A Prediction/Screening
Instrument for Problem Gamblers

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Abstract

   The new screening instrument classifies gamblers into four gambler-types: social, regular, transitional, or problem gambler. This instrument determines independently (a) an individual's actual gambler-type by measuring his gambling activities, and (b) the individual's predicted (potential) gambler-type in terms of five variables (e.g., first gambling experience). The instrument serves a diagnostic function when a match is found between the actual and the predicted membership. This screening instrument becomes a predictive tool when an individual's actual type is more benign than his predicted type. The progress of a treatment program may be monitored if it is shown with the instrument that the predicted gambler-type becomes progressively more benign than the actual gambler-type.

Keywords: Screening instrument; Types of gamblers; Validity; Discriminate analysis; Diagnostic function; Predictive function; Monitoring function.

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This paper begins by examining the meanings of "gambling." Also discussed are various gambler-types, and the need to distinguish between a diagnostic tool (actual gambling status) and a screening tool (potential gambling status) for identifying gambler-types. An account of the development of the first Chinese (and English version) screening test, Leung's Predictive Screening Tool for Problem Gamblers, is described.

Gambling and Gambler-types

A *gambler* is someone who engages voluntarily in a game of chance with the intention of winning something. Such a definition includes anyone who buys a charity raffle ticket once to anyone who gambles heavily everyday. Given this definition, it is not surprising that the percentage of people who have gambled is very high in every gambling prevalence study (e.g., Sproston, Erens, & Orford, 2000).

However, society uses the label, "gambler," in an evaluative manner. For example, it is not uncommon to hear someone say, "I play cards occasionally with friends. But I am not a gambler." At the same time, most people would treat an occasional participation in a game of chance as an acceptable pastime even though they object to those who "gamble" all the time or run into "gambling" difficulties. In other words, the "gambler" or "gambling" label is often used with an evaluative meaning that signifies disapproval of the person or of the gambling activity itself.

Gambling is deemed excessive (and hence, disapproved of) if it is carried out at the expense of other obligations in terms of time, attention or money. Gambling becomes unacceptable if the individual's relationship with family members, friends, colleagues or society at large suffers as a result of his or her gambling activities. The problems caused by gambling escalate when the individual runs into debts or loses employment or sees his or her family disintegrate. The gambler also suffers from anxiety, distraught feelings, depression or more severe psychological problems, such as suicidal ideations.

The aforementioned set of intertwining criteria is reflected in the common distinction among different types of gamblers: Social, regular, transitional and problem gamblers. A *social*

gambler is an individual who participates in a game of chance occasionally for the purpose of socializing. A *regular gambler* is one who participates in a game of chance on a regular basis as a pastime. However, the stake is small and regulated, such that the individual is never at any financial risk. Neither a social nor a regular gambler would engage in gambling at the expense of the individual's personal, familial, professional or societal obligation.

At the other end of the continuum are individuals for whom gambling is a top priority, despite the psychological, personal, familial or financial difficulties it brings about. These individuals are categorized variously as *pathological* (medical model), *compulsive* (Gamblers Anonymous model) or *problem* (psychological model) gamblers. This group will be called *problem gamblers* henceforth, as this term is more inclusive and its use avoids some conceptual difficulties (see Walker, 1995). Some investigators identify an individual who oscillates between being a regular gambler and a problem gambler as a *transitional gambler*. In short, there is a benign-to-problematic continuum of involvement in gambling activities.

Diagnosis versus Screening

The majority of contemporary research concentrates on problem gamblers. Currently, professionals or researchers dealing with gambling problems have used the following tools: (a) Lesieur and Blume's (1987) South Oaks Gambling Screen (SOGS); (b) the Gamblers Anonymous (GA) Questionnaire; and (c) the Diagnostic and Statistical Manual for Mental Disorders—Fourth Edition (DSM-IV; American Psychiatric Association, 1994) items for depression. Although these tools are useful for diagnostic purposes, they may not be as useful as proactive screening instruments, as there are important differences between the diagnostic and screening situations.

To begin with, the aforementioned tools were developed to confirm and assess individuals who are seeking help because of their gambling problems. Hence, the generality of these tools is suspect when used outside the clinical setting (Culleton, 1989; Dickerson, 1993). A screen, on the other hand, should be a tool that may be applicable to anyone who has not yet developed the problematic behavioral patterns. Consequently, it can be validy applied to someone who is not necessarily seeking help.

