是总测验系列位置曲线各点正确回忆百分数的平均数之间没有显著差异( $F(15,105)=1.55, P=0.102$ )。最后总测验系列位置曲线的第1点只与第11点( $P<0.01$ )和第14点( $P<0.05$ )正确回忆百分数的平均数有显著差异;而其最后一点与系列位置曲线其他所有点的正确回忆百分数的平均数均无显著差异。

线索回忆测验分测验系列位置曲线各点和总测验系列位置曲线各点正确回忆百分数的平均数之间也存在显著差异( $F(1,14)=6.83, P<0.05$ )。但是分测验和总测验之间没有交互作用( $F(15,210)=1.8, P=0.290$ )。因而说明没有出现负近因现象。

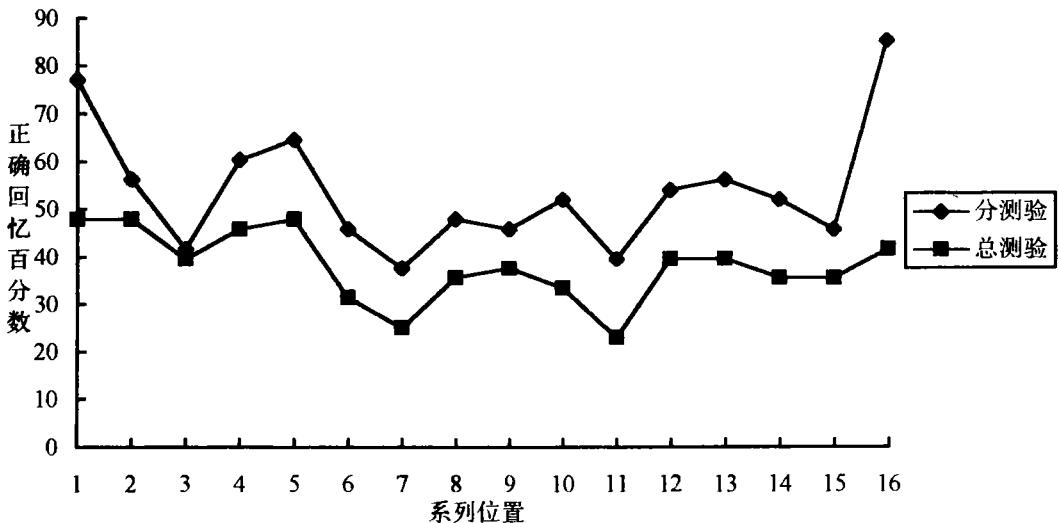


图2: 线索回忆分测验和总测验系列位置曲线

结果说明,线索回忆测验的分测验中存在明显的系列位置效应,而最后的总测验既没有表现出首因效应也没有表现出近因效应或负近因效应。

## 4 讨论

以上结果表明,自由回忆和线索回忆测验的分测验中都存在明显的系列位置效应,这与以国外文献报道的用不同实验方法得到的结果一致。本实验以中国汉字为实验材料,采用与 Craik (1970) 负近因现象实验相类似的实验程序,进行自由回忆测验时,得到与 Craik (1970) 相同的实验结果,即分测验表现出明显的系列位置效应,最后总测验保留首因效应,并出现负近因现象。而在线索回忆测验中,分测验的系列位置效应与 Craik (1970) 的实验结果相同,总测验没有表现出首因效应和负近因现象,在这一点上不同于 Craik (1970) 的实验结果。因此,我们认为很难用两种记忆过程理论来解释本实验结果。1996年,Neath 和 Crowder 的实验证明<sup>[3]</sup>,系列呈现的时间非常短暂时(0.5秒和1.1秒),仍然存在明显的系列位置效应。这也是两种记忆过程理论不能解释的。根据本实验自由回忆和线索回忆测验的结果,我们更倾向于接受 Bjork 和 Whitten (1974) 提出的顺序或情景理论。

4.1 由于自由回忆测验时要求被试有意识记忆,被试对系列位置曲线前面一些汉字复述次数较

多,因此对这些汉字的加工水平较深,汉字之间容易形成联系,即时回忆和记忆保持的效果好;被试对系列位置曲线中间几个汉字复述次数少于以对前面几个汉字的复述次数,因此对这些汉字的加工水平相对较浅,汉字之间形成的联系也较差,即时回忆和记忆保持效果相对也较差;对系列位置曲线后面几个汉字复述次数最少,对这些汉字的加工水平最低,汉字之间难以形成联系,但由于顺序(ordinal)效应的作用,即最后几个汉字记忆痕迹区辨率高,因而即时回忆效果较好。顺序效应和Crowder(1976)提出的类比一致,Crowder认为<sup>[4]</sup>,对一个词单的自由回忆就好像是在某一点看铁道沿线的电线杆。离注视点最近的电线杆最容易分辨,离注视点越远越难以分辨任何两个电线杆。因此,自由回忆分测验表现出明显的系列位置效应。但是,总测验时,系列位置曲线前面几个汉字仍然具有线索可以利用,而后面几个汉字既没有线索可以利用,顺序效应又已经消失,而对最后几个汉字的提取策略,在分测验和总测验时有所不同,即对最后几个汉字出现提取策略由顺序或情景线索到联系线索的转换。所以总测验系列位置曲线只保持首因效应,并且出现负近因现象。

