INNOVATIVE POTENTIAL IN THE ROLE OF HUMAN INTUITION IN DECISION MAKING COMPARED TO TECHNOLOGICALLY BASED COMPUTER RANDOM DECISIONS IN THE CONDITIONS OF UNCERTAINTY

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Abstract

The paper focuses on the hidden potential of humans and management in the uncertainty conditions. The focus is on measurement of human success versus computer success when forced to decide under uncertainty among several variants. Human intuition is a human's advantage which the paper focuses on based on measurements and statistical analysis of decision scenario performed either by human and either by computer. The long term measurements and runs seem to be slightly but noticeably more successful for human compared to random computer decisions.

The paper presents quantitative research where result of human gives slightly better than average results, but computer results are average based on number of variants and number of decision steps in experiment runs. Author of this paper also developed a computer program where the tests were performed. The paper presents results of measurements in different time periods measured over past years and new learning intuition hypothesis based on measurements and performed test runs is presented. Human ability to evolve and learn seems to be also applicable on situations where we have no or irrelevant information for decision making when practice is taken in account.

Key words: decision, intuition, management, innovation, computer

JEL Code: JEL D81, JEL D87, JEL D84

Introduction

There is a great innovative potential in the intuition area of humans if we look at this topic from the perspective of consciousness, changes of state of mind and non-consciousness processes that might have a great effect on human performance even if we do not realize based on rational knowledge and thinking. Experiment in Hagelin et al. (1999) describes the collective consciousness possible impact into the physical world changes influencing statistically collected

data. Also Roger Nelson's Global Consciousness Project reflects statistically significant changes in randomly generated data when global consciousness is affected by global event ("The Global Consciousness Project", 2015). This paper also presents new unpublished results based on Brixí (2013) research paper presented in Singapore in 2013 and follows with new data and observations. This paper also supports another approach to measuring bodily interaction with lack of knowledge like the famous bodily intuition researches observation that the body knows earlier than the mind.

These and similar research results very much influence interpretation and understanding of human-world and human-computer interaction and human's influence of the consciousness on outer reality. Quantum entanglement of all particles implicates in thoughts about connection between consciousness and reality. The experiments we face in this paper seem to reveal statistical results that indicate that the human intuition and ability to choose the right option performance seem to be slightly better or significantly vary from the theoretical probability value in most of the presented test runs.

1 Intuitive decision making of human in the uncertainty

1.1 Experiment description

We focus on measuring the correct decision making of human in condition where no relevant information is available for rational decision. Then we compare it with the computer random decisions which limit to appropriate probability. We run the experiments with assumption that one choice from all is the right one in every decision step between more options. Human can choose between how many options it is necessary to choose. If two options are chosen, then the probability of random correct choice is 1/2 (50%), if four options are chosen than the probability of random choice is 1/4 (25%) The experiment for human has only one correct option per decision step. Each experiment run is done with 2-100 options where typical choice for human is 3 options, but varies among experiments. Human must choose one from X options in every step and if the choice was made correctly, then proceeds to next step of next choice. If the choice was selected by human incorrectly, a feedback information informs the human which choice was meant to be the right one – to simulate learning approach during experiment interaction.