Reasons for Leung's Predictive Screening Tool

There are both general and specific reasons why a new tool for screening all types of gamblers is needed. In general, research on gambling hitherto has been all about gamblers who were experiencing significant difficulties. Given the benign-to-problematic continuum of gamblers and the social costs of problems created by excessive gambling, it is not sufficient to concentrate

research efforts only on problem gamblers (Walker & Dickerson, 1996). It may be necessary to be able to locate any gambler on the continuum, so that the necessary proactive, preventive measures may be undertaken to help prevent the individual from becoming a problem gambler. There is, unfortunately, no such proactive selection instrument available.

By definition, non-problem gamblers do not have the symptoms indicated by the commonly-used diagnostic tools (e.g., criminal behavior). Moreover, there are situations in which it is necessary to predict whether or not an individual is a potential problem gambler (e.g., in personnel selection). Existing tools are not suited for such a purpose.

There are also two specific reasons for developing a learning tool. First, there is neither a diagnostic nor a screening tool presently available in Chinese. The three commonly-used diagnostic tools may not be ideal for tapping into the distorted thinking patterns of Chinese gamblers. The second specific reason is our response to the legalization of football gambling in Hong Kong (i.e., gambling on the outcomes of soccer matches). As soccer is a popular sport in Hong Kong, there exists the fear that many young people may be attracted to football gambling. A screening tool may be helpful to school officials who wish to assess whether or not their students are likely to become problem gamblers when exposed to the possibility of gambling on the popular sport.

Leung's Predective Screening Test for Gambling (called the *Screen* henceforth) was developed for the purposes just described. The objective of the Screen is to help classify Chinese gamblers on the benign-to-problematic continuum. The version to be reported is a modification of the previous version reported by Leung (in press). The substantive change is the addition of the variable, "general state of health."

Method

Participants

Two hundred and seventy-eight voluntary participants were recruited from three settings in Hong Kong. Apart from 11 participants who did not report their gender, there were 179 males and 88 females. Their age ranged from 17 through 80; their mean age was 40.67 with a standard deviation of 13.79. A questionnaire was administered to 91 individuals in a Gamblers Anonymous Meeting (GA). Ninety-six individuals attending the off-course betting shops agreed to voluntarily answer the questionnaire. Ninety-one voluntary respondents were obtained in various settings other than a betting venue (e.g., university campus, recreation centers, and the like).

The 278 participants were randomly divided into the *discriminant-analysis group* (DAG;

N_1=201) and the *cross-validation group* (CVG; N_2=77). The DAG was used to derive the classification coefficients for the Screen, which were cross-validated with the CVG. The choice of N_1 and N_2 conformed to the practice of reserving a reasonable proportion of the original data for cross-validation purposes when a new screening tool is constructed (Tabachnick & Fidell, 2001).

Materials

The questionnaire was constructed in Chinese and consisted of questions on about 25 topics, many of which had multiple sub-questions for clarification purposes. In total, there were 195 items (see Table 1). For example, the respondent was asked 19 questions about his or her "feelings towards gambling" (e.g., "Being happy?" "Being diffident?" "Being excited?", etc.) Moreover, each of these questions had four frames of reference: (a) during the first gambling episode; (b) while gambling; (c) while winning; and (d) while losing.

The 195 items in the questionnaire were constructed to measure six variables. Five of these were predictor variables (see Rows 1 through 5 of Table 1): (a) first gambling experience (FGE); (b) general attitudes towards gambling (GATG); (c) environmental conduciveness to gambling (ECTG); (d) distorted thinking (DT); and (e) general state of health (GSH). The sixth variable was the benchmark variable: Current gambling status (CGS). As may be seen from the italicized entry in Row 6 of Table 1, CGS consisted of items that solicited information about the individual's frequency of gambling, monetary commitment and debts incurred (if any). An illustrative example of each of the six variables may be found in Table 1.

Procedures

Separate procedures were carried out for (a) data collection, (b) setting up the gambler-type benchmark, and (c) cross-validating the Screen.

Data Collection

Data were collected with the Screen in three settings: (a) a GA meeting; (b) four off-course betting shops in different parts of Hong Kong; and (c) several non-gambling venues (e.g., a university campus, recreation centers, etc.). The questionnaire was administered to those who attended the GA meeting as a group. Participants in the other two settings were approached individually. The respondent answered the questionnaire on his or her own. One of the experimenters was available, regardless of the setting, to answer questions about the questionnaire. In all cases, the questionnaire was filled out and collected *in situ*.