4.2 线索回忆测验时被试对呈现的汉字只做比较浅的加工(判断呈现汉字的颜色),对汉字没有进行有意记忆,系列位置中所有汉字与汉字之间形成的联系都较浅,但是由于给被试提供现成的回忆线索(汉字偏旁),从实验结果来看,这足以弥补汉字加工较浅的不足,所以线索回忆分测验的系列位置曲线与自由回忆分测验的系列位置曲线比较一致。分测验之所以出现系列位置效应,可能也是因为如Bjork和Whitten(1974)所谓的顺序或情景因素的作用。也就是说,系列位置曲线前面几个汉字和后面几个汉字相对于中间位置的汉字来说易于分辨,所以分测验中出现系列位置效应;线索回忆总测验中,由于顺序或情景因素作用已经消失,因而不能出现近因效应。而且,所有位置的汉字都只能以提供给被试的汉字偏旁这一个线索进行回忆。即由于系列位置的所有汉字都有现成的线索可以利用,所以提取时既没有表现出前面几个汉字的优势,也没有表现出最后几个汉字的劣势。这样,在线索回忆总测验中,既没有出现首因效应,也没有出现负近因现象。

关于首因效应与近因效应性质的研究正成为一个热点<sup>[11]</sup>。因为它涉及短时记忆与长时记忆的区别是否正确,记忆痕迹区辨率的假设是否成立等重要理论问题。下一步我们将尝试直接证明,首因效应主要依赖线索(cue-dependent),而近因效应主要是依赖痕迹(trace-dependent)。

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# ENGLISH ABSTRACTS

## A RESEARCH ON THE COGNITIVE CHARACTERISTICS OF MIN-DURATION ESTIMATION

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The cognitive characteristics of Min-duration estimation were studied, and the validities of the SS model, PT model and CS model were tested in this research. The results showed that min-duration estimation was a process in which the temporal information would be rebuilt when it was retrieved by the segmentation of the non-temporal information, that change / segmentation and attentional allocation had significant effects on min-duration estimation, and that the validity of the SS model was the lowest, while those of the others were higher.

**Key words:** min-duration estimation, cognitive characteristic, SS model, PT model, CS model.

## CONSTRUCTING THE CHINESE MORAL JUDGMENT COMPETENCE RATING SCALE FOR 12-17-YEAR-OLD SCHOOL CHILDREN

Gu Haigeng, Li Boshu

(Shanghai Teacher's University)

This thesis focuses on the whole constructing process of the Chinese moral judgment competence rating scale for 12-17-year-old school children which consists of four moral dilemmas. The scale was developed to measure simultaneously children's preferences for moral agreements and their competence in applying self-accepted moral reasons to these dilemmas. A set of age norms was established from a standard sample which included 1324 subjects of urban and rural middle schools in Shanghai, and some psychometric properties were also examined. The reliability and validity were found to be high.

**Key words:** the moral judgment competence, rating scale, norm.

## EFFECTS OF A TWO-HOUR UNILATERAL VISUAL DEPRIVATION ON MEMORY RETENTION IN CHICKS

Gao Yang, Kuang Peizi, et al.

(Institute of Psychology, Chinese Academy of Sciences)

In order to find out the difference between one-eye learning and double-eye learning, 2-day-old chicks were trained to learn the one-trial passive avoidance task with just one eye after 2 hours of unilateral visual deprivation in this research. The main result was: No matter which eye it learnt with, the 2-day-old chick retained its short-term memory very well. The intermediate-term memory of 2-day-old chicks learning with one eye was unstable, especially learning with the right eye.

**Key words:** chick, one trial passive avoidance task, intermediate medial hyperstriatum ventrale, lobus parolfactorius.

## THE EFFECTS OF DIFFERENT RADICALS AS A PRIME ON THE IDENTIFICATION OF COMPOUND CHINESE CHARACTERS

Shen Mowei, Li Zhongping, Zhu Zhuxiang

(Psychology Department, Hangzhou University)

Using a priming paradigm, the present research investigated into the effects of different radicals, as a prime. The results showed that: 1) priming effects were found in the four prime type conditions and 2) the quantities of priming varied with three different levels of display time.