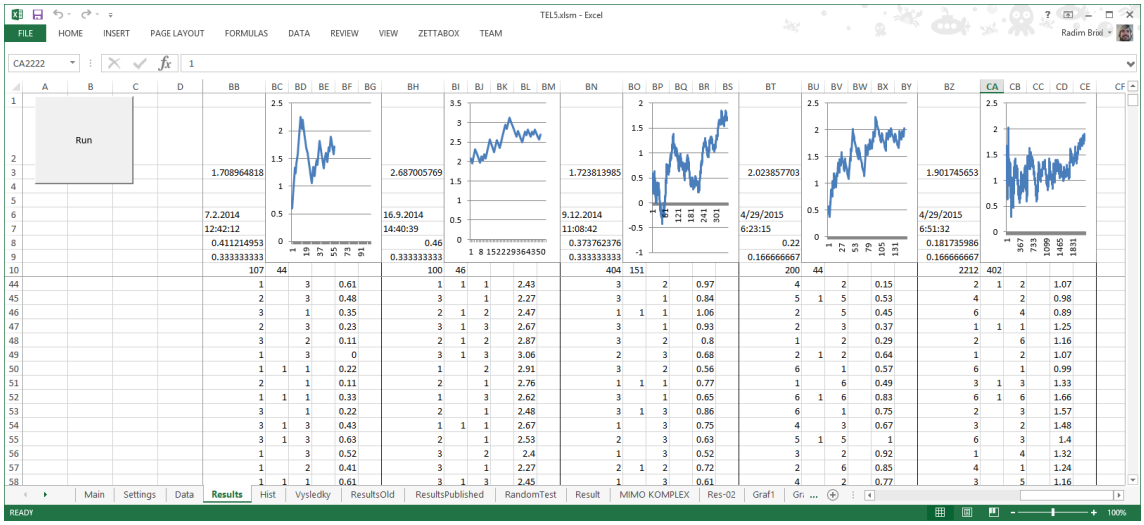
Based on how the human feels or how tired he is, number of steps varies per experiment but given minimum is 100 steps per experiment run. We measure in the extreme conditions where the human doesn't obtain any information about which option is right and why, therefore he may use just absolutely non relevant other information obtained through senses and memory, eventually experience. Nevertheless the right option is generated and calculated in the

background of a computer program, so there is no visible information available for the human, so only intuitive or random choice is available. This paper is trying to experimentally describe, that there seems to be a slightly measurable difference between random and intuitive decisions in terms of success ratio of right choice based on average measurements from the experiment test runs.

2 Computer program for measuring the successful decisions by human

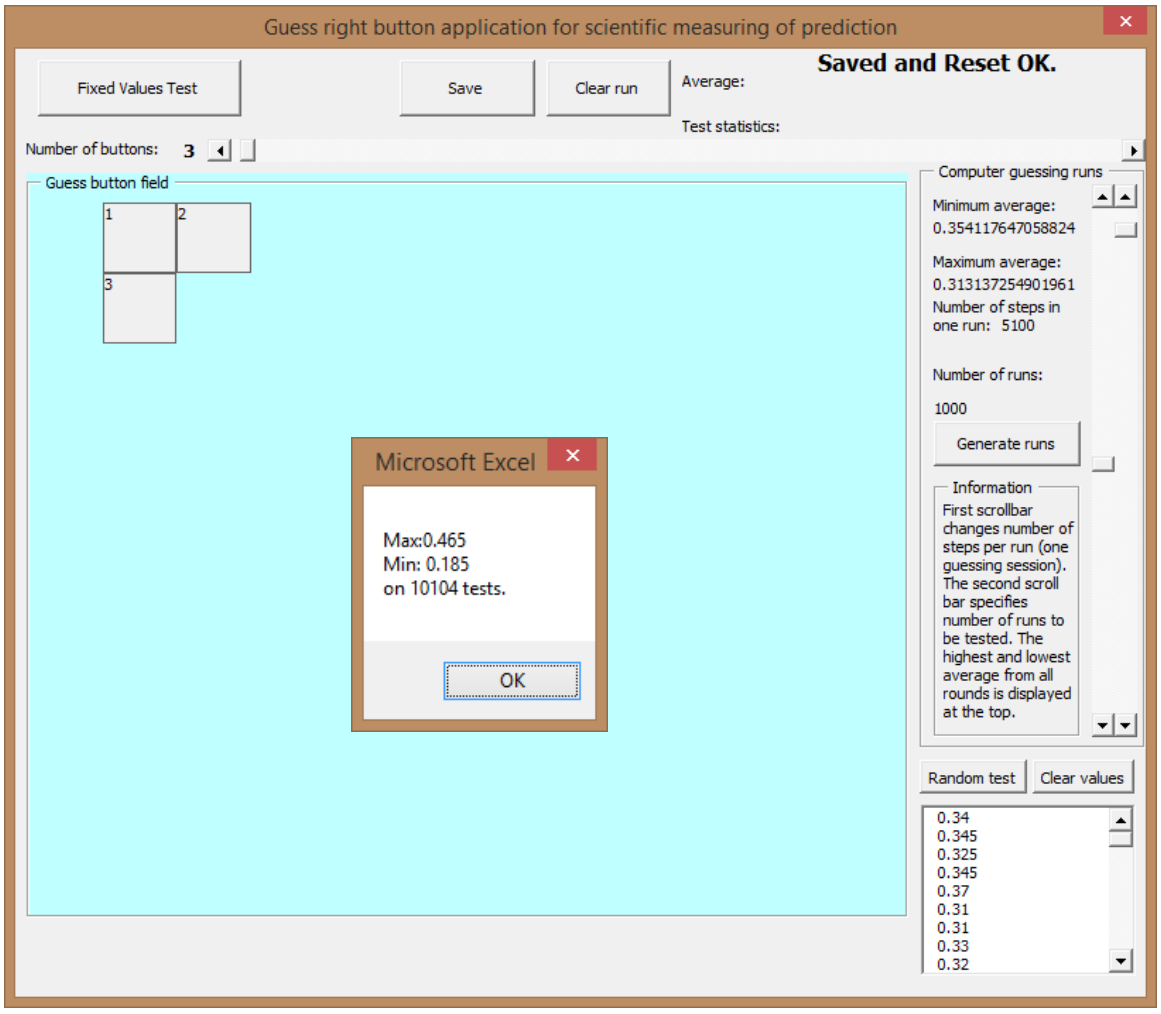
Computer program in Microsoft Excel (Fig.1) was implemented using macros and VBE editor with designed form (Fig.2) to measure interaction of Human while decision is being made among several choices. The form is used to obtain and store the measured data in a sheet. (Internal random number generator is used to generate numbers. The generator randomness quality seems to be good enough for such an experiment. If deeper test for randomness is desired, data may be provided for such a reason to anyone who wants to be more confident about this aspect of the experiment.)