Data Analysis: Questionnaire Items and Variables

As shown in the right-most column of Table 1, multiple questionnaire items were combined to represent the five predictor variables, as well as the lone benchmark variable. For example, the benchmark variable, "current gambling status," consisted of 39 items. These items were used to collect information about (a) when the respondent last gambled (Column 2 of Table 2); (b) the sort of games played (Column 3); (c) from whom money was borrowed (if applicable; Column 4); (d) the gambling venues visited (Column 5); (e) the frequency of gambling (Column 6); and (f) the amount of money committed to gambling, including debts (if applicable; Column 7). The "Time last gambled," "Frequency" and "Monetary commitment" questions were fixed-option items (viz., participants were allowed only one response). However, participants were allowed multiple answers to "Type of game," "Lender" and "Gambling venue."

Data Analysis: Weighting Questionnaire Items

Column 1 of Table 2 shows that answers to the six questions, represented by Columns 2 through 7, were weighted in terms of their influences on someone getting into gambling difficulties. For instance, suppose that the respondent has incurred a gambling debt of $5,000.00. The answer to the "Monetary commitment" question would be assigned 3 points if the individual borrowed the money from a loan shark, but only 1 point if the individual borrowed the money from his parents (see Column 4 of Table 2). The assumption is that one could get into bigger (and sooner) troubles when borrowing from a loan shark.

Likewise, playing roulette at casinos was worth 3 points, whereas playing *mah-jong* (a commonly-played game in Chinese communities) was worth 1 point (see Column 3 of Table 2). The assumption is that, as the mah-jong game is often played among relatives or friends (who may refuse to play if the wager or stake is too high or if the individual is losing control during the game), it is less likely than in a game of roulette that an individual player would lose a lot of money.

As illustrated in Columns 3 and 4 of Table 2, the rationale for weighting the benchmark variable was informed by clinical experience, or theoretical or empirical understanding. It applied to all five predictor variables as well. Moreover, the coding was such that a large numerical value signifies a condition more conducive to gambling difficulties.

Data Analysis: The "Actual Gambler-Types"

The Screen enables one to categorize an individual into one of four gambler-types (viz., social gambler, regular gambler, transitional gambler and problem gambler) in two independent ways, as may be seen from (a) the blue components that culminated at the "Predicted gambler-type" rectangle[4], and (b) the green components that end at the green "Actual gambler-type" hexagon[6] in Figure 1.

The participants' "current gambling status" scores (see green hexagon[2] in Figure 1) were first cast into a cumulative percentage distribution. Consequently, every participant was assigned a percentile rank. These percentile ranks were used to assign participants to the four actual gambler-type (see the green elongated crescent[5] in Figure 1): The top 33% were categorized as "problem gamblers," the next 10% were "transitional gamblers," the next 37% were "regular gamblers," and the bottom 20% were social gamblers. The result of this categorization (see the pink rectangular shape in Figure 1) was used as the benchmark for assessing the categorization outcome based on the method to be described next.

Data Analysis: The "Predicted Gambler-Types"

The second method of ascertaining gambler-type is shown in the blue components of Figure 1. Participants' scores on five predictor variables (viz., the five blue FGE, GATG, ECG, DT and GSH ovals in Figure 1) were entered together into the discriminant analysis procedure (see the blue "Discriminant Scores" elongated crescent[3]) in the following manner to predict the participants' potential gambler-type (see the pink rectangular shape[9] in Figure 1):

1. To start the discriminant analysis procedure, one has to specify the grouping factor, as well as the respective prior probabilities of its four levels. The actual gambler-types were used as the levels of the grouping factor, and their respective sizes were used as the prior probabilities.

2. Some initial coefficients were assigned to the five predictor variables to form a linear equation that determined a discriminant score for each participant. Consequently, members of the four actual gambler-types (see the green hexagon[6] in Figure 1) were given a second set of scores, called the "discriminant scores."

3. Using the discriminant scores, the following calculations were performed: (a) the between-group sum of squares (SSbetween); (b) the within-group sum of squares (SSwithin); and (c) the eigenvalue of the discriminant function (viz., the ratio between SSbetween and SSwithin).

4. Steps 2 and 3 were reiterated until the largest eigenvalue(s) were obtained.

5. The set of discriminant functions obtained at the end of Step 4 was deemed the best set of discriminant functions. They were used to assess if there was any relationship between the actual gambler-types and the five predictor variables.

