NOTICE:

Following large wins from professional roulette teams, the UK Weights and Measures Lab (government lab) conducted a study to determine if particular "wheel conditions" made roulette spins predictable. This document explains their testing.

The testers referred to the "wheel condition" as "bias", although this is an incorrect term because "bias" (in terms of roulette) means a physical defect of a wheel. But the "condition" itself is not a physical defect, and it exists even on brand new wheels. So understand when they mention "bias", they are referring to the "condition".

The "condition" relates to the wheel not being perfectly "level". This causes the ball to hit particular diamonds (metal deflectors) more than others. The testers call this a "drop zone", although we call it "dominant diamonds" because on many wheels, the dominant diamonds are not always on the same side of the wheel. So rather than there being just "one dropzone", there are often 2-3 of them. If you check your casino's wheels, you'll find most wheels have "dominant diamonds". Many factors cause this, although "tilt" is just one.

Dominant diamonds are not "random", so where the ball falls is not random, and this physical anomaly leads to long-term predictable patterns. Both our roulette system (roulettephysics.com) and computers (roulette-computers.com) use these principles.

The lab testers used a "roulette computer" device such as the ones at www.roulette-computers.com. This was not our device, but it applies traditional roulette computer algorithms also used by our free roulette system at www.roulettephysics.com. Our basic version roulette computer (free to our players) also applies this basic algorithm, although much more sophisticated and accurate algorithms are applied by our more advanced roulette computers.

The end result of the testing described in the document is the testers found the "wheel condition" of dominant diamonds did indeed make roulette spins predictable, and enormous player edges can be obtained. But they also found that on different days, the ball deceleration rate varies so that data from previous days could not be used. Our roulette computers and system are the only technology that properly address this problem (referred to as "peak chasing"), so the player's edge is maintained on different days.

They ultimately found that in reasonably common conditions, roulette is indeed predictable. But the testing is by no means exhaustive because they only tested very basic approaches, and not more advanced methods.

Effective methods to deal with "chasing peaks" and "scatter" (ball bounce) are applied by the technology described at roulettephysics.com and roulette-computers.com. Specifically they both solve the "chasing peaks" issue, although only our Uber and Hybrid version roulette computers resolve the "scatter" issue, which is done by being able to give predictions only when the ball is predicted to hit particular diamonds and fall in a way with the most predictable bounce.

ANNEX A

Roulette Wheel Testing

Report on Stage 3.1 of NWML/GBGB Project Proposal

1. Introduction

This is a report on the findings of stage 3.1 of the project proposal submitted by NWML to GBGB on the 24 February 2005.

2. Background

It is understood that a roulette wheel can become "biased", either through wear of the rim or tilting of the wheel, so that the ball will fall towards the centre at a reasonably predictable fixed area of the stationary part of the wheel (known as the "drop zone").

Any wheel will exhibit this "bias" if sufficiently tilted, but the necessary angle of tilt to cause this is not known. As NWML already owns calibrated digital tilt measuring devices (inclinometers) the following proposal was made to test for the effects of tilt on a wheel.

- Adjust the level of the wheel until there is no "bias" (i.e. there is no regular "drop zone").
- Measure the angle of tilt, if any, of the wheel in this position, to determine whether simply levelling the wheel accurately would result in a lack of bias.
- Tilt the wheel from this position, in at least four different directions, until regular "drop zones" are produced.
- Consider whether a spirit level is sufficiently accurate to determine whether an installed wheel will be biased, if simply levelling is found to be sufficient.

3. Method and results

A modern roulette wheel, in excellent condition, was received from TCS Huxley. The roulette wheel was mounted onto a "tilt table" which is normally used for tilt testing of weighing instruments. The table allowed tilting of the wheel in any direction, up to a maximum angle of 1.35°.

The proposed method outlined above was modified slightly such that the tilt table (roulette wheel) was set so as to be "level" (N.B. small angles of tilt could be measured on parts of the table as shown in Annex 1). The outer rim of the roulette wheel was then divided into 8 equal segments (see Annex 1). 176 spins of the ball were conducted, with a record made of which segment the ball fell into on each spin. The ball was introduced to the wheel at the same point (segment 5) for each spin on this test and for all subsequent tests. Table 1 shows the results of this initial test.