Fig. 1: Excel (used to calculate statistics and store experiments data and details)



We store every experiment in the sheet that we have a record of each step. In every step we save information about what was generated, what user selected and whether the decision was correct (equal to the one generated by computer in background), we also calculate since 50th step the statistic value from step 1 until the particular step. This represents a potential range for statistic calculation so we also have graph of the progress of the statistic through steps to better understand how the performance of human evolves in time (with following steps). These graphs are available for measurements since year 2014 and may be calculated also for older measurements, but they are not presented due to too big detail level. Aggregate results are presented in this paper instead in the Tab. 1.

Fig. 2: Form used to process interaction of user (3 options experiment initialization for human, computer measurements are available anytime to run on the right side window, where it is possible to simulate computer random selection – number of steps per each run and number of test runs can be specified using the scrollbars, the window also calculates the minimum average among all runs and maximum average among all runs)



The typical experiment run for measuring human's success radio in selecting right choice (option) begins typically with choosing number of options between 2 and 100 using the horizontal scrollbar. This will generate appropriate number of buttons. Each button represents an option. Only one button from all represents a correct choice but the other rest of buttons represent incorrect choice. All buttons are visually the same apart from number that may be used on numpad eventually. The correct button is randomly regenerated in each step of experiment, but it is not possible to see any visual difference between the correct choice button and other incorrect choices buttons. This represents the uncertainty while decision is being made.