6. As there were four actual gambler-types, a set of four classification coefficients was obtained, one for each gambler-type.

As an individual's predictor-variable scores were plugged into the four classification functions, s/he had a score for each of the gambler-types. The classification function that gave the individual the highest score determined his or her predicted gambler-type. Suppose that,

among the individual's four classification scores, the "regular gambler" score is the highest; he or she would consequently be deemed a regular gambler.

Data Analysis: Comparing the Predicted and Actual Gambler-Types

A comparision was made between the actual and predicted gambler-types (see the yellow "Compared[8]" component in Figure 1). The extent of matching was used as an index of the criterion-related validity of the Screen (Anastasi, 1976).

Results

The number of valid cases (N), minimum values, maximum values, means and standard deviations of the five predictor variables are shown in Table 3, wherein the distinction between the discriminant-analysis group and the cross-validation group was not made. The means and standard deviations of the five predictor variables for the four actual gambler-types may be found in Figure 2 and in Table 4.

Five separate one-way (actual gambler-type) ANOVAs were carried out for FGE, GATG, ECTG, DT and GSH. These analyses were used to assess whether or not the four actual gambler-types differed in terms of the five predictor variables (see the "F" column in Table 4). As shown, the four actual gambler-types differed significantly (at the 0.05 level) in terms of GATG, $F(3, 153)$ =8.34, and DT, $F(3, 153)$=7.43. They did not differ in terms of FGE, ECTG or GSH.

When all 278 participants were considered, their "current gambling status" scores (see the green hexagons[2,6] in Figure 1) ranged from 0 through 111, with a mean of 41.73 and a standard deviation of 23.80. These scores were used to determine the participants' actual gambler-type membership. The "Total" column of Table 5 shows that there were 17 "actual" social gamblers, 100 "actual" regular gamblers, 14 "actual" transitional gamblers, and 70 "actual" problem gamblers.

In anticipation of the subsequent need for cross-validation, only data from the discriminant-analysis group ($N_1 = 201$) were used in deriving the coefficients of the classification functions (called the *original* function), so as to obtain the predicted gambler-types (see the blue "Predicted gambler-type[4]" square in Figure 1). The five predictor-variable scores of these 201 participants were subjected to the discriminant analysis procedure (as described in detail above; see also the blue elongated crescent[3] in Figure 1).

Three discriminant functions were obtained; they were used to assess the relationship between the actual gambler-type and the predicted gambler-type. At the same time, participants were

classified into the four gambler-types with the four classification functions that were based on the means of the five predictor variables and the pooled within-group variance-covariance matrix.

The classification result is shown in the four cells defined by the intersection of the "Total" row and the four "Predicted gambler-type" columns in Table 5. Among the 201 participants, the Screen did not find any social gambler, nor did it find any transitional gamblers. However, the Screen identified 142 regular gamblers and 59 problem gamblers.

Agreement Between the Predicted and the Actual Gambler-Types

The first question asked about the Screen was whether or not the match between the predicted and the actual gambler-types was statistically significant. The match between the predicted gambler-type and the actual gambler-type was 61.2% (see Table 5), with a combined $\square_{(15)}^2$ of 37.29 (p<0.05). Therefore, the overall relationship observed between the actual gambler-types and the five predictor variables was not due to chance alone.

Determination of Chance Level

The second question asked about the statistically-significant match regarded the magnitude of superiority of the Screen's use over chance. To answer this question, the level of matching by chance alone must be known. As the four gambler-types differed in size, the average probability of a participant being assigned to a predicted gambler-type by chance was given by Equation 1 (see Garner, 1962):

Equation 1: $C_{pro} = p_{sg}^2 + p_{rg}^2 + p_{tg}^2 + p_{pg}^2$, where

C_{pro} = chance probability

p_{sg} = the prior probability of being a social gambler

p_{rg} = the prior probability of being a regular gambler

p_{tg} = the prior probability of being a transitional gambler

p_{pg} = the prior probability of being a problem gambler

Hence, C_{pro} was used as the reference when matching the predicted gambler-type to the acutal gambler-type. The chance level was 0.2958. Hence, the superiority of using the classification functions over guessing by chance was 31.62% (viz., 61.2% - 29.58%).