Table 1 – Wheel "level"

Segment	Number of times selected
1	23
2	18
3	24
4	22
5	22

6	28
7	18
8	21

By applying chi-square analysis to the results (X^2 = 3.36 with 7 degrees of freedom) it was determined that the probability that the measurement results were down to pure chance (i.e. random) was approximately 85 %.

The tilt table was then tilted to give a maximum tilt of 1.35° in one plane (right to left when viewing the wheel as per Annex 1). The test was repeated, with Table 2 showing the results of this test.

Table 2 – Wheel tilted 1.35° "right to left"

Segment	Number of times selected
1	40
2	37
3	11
4	8
5	10
6	10
7	22
8	38

Chi-square analysis of these results (X^2 = 64.1 with 7 degrees of freedom) indicates a probability of less than 0.1% that these results are down to chance, i.e. there is a greater than 99.9% probability that the results are due to a "bias" on the table.

The angle of tilt was then reduced, to 0.5°, 0.25° and then 0.1°. Again, the tests were repeated at each of these angles of tilt. A chi-squire analysis was made of each set of results. These results are shown in Table 3.

Table 3 – Wheel tilted 0.5°, 0.25° and 0.1° "right to left"

Segment	Number of times selected		
	0.5°	0.25°	0.1°
1	34	39	31
2	48	30	31
3	21	28	28
4	9	6	17
5	16	11	10
6	7	10	19
7	13	14	22
8	28	38	18
Chi-square (7 degrees of freedom)	X^2 = 62.2	X^2 = 55.9	X^2 = 17.8
Probability of "bias"	> 99.9%	> 99.9%	98%

The table was then tilted to an angle of 0.1° in the other three planes. Only 80 spins were conducted for each of these tests. The results are shown in Table 4.

Table 4 – Wheel tilted 0.1° in three other planes

Segment	Number of times selected		
	Left to right	Front to back	Back to front
1	7	6	7
2	9	6	2
3	5	20	4
4	8	18	15
5	21	16	14
6	13	7	8
7	9	3	17
8	8	4	13
Chi-square (7 degrees of freedom)	$X^2 = 17.4$	$X^2 = 32.6$	$X^2 = 21.2$
Probability of “bias”	98%	> 99.9%	99.5%

A check of a typical standard spirit level (obtained from a DIY store) showed that a 0.1° angle equates to the bubble just touching the first indicating line on the bubble window as shown in Figure 1.

Figure 1 – Comparison of inclinometer and spirit level

4. Summary of results

The results indicate that when the wheel was "level" (it should be noted that a certain amount of tilt was discernable on some parts of the tilt table using the digital inclinometer) a figure of 85% probability that the results were down to chance (i.e. random) was achieved. It is possible that this figure could be improved to the more generally accepted 95% level by making very fine adjustments to the tilt table to ensure that it was perfectly level. However, it was decided not to "chase perfection" as these initial results indicated a good benchmark with which to compare the results of the tilt testing.

Tilting the wheel to 1.35° led to a greater than 99.9% probability that the results were the result of a "bias" on the wheel. Reducing the angle of tilt reduced the probability figure, but even at an angle of only 0.1°, a probability of 98% that the wheel was "biased" was still obtained. The results in the other three planes gave repeatable results, with the lowest probability still in the region of 98%. An analysis of the peak segment numbers also indicates that the "bias" appears to move in relation to the plane in which the table is tilted.