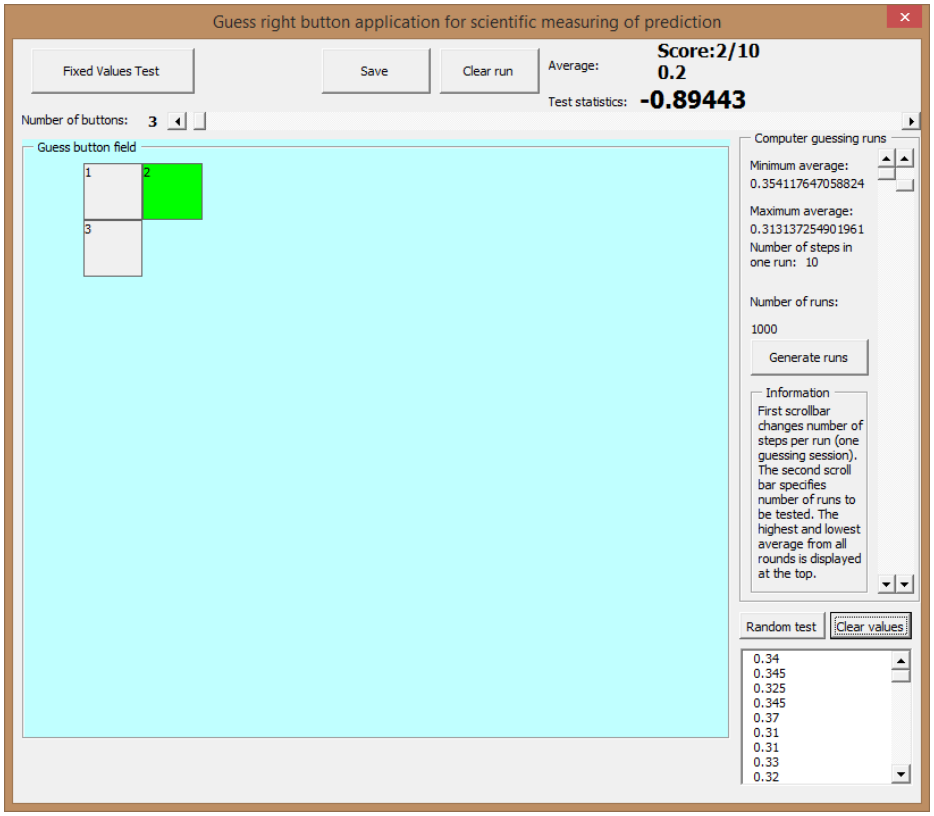
The next step is that the user starts in the step 1 with a choice among the buttons and always is supposed to try to select the only one correct choice (button). This means that the user is supposed to be most successful based on intuitive selection as possible but with absence of rational thinking and selection process based on relevant information about which choice should be right.

After the user makes the choice, two scenarios may occur. The first is that the chosen button was the correct one and then the user proceeds to step 2 which continues in the same manner. The second is, that wrong choice (button) was selected. In such a case the program highlights with a green colour the button, which was supposed to be the right one (always different one from the one we selected) and the application waits until the user clicks the green button (Fig.3) to confirm the application's feedback in order to simulate learning what was supposed to be correct (even though we had no clue what was generated).

The next step is another guessing step but with newly generated choice which is meant to be the right one. The user must do at least 100 steps but may do whatever more if the user feels to do to collect larger set of steps, that is always better to have a larger scale of steps.

When the user finishes, we can see number of successful choices divided by total number of steps, the average success ratio and the statistics used to measure performance. The statistic test is used to see the performance within any number of steps.

Fig. 3: Form with three options experiment running in the moment where user is making 10th decision, 2 were successful and the last one was selected incorrectly. The green button gives the information feedback so the user knows which option was supposed to be pressed. (Score describes number of successful decisions divided by all steps)



3 Experiment design and statistics, measurements

3.1 The goals of the experiment

The major goal of the experiment is to gather data based on measuring the number of successful choices made by human divided by the number of steps in the experiment run with assumption that if the human tries to select as many correct choices as possible. This should give us an average number which we would like to compare to a probability which is calculated from one divided by the number of buttons in the experiment run (in case of three buttons, the probability would be 1/3 where we would like to measure higher average for human's intuitive decisions greater than 1/3). The statistic used should then calculate whether the measured average number is significantly higher or not. It is assumed and measured that the success ratio of human's intuitive choices should be at least little bit higher than the theoretical probability if intuition and proper state of consciousness is used.