Cross-Validation

For cross-validation purposes, the original classification coefficients based on the discriminant-analysis group (N_1=201) were applied to the remaining 77 participants in the cross-validation group. The objective was to ascertain the utility of the original classification functions in classifying cases not included in the original analysis. Sixty-four members of the cross-validation group were classified with the original classification functions (13 cases were dropped because of incomplete information). The results are shown in Table 6. The match between the predicted and the actual gambler-types was 62.5%. The chance level of matching this new, validation matching was 0.368 (as determined from Equation 1). Use of the five variables of the Screen resulted in performance that was better than chance by 25.7% for the new cases. This magnitude compares well with the original 31.62% because the original classification functions are expected to perform less well with new data (Tabachnick & Fidell, 2001). It seems reasonable to suggest that the Screen has been cross-validated.

Discussion and Conclusions

Our objectives were to develop an instrument that may be used for (a) diagnosing gamblers who seek treatment, and (b) placing any individual on the benign-to-problematic gambler continuum for proactive screening purposes. The first concern regarding these objectives is the validity of the benchmark.

The common practice is to place a gambler on the benign-to-problematic gambling continuum with reference to an individual's (a) gambling frequency, (b) amount of money wagered, and (c) amount of gambling debts incurred. The participant's "current gambling status" score was a reasonable index of this common practice (as described in the "Questionnaire items and variables" and "Weighting questionnaire items" sections above; see also the green "Current gambling status" hexagon[2] in Figure 1). Hence, the gambler-types thus determined were characterized as the "actual gambler-types." At the same time, it is a reasonable benchmark for assessing the validity of the Screen.

As described above, the top 33% in terms of the "current gambling status" score were classified as "problem gamblers." This cut-off point was higher than what one would expect from prevalence studies (between 1 to 3%). However, the 33% were chosen because one-third of the participants were recruited in a GA meeting.

Given our objectives, the second concern is how useful the Screen is. To recapitulate, it was found that the predicted gambler-types matched the actual gambler-types better than chance (see the "Predicted = Actual" arrow in Figure 1). Specifically, among the 70 "actual" problem gamblers, 38 of them were predicted problem gamblers in Table 5 (or 13 out of 20 in Table 6).

This categorization was achieved without knowing the participants' actual involvement in gambling, thereby suggesting that the categorization achieved with the Screen is useful as a diagnostic tool.

Nevertheless, one may not be satisfied with an overall match between the predicted and actual gambler-types of 61.2% (see Table 5). However, this state of affairs does not detract from the Screen's usefulness for the following reason. All problem gamblers begin their gambling career as social or regular gamblers. As such, they would have low "current gambling status" scores before they become problem gamblers. Nonetheless, someone who is not currently heavily involved in gambling activities may become so later. This possibility suggests that, despite his or her low "current gambling status" score at the time of the test, some aspects of the social or regular gambler's attitudes or thinking may be quite like that of a problem gambler. The aspects in question are measured by the five predictor variables, and are reflected in the predicted gambler-type membership. In other words, the mismatch between the predicted and actual gambler-types may be as informative as the match.

As may be seen from the predicted "Problem gambler" column in Table 5, there are 21 false alarms (viz., 1 + 15 + 5 in the predicted "Problem gambler" column): One "actual" social gambler, 15 "actual" regular gamblers, and five "actual" transitonal gamblers were identified as predicted "problem gamblers." These are instances of the actual gambler-type being more benign than the predicted gambler-type (see the "Predicted > Actual" arrow in Figure 1). That is, even though these individuals had relatively "low current gambling status" scores, the configuration of the five predictor-variables for these participants suggests a high potential for becoming a problem gambler. In such a capacity, the Screen is a useful predictive tool.

Likewise, there are 32 misses; 32 "actual" problem gamblers were identifed as "predicted" regular gamblers. That is, the predicted gambler-type was more benign than the actual gambler-type (see the "Predicted < Acutal" arrow in Figure 1). This type of discrepancy may arise in the following situation. A problem gambler has been receiving cognitive-behavioural therapy for the last two months. Although his gambling behaviour is still problematic (hence, the high "actual" gambler-type), he has begun to change his attitudes towards gambling or has reduced his distorted thinking (hence, the lower "predicted" gambler-type). When used systematically, this information is helpful in monitoring whether or not a treatment is successful.

In conclusion, the cross-validated Screen may be used for two purposes at a level better than chance. First, it may be used to place gamblers on the benign-to-problematic continuum of gamblers when the configuration of the five predictor-variables is consistent with the gambler's current gambling status. Second, in case of an inconsistency between the actual and predicted

gambler-type membership, the Screen can serve either a predictive or a monitoring function.