5. Conclusions

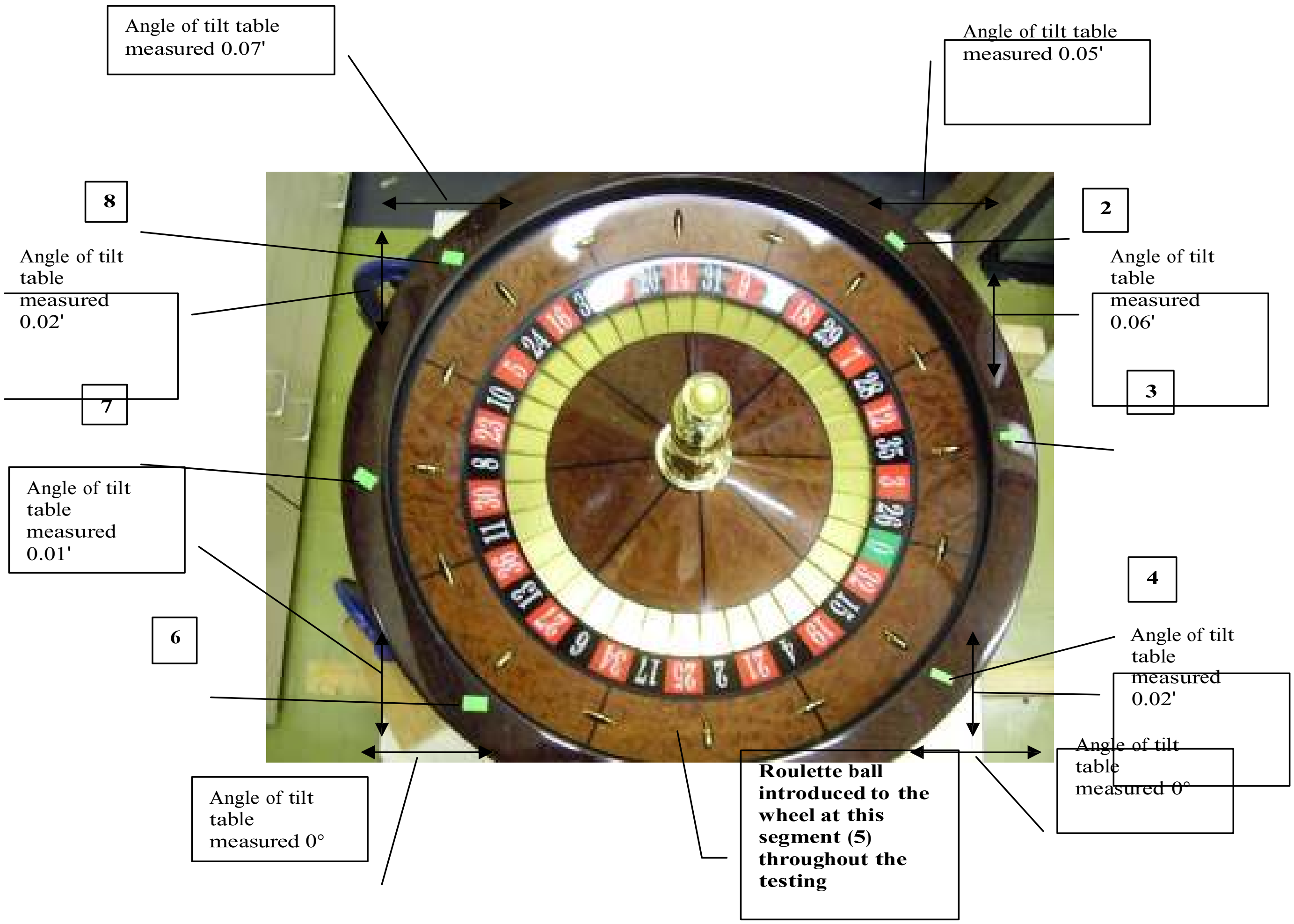
It appears from the results of testing that an angle of as little as 0.1° (the first line on the bubble window of a standard spirit level) will introduce a "bias" into the wheel. It can also be seen that the "bias" will vary according to the plane in which the wheel is tilted.

A tilt of only 0.1° could be easily introduced if the wheel is not mounted correctly, if the mounting and/or the table is not stable over time, or by leaning on the table on which the wheel is mounted if it is not sufficiently rigid. It therefore appears essential from these initial findings that particular attention should be given to the tables in the casinos onto/into which the roulette wheels are mounted. It is suggested that calibrated digital inclinometers be used when mounting the wheels (although it can be seen that a standard spirit level can indicate, quite clearly, a tilt of 0.1°). The tables should be sufficiently rigid and stable over time and not be liable to tilting by someone leaning on the table. Stability over time could be ensured by regular checks of the level and adjustment if necessary.