3.2 Statistic used to evaluate hypotheses

Hypotheses are H_0: $\pi=1/3$ for three buttons runs and H_0: $\pi=1/x$ for x buttons run with H_1: $\pi > 1/3$ for three buttons runs and H_1: $\pi > 1/x$ for x buttons run.

The following formula describes the test criteria:

$$u = \frac{p - \pi_0}{\sqrt{\frac{\pi(1-\pi_0)}{n}}} \qquad (1)$$

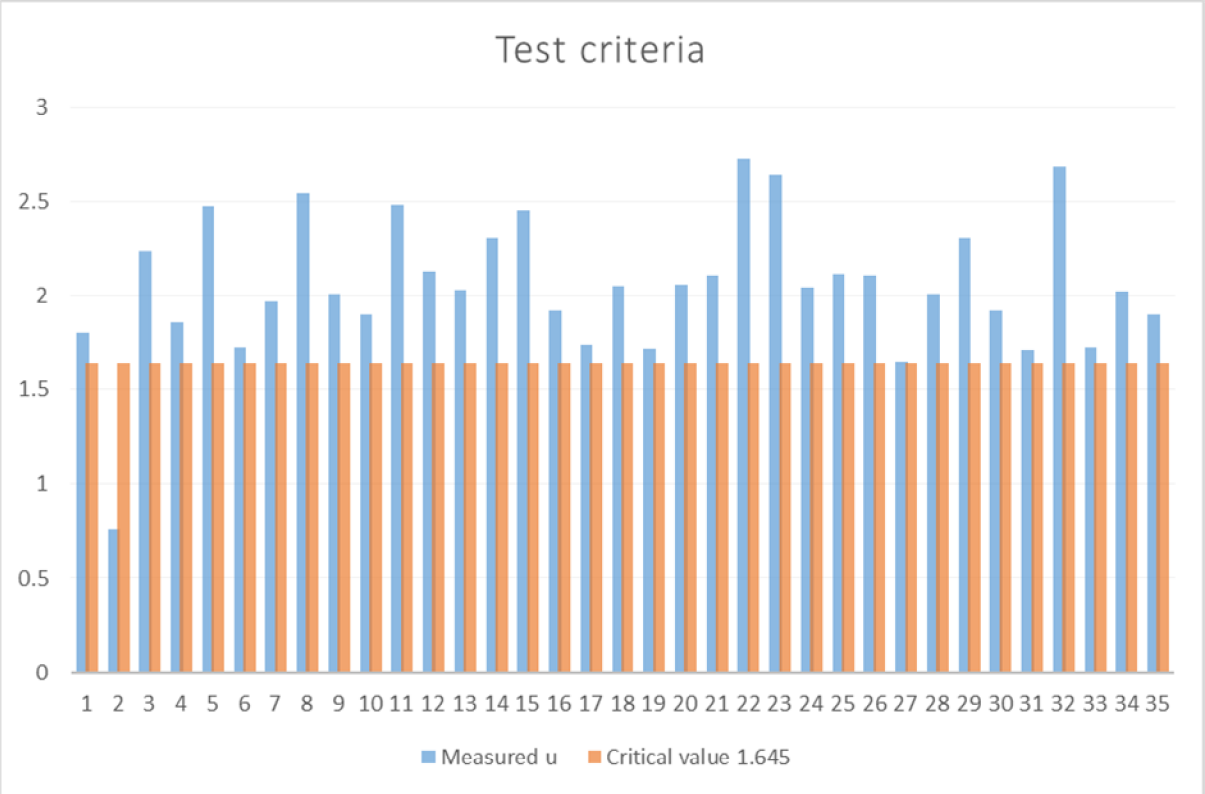
Significance level $W_{0.05}$ $\{u; u \geq u_{0.95}\}$; $u_{0.95} = 1.645$.
Please note that approximation with normal distribution is used in calculations as the accuracy compared with binomial distribution is sufficient for number of steps and probability values.