References

- American Psychiatric Association. (1994). *Diagnostic and Statistical Manual for Mental Disorders* (4th ed.). Washington, DC.
- Anastasi, A. (1976). *Psychological testing* (4th Ed.). New York: Collier MacMillan International Edition.
- Culleton, R. P. (1989). The prevalence rates of pathological gambling: A look at methods. *Journal of Gambling Behavior, 5*(1), 22-41.
- Dickerson, M. (1993). Internal and external determinants of persistent gambling: Problems in generalizing from one form of gambling to another. *Journal of Gambling Studies, 9*(3), 225-245.
- Garner, W. R. (1962). *Uncertainty and structure as psychological concepts*. New York: John Wiley.
- Lesieur, H. R., & Blume, S. B. (1987). The South Oaks Gambling Screen (The SOGS): A new instrument for the identification of pathological gamblers. *American Journal of Psychiatry, 144*, 1184-1188.
- Leung, G. (in press). *A screening instrument for classifying gamblers*. Proceedings of the 10th Annual National Association for Gambling Studies (NAGS) Conference. Melbourne.
- Sproston, K., Erens, B., & Orford, J. (2000). *Gambling behaviour in Britain: Results from the gambling prevalence survey*. London: National Centre for Social Research.
- Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th Ed.). Boston: Ally and Bacon.
- Walker, M. B. (1995). *Psychology of gambling*. Oxford: Butterworth-Heinemann.
- Walker, M. B., & Dickerson, M. G. (1996). The prevalence of problem and pathological gambling: A critical analysis. *Journal of Gambling Studies, 12*(2) 233-248.

Table 1. An example of each of the five predictor variables, as well as the "current gambling status" variable		
Variable	An illustrative item of the variable	Number of items
1 First gambling experience	I won the first time I gambled.	17
2 General attitudes towards gambling	Gambling is not necessarily bad.	59
3 Conduciveness of environment to gambling	My home (or place of work) is close to a gambling venue.	30
4 Distorted thinking	I can win because I am lucky.	28

5 General state of health	In the last seven days, have you felt unable to concentrate?		22
Current gambling status	*You currently gamble (at least once):* *- daily;* *- weekly;* *- monthly;* *- half-yearly;* *- yearly;* *- (don't gamble any more)*		*39*
	Total		**195**

Table 2. Thirty-nine Screen items that contributed to six aspects of the "current gambling status"

1	2	3	4	5	6	7
Points	**Time last gambled (1 item)**	**Type of game (18 items)**	**Lender (8 items)**	**Gambling venue (8 items)**	**Frequency (1 item)**	**Monetary commitment (3 items)**
3	Last week	Casino games	Loan sharks	Gambling institutions (e.g., casinos, race courses, etc.)	Everyday	Heavy debts
2	Last year	Races	Financial institution	Hired venue	Every week/ month	Occasional/ small debts
1	Life-time	Mahjong	Family/ friends	Home	Once a year or less frequent	No debt

Table 3. The number of valid cases (*N*), minimum values, maximum values, means and standard deviations of the five predictor variables

Predictor variable	N	Minimum	Maximum	Mean	Std. Deviation
First gambling experience (FGE)	260	1.00	45.00	18.00	3.32

General attitudes towards gambling (GATG)	256	1.00	40.00	11.80	3.96
Environmental conduciveness to gambling* (ECTG)	258	-7.00	24.00	0.20	1.10
Distorted thinking (DT)	244	1.00	21.00	6.60	3.29
Current state of health (GSH)	236	.00	29.00	11.80	10.03

* Anti-gambling environmental elements were given a negative weight.

Table 4. The means, standard deviations, and *F*-ratios** for the five predictor variables

Predictor variable	The four levels of the independent variable (actual gambler-type)						
	Social	Regular	Transitional	Problem	F	df_1	df_2
First gambling experience (FGE)	18.0 (3.32)	15.57 (5.9)	14.17 (4.47)	17.67 (5.47)	2.45	3	153
General attitudes towards gambling (GATG)	11.8 (3.96)	11.93 (7.05)	14.00 (8.90)	18.17 (7.87)	8.34*	3	153
Environmental conduciveness to gambling (ECTG)	0.20 (1.10)	1.17 (3.65)	1.15 (2.81)	1.55 (3.83)	0.30	3	153
Distorted thinking (DT)	6.60 (3.29)	5.95 (3.57)	6.67 (4.32)	9.10 (4.44)	7.43*	3	153
General state of health (GSH)	11.8 (10.03)	14.62 (5.00)	18.28 (3.94)	16.41 (3.89)	3.90	3	153

* Significant at the .05 level

** The four levels of the independent variable (the actual gambler-type) of the 1-way ANOVA were social gambler, regular gambler, transitional gambler and problem gambler.