As it can be seen how easily a "bias" can be introduced, the next two stages of the project can now be undertaken. These will begin upon receipt of the roulette prediction device and software.

Paul Dixon, NWML
08 July 2005

Annex 1 – Roulette wheel segments and initial tilt measurement



Segments 1 and 5 are not shown.

ANNEX B

Roulette Wheel Testing

Report on Stages 3.2 and 3.3 of NWML/GBGB Project Proposal

1. Introduction

This is a report on the findings of stages 3.2 and 3.3 of the project proposal submitted by NWML to GBGB on the 24 February 2005.

2. Background

A number of individuals claim to have developed roulette prediction devices that will provide the user with an advantage over the casino when gambling on roulette. A casino consultant claims that his prediction device can give a return of 20 % on turnover over a period of time on a biased wheel. This relates to a win once in every six spins when betting on the predicted number and neighbours (predicted number and the two numbers either side). Another individual claims a better return, even on a wheel with no tilt.

The casino consultant was contacted with a view to him loaning NWML one of his prediction devices (software running on a modified iPAQ) for the purposes of this evaluation exercise.

The following proposal was made to determine the effectiveness of the prediction device.

- Adjust the level of the wheel to introduce a “bias” (i.e. a regular “drop zone”) and use the prediction device to attempt to predict the outcome (section 3.2 of proposal).
- Adjust the wheel so that there is no discernable “bias” and use the prediction device to attempt to predict the outcome (section 3.3 of proposal).

N.B. during this stage of the project the second developer contacted NWML requesting that we “certify” his device. I responded to him that we were unable to endorse or “certify” devices of this kind. He also claims to have developed a device that can be fitted to a roulette wheel to negate the effect of prediction devices and other prediction methods. I indicated to him that we could be willing to investigate the effectiveness of this particular device as it would be of interest to the gaming industry.

3. Prediction device (Method of operation and calibration)

The prediction device is a modified iPAQ running specially written prediction software. The iPAQ has been modified to allow the connection of a simple pushbutton switch which is used to operate the prediction software. The prediction software has two modes; a calibration mode to calibrate the device against the wheel, and a normal operation mode for predicting the number. The normal operation mode also permits recording of the actual number selected on completion of each spin. This is used by another piece of software which produces a histogram to identify the optimum offset value (to account for “scatter”). Normally, this software will automatically correct the prediction software to take account of any variation in the offset value. However, this automatic correction was disabled for test purposes so that the correction could be done manually.

A video clip of a roulette spin was provided by the casino consultant. The purpose of this was to enable me to practice using the device against the video clip to see if I could get the prediction device to predict the number against a known outcome, i.e. the ball dropping from the rim at the same point and coming to rest in the same slot every spin. After some practice I was able to get the device to predict a number such that a win would have been obtained (using the predicted number plus neighbours betting approach) on practically every practice spin. This proved that I was able to operate the device correctly, and that the device itself was functioning correctly. N.B. the casino consultant supplied the device calibrated against this video clip. However, I repeated this test on a couple of occasions after re-calibrating the device myself and I was able to achieve the same consistent performance.

In practice, the device operates in the following manner. For calibration, only the ball is "clocked". The ball is spun, and each time it passes beneath the reference point (drop zone) the switch is pressed. The device will ignore all revolutions faster than 1200 milliseconds. When the correct revolution is captured the device emits a high pitched "beep". The switch is then pressed when the ball hits the wheel so that the device can calculate the "time to drop".

With the device calibrated it is then possible to attempt predicting. The "zero" on the wheel is clocked when it passes the reference point for the first time and is then clocked again when it passes the reference point for the second time. Clocking of the "zero" enables the speed of the wheel to be calculated.

With the speed of the wheel calculated, the ball is then clocked as it passes the reference point. The ball is clocked each time it passes the reference point until the ball speed falls within the capture envelope (in this case 1200 – 1400 ms). When this occurs, the device predicts the number. Any revolutions greater than 1400 ms result in an "error" message.