3.3 Measurements

Test run	Date	Time	Number of steps in the test run	Number of successful decisions in experiment	Number of buttons	**Test criteria value u with critical value 1,645**	Measured average score	Theoretical probability
1	27.6.2012	21:30:29	234	91	3	**1.80277564**	0.3888889	0.33333333
2	27.6.2012	21:45:31	4241	1437	3	**0.7600618**	0.3388352	0.33333333
3	11.11.2012	23:11:02	1000	193	6	**2.23445743**	0.193	0.16666667
4	11.11.2012	23:40:43	2564	899	3	**1.85728107**	0.350624	0.33333333
5	14.11.2012	0:33:44	100	45	3	**2.47487373**	0.45	0.33333333
6	14.11.2012	11:43:20	142	57	3	**1.7208334**	0.4014085	0.33333333
7	25.11.2012	1:53:59	389	148	3	**1.97184553**	0.3804627	0.33333333
8	30.11.2012	23:58:51	209	87	3	**2.54340314**	0.4162679	0.33333333
9	19.12.2012	18:42:15	125	41	4	**2.01395134**	0.328	0.25
10	19.12.2012	18:54:11	10731	2768	4	**1.90052529**	0.2579443	0.25
11	11.10.2013	18:59:03	118	10	25	**2.48043189**	0.0847458	0.04
12	19.10.2013	14:49:38	410	157	3	**2.1302124**	0.3829268	0.33333333
13	19.10.2013	23:20:14	1161	60	25	**2.03085056**	0.0516796	0.04
14	20.10.2013	12:30:56	1015	373	3	**2.30826316**	0.3674877	0.33333333
15	20.10.2013	13:17:38	208	86	3	**2.45145169**	0.4134615	0.33333333
16	20.10.2013	14:11:07	143	83	2	**1.92335662**	0.5804196	0.5
17	20.10.2013	20:11:47	818	226	4	**1.73604577**	0.2762836	0.25
18	21.10.2013	14:24:01	100	43	3	**2.05060967**	0.43	0.33333333
19	21.10.2013	14:30:35	208	81	3	**1.71601618**	0.3894231	0.33333333
20	27.10.2013	18:43:50	148	34	6	**2.05860094**	0.2297297	0.16666667
21	27.10.2013	18:53:40	318	67	6	**2.10659342**	0.2106918	0.16666667
22	27.10.2013	22:11:49	378	151	3	**2.72772363**	0.3994709	0.33333333
23	27.10.2013	22:32:17	1977	152	16	**2.64218019**	0.0768842	0.0625
24	28.10.2013	10:55:02	1693	604	3	**2.0450479**	0.3567631	0.33333333
25	30.10.2013	15:58:13	2692	949	3	**2.11241466**	0.352526	0.33333333
26	4.11.2013	21:49:30	157	36	6	**2.1058003**	0.2292994	0.16666667
27	5.11.2013	9:24:42	3981	1376	3	**1.64742726**	0.3456418	0.33333333
28	6.11.2013	10:47:23	1163	420	3	**2.01125381**	0.361135	0.33333333
29	6.11.2013	12:12:10	397	154	3	**2.30676368**	0.3879093	0.33333333

30	10.11.2013	10:25:40	139	57	3	**1.91923246**	0.4100719	0.33333333
31	7.2.2014	12:42:12	107	44	3	**1.70896482**	0.411215	0.33333333
32	16.9.2014	14:40:39	100	46	3	**2.68700577**	0.46	0.33333333
33	9.12.2014	11:08:42	404	151	3	**1.72381398**	0.3737624	0.33333333
34	29.4.2015	18:23:15	200	44	6	**2.0238577**	0.22	0.16666667
35	29.4.2015	18:51:32	2212	402	6	**1.90174565**	0.181736	0.16666667

Fig. 4: One-tailed tests per each experiment run (In 95% level of confidence Null Hypothesis should be rejected in favour of the Alternative)