Table 5. The cross-tabulation of the actual gambler-type and the predicted gambler-type of the "discriminant analysis group" (n_1 = 201)

		Predicted Gambler-Type				
		Social gambler	Regular gambler	Transitional gambler	Problem gambler	Total
Actual Gambler-Type	Social gambler	0	16	0	1	17
	Regular gambler	0	85	0	15	100
	Transitional gambler	0	9	0	5	14
	Problem gambler	0	32	0	38	70
Total		0	142	0	59	201

* 61.2% of "current gambling status" grouped cases correctly classified;

% of correct classification by chance = 0.2958.

Table 6. The cross-tabulation of the actual gambler-type and the predicted gambler-type of the "cross-validataion group" ($n_2 = 77$)

		Group Membership Determined by Discriminant Functions				
		Social gambler	Regular gambler	Transitional gambler	Problem gambler	Total
Group membership by "current gambling status" (count)	Social gambler	0	3	0	1	4
	Regular gambler	0	27	0	5	32
	Transitional gambler	0	6	0	2	8
	Problem gambler	0	7	0	13	20
Total		0	43	0	21	64

*62.5 % of "current gambling status" grouped cases correctly classified;

% of correct classification by chance was 0.368.

Figure 1. An individual's gambler-type, determined independently with: (a) the five predictor variables (blue), and (b) the individual's current gambling status (green)
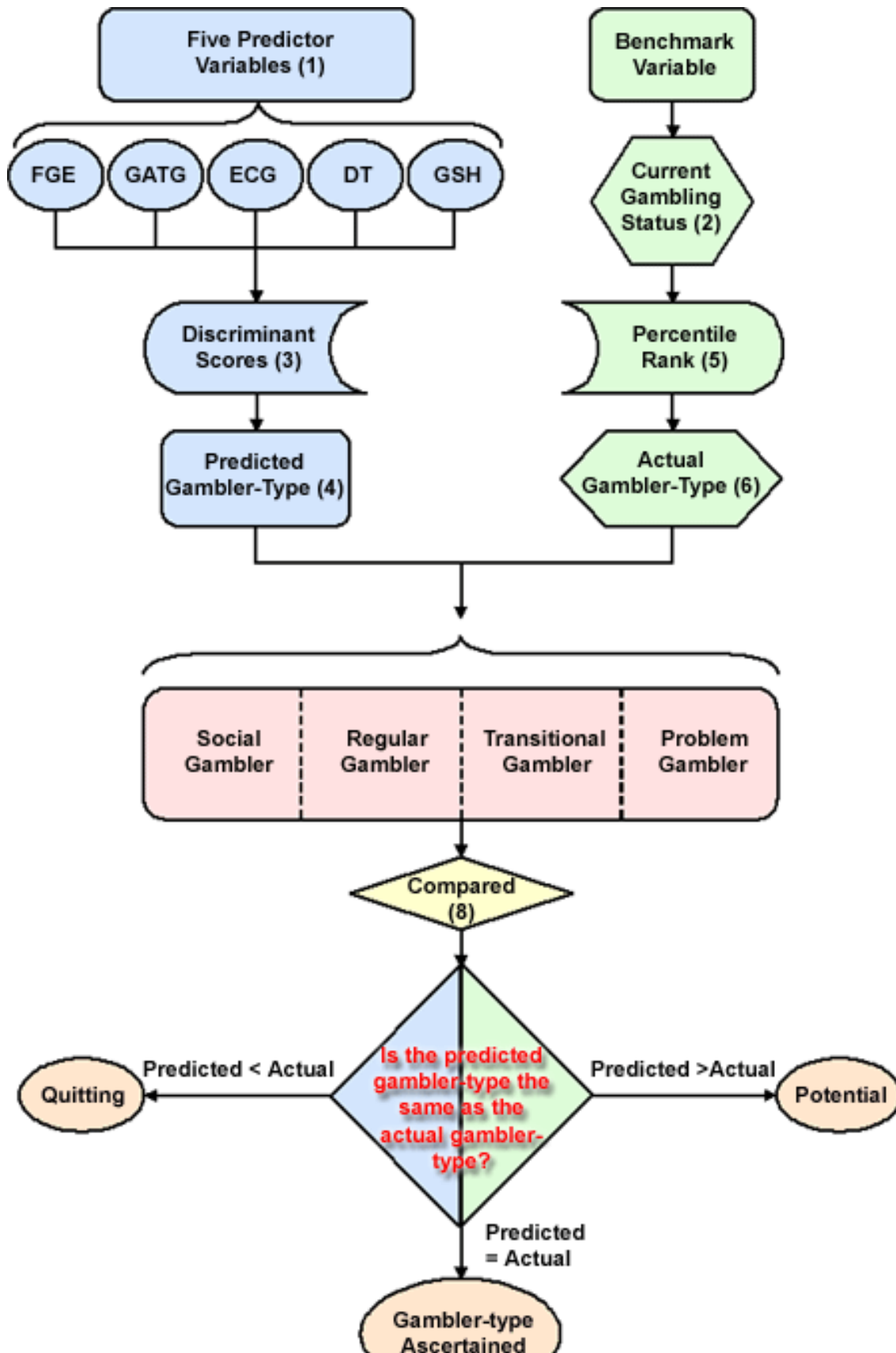
Gambler-type Ascertained