The device says "now" when it estimates that the ball should drop from the rim into the rotor. This gives an indication of how well the device has been calibrated and how well that particular spin was clocked. If the device does not say "now" when the ball drops it is likely that the wrong revolution of the ball was captured, e.g. the revolution captured was on the extreme limits of the 1200 – 1400 ms acceptance envelope.

On completion of the spin it is then possible to enter the actual number that was obtained to enable the optimum offset to be determined (caused by the "scatter" of the ball as it hits the rotor). When an offset has been determined, this is compensated for by changing the clocking point accordingly, e.g. if the offset is calculated to be plus 5 then the reference point is moved forward 5 slots in the direction of travel of the ball. The "zero" of the wheel and the ball are both clocked at this new reference point.

4. Test method and results (section 3.2)

The TCS Huxley wheel was tilted by 1.35° in one plane to create a "bias" (known drop zone). Over 50 spins the ball hit the vertical diamonds in segments 3 and 4 (see Annex 1) 49 times out of the 50 spins (24 hits for the diamond in segment 3 and 25 hits for diamond in segment 4). The horizontal diamond between these two vertical diamonds was therefore selected as the reference point for "clocking".

The device was calibrated against the wheel using the procedure described above. The calibration had to be repeated a number of times to achieve a sufficient level of confidence that the ball was dropping from the rim when the device said "now", and also that the predicted number was below the ball when it dropped. It should be noted that this situation is not expected to occur on every spin. However, it is expected that it should occur "more often than not". After some trial and error this situation was obtained on 38 out of 50 spins.

It should be noted that the calibration of the device had to be repeated through the course of the testing due to changes in the ball/wheel performance, i.e. on some days the ball would complete more revolutions following the 1200 – 1400 captured revolution than on other days. This need to change the calibration led to a large number of repeat tests being performed, hence the delay in completion of the project.

With the device calibrated, the "scatter" for this particular wheel had to be determined. The "scatter" is the amount of variation in the actual slot that the ball comes to rest in, compared with the slot beneath the ball when it drops from the rim.

Further spins were conducted to analyse the difference between the number under the ball when it dropped from the rim and the number (slot) that the ball falls into. Over the course of 25 spins, the average difference ("scatter") was plus 9 (although the range of scatter was in the region of 25 slots).

Test 1

This was performed by clocking at the original reference point (i.e. no offset). The actual number was entered into the offset software following each prediction. On completion of 50 spins the offset software indicated that an offset of plus 5 (5 slots in the direction of travel of the ball) would have resulted in 14 wins out of 50 (number plus neighbours). Without the offset, i.e. by comparing the predicted number to the actual number, 4 wins were obtained.

Test 2

This was also performed by clocking at the original reference point (i.e. no offset). The actual number was entered into the offset software following each prediction. On completion of 50 spins the offset software indicated that an offset of plus 9 (9 slots in the direction of travel of the ball) would have resulted in 12 wins out of 50 (number plus neighbours). An offset of plus 5 (the figure from Test 1) would have resulted in 6 wins out of 50 (number plus neighbours). Without the offset, i.e. by comparing the predicted number to the actual number, 7 wins were obtained.

Test 3

Based on the results of the previous two tests, the casino consultant suggested that an offset of 5 slots be used when clocking the "zero" and the ball. On completion of 50 spins the offset software indicated that an additional offset of plus 5 (5 slots in the direction of travel of the ball) would have resulted in 15 wins out of 50 (number plus neighbours). This is effectively an offset of 10 slots (the original offset of 5 slots plus this additional offset of 5 slots). However, without the additional offset, i.e. by comparing the predicted number to the actual number, 3 wins were obtained.

Test 4

Based on the results of the previous test, an offset of 10 slots was used when clocking the "zero" and the ball. On completion of 50 spins the offset software indicated that an additional offset of plus 31 (31 slots forward in the direction of travel of the ball) or, alternatively, minus 6 (6 slots in the opposite direction of travel) would have resulted in 14 wins out of 50 (number plus neighbours). This is effectively an offset of 4 slots (the original offset of 10 slots minus this proposed offset of 6 slots). However, without the additional offset, i.e. by comparing the predicted number to the actual number, 4 wins were obtained.