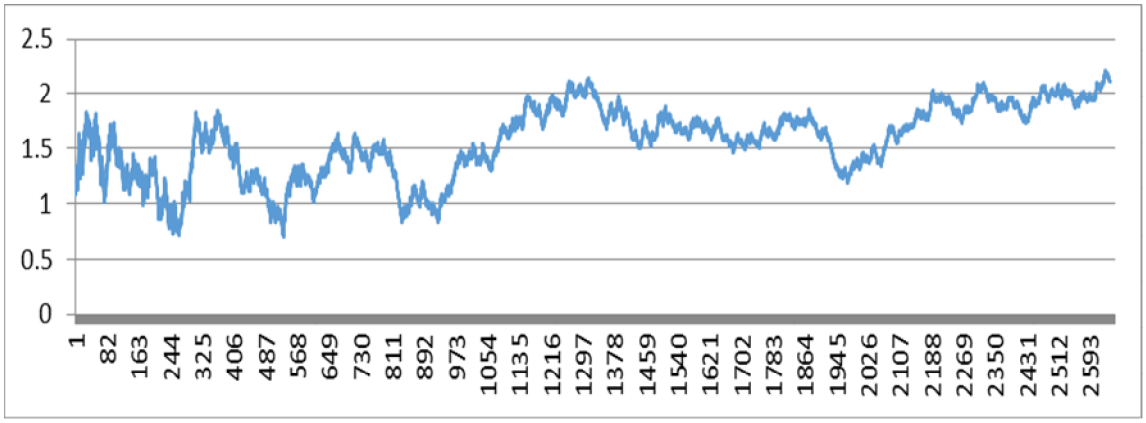
The detailed measurements are presented in the table Tab. 1. In 34/35 cases we would reject the null hypothesis in favour of the Alternative. These measurements therefore support the assumption of the experiment that intuitive decision making in uncertainty done intuitively by the human (on which the test were used) seem to have significantly little bit higher success rate than computer random decisions which limit to the theoretical probability. This reveals a hidden potential in the decision making area with uncertainty conditions where intuition is used properly.

4 Discussion and observations during experiments

4.1 Human random versus human intuitive decisions

Very interesting test was to compare random versus intuitive decisions experiment. If just random clicking with just random movement with no intention was used, the human results also oscillated around 0 value. If intention to have better results with higher average were applied the oscillation moved to the positive statistic results. The typical progress describes Fig. 5.

Fig. 5: One-tailed test statistic calculated in each step evolution for 30.10.2013 experiment



4.2 Self-efficacy role and improvements based on learning

One of the assumptions for the next experiments seems to be the role of self-efficacy as a very important factor. The reason for this assumption is one measurement performed on a student that saw several results with higher human's success rate measured in the Tab1.

This student was very nervous about his first try in the experiment that he almost believed before the experiment that he will do very badly with very bad results. We agreed that he will go through one experiment run and his results were so bad, that on the two-tailed test (whether the result corresponds to the average 1/3) with critical value -1,96 on the 95% confidence level the result emerged to be in the rejection region, because his test statistic was -2,08. This would be interpreted that if the student used so much worries about the result, the success ratio was so low that it was significantly lower (average 0.2881) than the theoretical probability (0.3333) with 472 steps in the experiment which shows how hard is to control the human performance based on self-control and sub consciousness processes.

Therefore it is encouraged to do more research on self-efficacy role in the intuition performance in the uncertainty conditions. The detailed table of the student's result follows in the table Tab.2.

Tab. 2: Two-tailed test applied on student's results measurement

Test run	Date	Time	Number of steps in the test run	Number of successful decisions in experiment	Number of buttons	Test criteria value u	Measured average score	Theoretical probability
Nervous student	31.10.2013	10:05:52	472	136	3	-2.0830226	0.2881356	0.33333333

Conclusion

Human intuition in the uncertainty conditions may help to have a better chance (or even possibly worse if we examine and understand self-efficacy connection and results of measurements and the intention or disbelief) even with lack of information because the measurements support the assumption that the human performance may vary from theoretical probability. If the intention is to have a great performance with good self-efficacy approach, the result success ratio while decisions made in uncertainty might be better for humans using intuition instead of randomly generated decision by computer. Examination of how much may one learn this ability is a matter of further experiments and self-efficacy study connected to intuition.

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