FGE	First gambling experience
GATG	General attitudes towards gambling
ECTG	Environmental conduciveness to gambling
DT	Distorted thinking
GSH	General state of health

Figure 2. Difference among the four gambler-types on five predictor variables
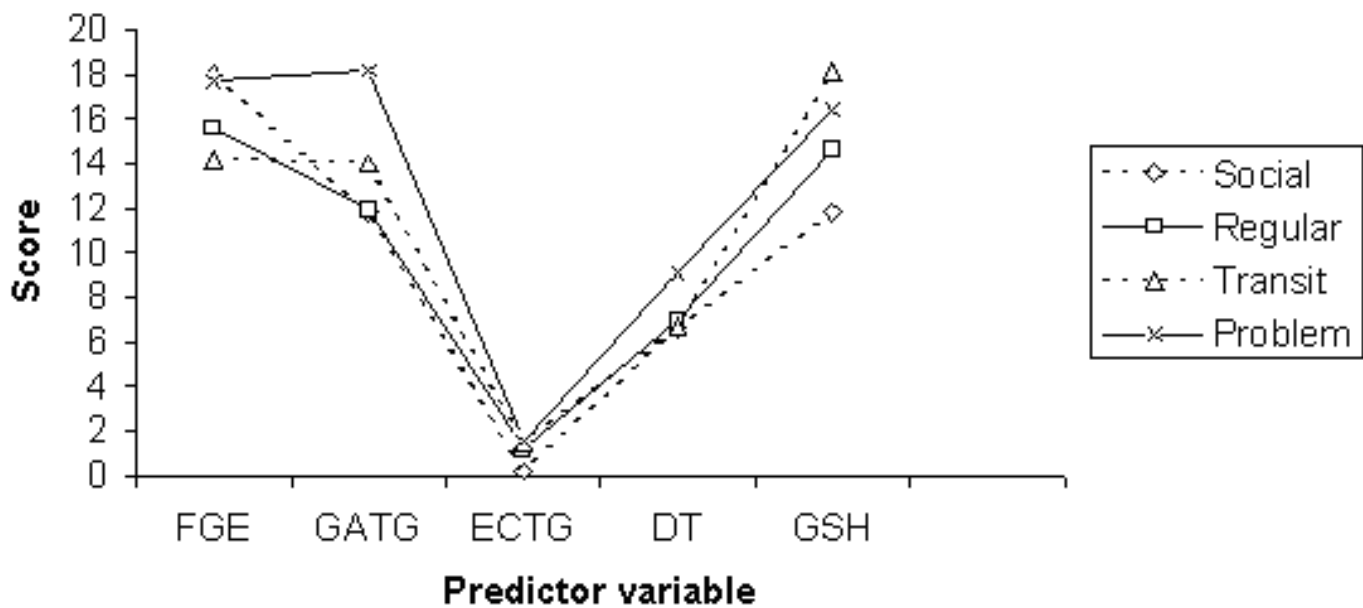
FGE	First gambling experience
GATG	General attitudes towards gambling
ECTG	Environmental conduciveness to gambling
DT	Distorted thinking
GSH	General state of health

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