Test 5

Based on the results of the previous test, an offset of 5 slots was used when clocking the "zero" and the ball. On completion of 50 spins the offset software indicated that an additional offset of plus 4 (4 slots forward in the direction of travel of the ball) would have resulted in 13 wins out of 50 (number plus neighbours). This is effectively an offset of 9 slots (the original offset of 5 slots plus this additional offset of 4 slots). However, without the additional offset, i.e. by comparing the predicted number to the actual number, 8 wins were obtained.

Test 6

The results of the previous tests indicated that the offset was varying with each test and that "peak chasing" was occurring. This test was therefore performed by clocking at the original reference point to check the performance of the device. No offset was used when clocking the "zero" and the ball as per tests 1 and 2. On completion of 50 spins the offset software indicated that an offset of plus 14 (14 slots forward in the direction of travel of the ball) would have resulted in 14 wins out of 50 (number plus neighbours). However, without the additional offset, i.e. by comparing the predicted number to the actual number, 7 wins were obtained.

Test 7

Based on the results of the previous test, an offset of 10 slots was used when clocking the "zero" and the ball. On completion of 50 spins the offset software indicated that an additional offset of plus 32 (32 slots forward in the direction of travel of the ball) or, alternatively, minus 5 (5 slots in the opposite direction of travel) would have resulted in 14 wins out of 50 (number plus neighbours). This is effectively an offset of 5 slots (the original offset of 10 slots minus this proposed offset of 5 slots). However, without the additional offset, i.e. by comparing the predicted number to the actual number, 8 wins were obtained.

Test 8

This test was performed with an offset of 8 slots (approximately midway in the range of offset values obtained) when clocking the "zero" and the ball. On completion of 50 spins the offset software indicated an offset of zero. 13 wins out of 50 (number plus neighbours) were obtained.

5. Test method and results (section 3.3)

The tilt table was levelled in order to try and eliminate the bias on the wheel. 200 spins were performed and the segment number in which the ball fell from the rim was recorded. The results obtained are shown in Table 1.

Table 1

Segment	Number of spins
1	25
2	26
3	20
4	22
5	22
6	23
7	20
8	40

By applying chi-square analysis to these results it can be seen that there is a 90% chance of a bias on the wheel (due to the peak on segment 8). A slight tilt was therefore applied (lifting the wheel under segment 4) in an effort to eliminate the peak at segment 8. A further 160 spins were performed and the segment number in which the ball fell from the rim was recorded. The results obtained are shown in Table 2.

Table 2

Segment	Number of spins
1	16
2	21
3	18
4	18
5	20
6	15
7	25
8	26

By applying chi-square analysis to these results it can be seen that there is now a 40% chance of a bias on the wheel. There is still a noticeable peak at segments 7 and 8, but it was felt that the wheel was providing a more random performance for this stage of the testing.

As a reference point for clocking, the horizontal diamond midway between the vertical diamonds in segments 7 and 8 was used. From the results of the previous set of tests, an offset of 8 from this reference point was selected as the clocking point for the wheel "zero" and the ball. This clocking point was used for five sets of tests (50 spins in each set).

Test 9

On completion of 50 spins the offset software indicated that an additional offset of plus 15 (15 slots forward in the direction of travel of the ball) would have resulted in 11 wins out of 50 (number plus neighbours). However, without this calculated offset, i.e. by comparing the predicted number to the actual number, 8 wins were obtained.

Test 10

On completion of 50 spins the offset software indicated that an additional offset of plus 3 (3 slots forward in the direction of travel of the ball) would have resulted in 12 wins out of 50 (number plus neighbours). However, without this calculated offset, i.e. by comparing the predicted number to the actual number, 6 wins were obtained.