**Key words:** priming paradigm, compound Chinese characters, the interactive activation model.

## THE PRECONSCIOUS MODEL AND A RESEARCH OF STUDENTS' FEELINGS-EMOTIONS

Gao Hua, Yang Zhiliang

(Psychology Department, East China Normal University)

The Independence Model and Redundancy Model of PDP were introduced and a new model, the Preconscious Model, was advanced. In the experiment, the feelings-emotions of 50 students were studied by explicit and implicit methods. The results indicated: the students showed different sensitivity to different feeling words; with the preconscious concept as a medium the Preconscious Model could display the dynamic relationship between the conscious and the unconscious.

**Key words:** implicit memory, process dissociation procedure, preconscious model, feeling-emotions test.

## SERIAL POSITION EFFECTS IN FREE RECALL

**ANDCUED RECALL TESTS***Wu Yanhong, Zhu Ying*

(Psychology Department, Beijing University)

96 Chinese characters were used in the experiment. The subjects were 20 collegestudents from Beijing University. Both primacy and recency effects were observed in the immediately free recall tests, and negative recency effects were found in the final overall free recall tests. Robust serial position effects were also observed in the 6 immediate cued—recall tests, but negative recency effects were absent in the final overall cued—recall tests. These results supported the ordinal or contextual theory developed by Bjork and Whitten (1974).

**Key words:** serial position effects, the primacy effect, the recency effect, negative recency effects, ordinal and contextual theory.

**CAN THE CHASM BETWEEN THE BRAIN AND THE COMPUTER BE BRIDGED?***Feng Ruiben*

(Biology Department, East China Normal University)

*Zhang Weidong*

(Psychology Department, East China Normal University)

Man's thorough understanding of the human brain and its mental process will indicate the occurrence of an event of a philosophically fundamental nature. Such an understanding will be marked by man's successful simulation and retrieval of the mental process. The rise of artificial intelligence as a branch and extension of neuroscience makes it possible that the chasm between the human brain and the computer will eventually be bridged.

**Key words:** neuroscience, artificial intelligence, neural network.

**WHAT AFFECT THE COOPERATION BEHAVIOR***Li Yan, Chao Zifang*

(Shanghai Normal University)

Cooperation is a typical pro—social behavior. Based on discussing the history of cooperation research, this thesis advocates the theory of representation and aims at testifying such a theory. 64 boys and girls aged 14 to 17 were involved in either Prisoner's Dilemma Game or Chicken Game for 18 trials under one of four communication—partner conditions. There search results suggested: Anticipated opportunity to communication enhanced initial cooperativeness in the PDG situation. The representation of a teacher partner

favoured the establishment of cooperative interaction; the representation of a student partner led to defensive behavior. In addition, the subject's age, sex and the matrix faced also affected his or her representation system, and these in turn affected the behavior of the subject. All these suggested that the representation of the subject had existed before the actual interaction began. Under the communication condition, the increase in cooperation behavior could be seen only in those who were willing to use the communication opportunity positively.

**Key words:** cooperative behavior, communication, partner, representation.

**THE MENTAL HEALTH OF COLLEGE AND MIDDLE—SCHOOL STUDENTS IN SHANGHAI AND ITS RELATIONSHIP WITH PHYSICAL EXERCISES***Jiang Biyan, Zhu Beili*

With the Abbreviated Profile of Mood States (POMS) revised in China, and the Physical Activity Rank Scale—3 (PARS—3), this study examined college and middle school students' mental health and its relationship with physical exercises. The results of the

study showed: 1) many students had high tension, anger, fatigue, depression and confusion, and low vigor and self—esteem; 2) physical exercises were helpful to reduce students' tension, anger, fatigue, depression and confusion, and improve their vigor and self—esteem; 3) physical exercises of moderate to high level had better mental health effect; 4) pleasure in sports was closely related to the persistence in exercises.

**Key words:** POMS, mental health, quantity of physical exercises.

**THE CHARACTERISTICS AND TESTING METHODS OF CONGENITAL COLOR VISION DEFECTS***Chi Haihong, Sun Xiuru, Xu Zonghui*

(Institute of Psychology, Chinese Academy of Sciences)

This paper introduced briefly characteristics of various congenital color vision defects and commonly used testing methods used. Different congenital color vision defects had different characteristics in color match, spectral sensitivity and color difference discrimination etc. Based on these characteristics, color vision tests were devised according to one of the color vision defects. The commonly used test methods were pseudoisochromatic plates, arrangement tests and anomaloscopes and so on. In general, these testing methods