Test 11

On completion of 50 spins the offset software indicated that an additional offset of plus 30 (30 slots forward in the direction of travel of the ball) or, alternatively, minus 7 (7 slots in the opposite direction of travel) would have resulted in 12 wins out of 50 (number plus neighbours). However, without this calculated offset, i.e. by comparing the predicted number to the actual number, 5 wins were obtained.

Test 12

On completion of 50 spins the offset software indicated that an additional offset of plus 11 (11 slots forward in the direction of travel of the ball) would have resulted in 9 wins out of 50 (number plus neighbours). However, without this calculated offset, i.e. by comparing the predicted number to the actual number, 8 wins were obtained.

Test 13

On completion of 50 spins the offset software indicated that an additional offset of plus 20 (20 slots forward in the direction of travel of the ball) or, alternatively, minus 17 (17 slots in the opposite direction of travel) would have resulted in 10 wins out of 50 (number plus neighbours). However, without this calculated offset, i.e. by comparing the predicted number to the actual number, 6 wins were obtained.

6. Summary of test results

6.1. The test results for stage 3.2 of the project are summarised in Table 3.

Table 3

Selected offset (slots)	Wins with this offset	Offset software analysis (slots)	Total calculated offset (slots)	Wins with calculated offset
0	4	Plus 5	Plus 5	14
0	7	Plus 9	Plus 9	12
Plus 5	3	Plus 5	Plus 10	15
Plus 10	4	Minus 6	Plus 4	14
Plus 5	8	Plus 4	Plus 9	13
0	7	Plus 14	Plus 14	14
Plus 10	8	Plus 5	Plus 5	14
Plus 8	13	0	Plus 8	13
	Avg = 6.75			Avg = 13.6

For each spin, 5 units would be bet (predicted number plus neighbours). For the predicted number with the selected offset, an average of 6.75 wins per 50 spins would result in a loss of 7 units as shown below.

$$- (250 + 6.75) + (6.75 \times 35) = - 7 \text{ units}$$

For the predicted number with the calculated offset, an average of 13.6 wins per 50 spins would result in a gain of almost 240 units as shown below.

$$- (250 + 13.6) + (13.6 \times 35) = 239.6 \text{ units (95.8 \% on turnover)}$$

6.2. The test results for stage 3.3 of the project are summarised in Table 4.

Table 4

Selected offset (slots)	Wins with this offset	Offset software analysis (slots)	Total calculated offset (slots)	Wins with calculated offset
Plus 8	8	Plus 15	Plus 23	11
Plus 8	6	Plus 3	Plus 11	12
Plus 8	5	Plus 30 (minus 7)	Plus 1	12
Plus 8	8	Plus 11	Plus 19	9
Plus 8	6	Plus 20 (minus 17)	Minus 9	10
	Avg = 6.6			Avg = 10.8

For the predicted number with the selected offset, an average of 6.6 wins per 50 spins would result in a loss of 12 units as shown below.

$$- (250 + 6.6) + (6.6 \times 35) = - 12.4 \text{ units}$$

For the predicted number with the calculated offset, an average of 10.8 wins per 50 spins would result in a gain of almost 139 units as shown below.

$$- (250 + 10.8) + (10.8 \times 35) = 138.8 \text{ units (55.5 \% on turnover)}$$

6.3. Ten series of 50 random numbers were generated to compare the performance of the device against randomly selected numbers. Each series of 50 random numbers were compared against the actual numbers obtained during each of the tests. On average, 6.4 wins per 50 spins would have been achieved using the random number plus neighbours betting approach. For the sets of random numbers, the maximum number of wins per 50 spins was 11, and the minimum number of wins per 50 spins was 3.

For the randomly generated numbers, an average of 6.4 wins per 50 spins would result in a loss of almost 20 units as shown below.

$$- (250 + 6.4) + (6.4 \times 35) = -19.6 \text{ units}$$

7. Conclusions

As expected, and as shown in stage 3.1 of the project, tilting the table introduces a definite bias (“drop zone”) onto the wheel. This made determining the reference point for clocking the “zero” on the wheel and the ball during each spin very easy during stage 3.2 of the project.

From the testing conducted for stage 3.2, the results appear to indicate that the prediction device could predict the number such that the peak number of wins would occur within a relatively narrow band of 10 slots (the calculated optimum offset varied from 4 slots to 14 slots). If the calculated offset was used then an average of 13.6 wins per 50 spins could be obtained; a return of almost 100 % on turnover. However, there was an element of “chasing the peak” involved with the testing, as on only one occasion (test 8) did the selected offset coincide with the peak number of wins. Further tests would need to be conducted to determine how consistently an offset of 8 would give this number of wins.

Without adjusting the offset to coincide with the peak, which obviously can’t be done in practice as it is “after the event”, it can be seen that the performance of the device was only marginally better, on average, than the randomly generated numbers. It should be noted, however, that for three of these tests no offset at all was used when clocking the “zero” and the ball. The probable reason for the peak moving within the 10 slot band is most likely the result of “scatter” of the ball when it drops into the rotor. It would appear that the wheel supplied is not suitable for predicting as the scatter is too random.

With the bias introduced into the wheel I could “feel” when the spin was potentially going to produce a “win”. On these occasions, when the predicted number was called it was possible to observe the ball and predicted number arriving at the drop zone simultaneously. “Scatter” would ultimately determine if a “win” was achieved on these occasions, but I got a real sense that the device had provided a good prediction. I could also “feel” when the spin was unlikely to produce a “win” as there was no cross-over of the number and ball at the drop zone. This was invariably caused by catching the wrong revolution (i.e. on the extreme of the 1200 – 1400 ms capture envelope) of the ball such that the ball would drop from the rim when the predicted number was on the opposite side of the wheel. It should be noted that wins were sometimes obtained in this situation due to the random nature of the scatter pattern.

I would therefore expect that with a more consistent “scatter”, a prediction device of this nature could work very well in this particular test situation. However, testing of the device took place in laboratory conditions with a very heavily biased wheel. I was able to stand immediately over the table which made clocking of the “zero” and the ball easy. This would not be the case in an actual casino where clocking would have to be done subversively. In addition, in practice it is unlikely that such a heavily biased wheel would ever be found.

To support this, stage 3.3 of the project shows that when the bias is reduced (N.B. I was unable to completely eliminate the bias) the range of the calculated offset varied enormously from minus 17 to plus 15 (almost the whole wheel). In addition, even when the calculated offset was used, the number of wins per 50 spins reduced from an average of 13.6 on the biased wheel to 10.8. It was noticeable that the histogram produced by the offset software was a smoother profile during these tests when compared with the profile of the histogram for the biased wheel tests. Again, without adjusting the offset to coincide with the peak, the average number of wins per 50 spins (6.6 wins) is comparable with the randomly generated numbers.

Therefore, it can be seen that on a wheel with a definite bias (“drop zone”) and a manageable scatter, a prediction device of this nature, when operated by a “skilled” roulette player, could obtain an advantage when used in a casino. The casino consultant claims that he can achieve an advantage of 20 % on turnover over a period of time on a wheel that exhibits these characteristics.

However, the testing at stage 3.3 shows that the effectiveness of such a device could be negated (minimised) by eliminating bias from the wheel as far as possible, i.e. ensuring that the wheel is levelled correctly and is not worn. In addition, wheels having a sufficiently random scatter pattern, i.e. using a light ball with shallow pockets, would also reduce the effectiveness of the device. This is demonstrated by the results at stage 3.2 which show that even with a significant bias on the wheel, the scatter appeared to produce a constantly changing offset (although with fairly tight limits), i.e. the wheel supplied was not suitable for predicting due to the scatter being too random.

A simple way to prevent these devices from having any effect at all would be to call “no more bets” as soon as the ball is spun. Alternatively, as the predicted number is not known until shortly before the ball falls from the rim, the practice of calling “number plus neighbours” (where the croupier then places the necessary bet) could be stopped. This would make it difficult for the person using the device to place the bet on the predicted number and the neighbours (5 numbers in total)

Paul Dixon, NWML
27 September 2005

Annex 1 – Roulette wheel segments

Segments 1 and 5 are not shown.

Roulette ball introduced to the wheel at this segment (5) throughout the testing