A historical note on the Beauty Contest

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Rosemarie Nagel (1993, 1995) rightfully became known for the Beauty Contest experiment that she initially called guessing game. Ho, Camerer and Weigelt (1996, 1998) were the first to call this guessing game "p-Beauty Contest", inspired by Nagel´s reference in 1995 to Keynes' (1936, p. 156) famous comparison of stock market investments and newspaper beauty contests. The Beauty Contest is an import tool as it provides researchers with a clear and feasible concept of "depth of reasoning". It is Nagel's achievement to have discovered this potential of the game, she does not claim to be its inventor - in the initial footnote (Nagel, 1995, p. 1313) she writes: "I learned about the guessing game in a game-theory class given by Roger Guesnerie, who used the game as a demonstration experiment." Probably Guesnerie's source was Hervé Moulin (1986) who is the first who published this game in a social science context. In his textbook, the game was called "Guess the average", with each player picking an integer between 1 and 999. The game served as the introductory example to the chapter on successive elimination of dominated strategies. Moulin on his part was inspired by a source that had slipped his memory when later, in the nineties, consulted by Rosemarie Nagel. Our recent call for participation in an online Beauty Contest experiment recently unearthed Moulin's source[1].

As a reminder: Participants in Nagel's first experiments (as in Guesnerie's class) were asked to guess a (real) number between 0 and 100, the winning number being the one that comes closest to a share p of the average. In Nagel (1995), p takes the values 1/2, 2/3 and 4/3, with p = 2/3 being most popular in later replications and variants of the experiment.

In 1981, the French magazine "Jeux & Stratégie", a popular magazine devoted mainly to strategic board games, but also covering card games and mathematical games, arranged a big readers' competition consisting of mathematical puzzles but also problems from games such as chess, bridge and go. Ledoux (1981) reports on almost 15,000 participants, 4,078 of them being *ex aequo*, hence the winner had to be decided in a playoff. All first round winners received a letter with new puzzles, and to avoid another round with multiple winners, chief editor Alain Ledoux invented in the last question of this letter what is today known as the Beauty Contest (the name given to it by Ledoux, according to an email to us from July 9th, was "psycho-statistique", although this does not appear to have appeared in print). Readers were asked to state an integer between 1 and 1,000,000,000, the wining number being the one closest to two third of the average! The average turned out to be 134,822,738.26, two third of this being 89,881,825.51. This is 8.99 percent of the maximum number, markedly less than what is typically found in first rounds of Beauty Contest experiments (Bosch-Domènech, Montalvo, Nagel and Satorra, 2002). However, as explained above, the participants had been

[1] We are indebted to Alain Ledoux, Rosemarie Nagel and Hervé Moulin for providing us with additional information and confirming our reconstruction of the birth of the Beauty Contest.

pre-selected, having solved a series of puzzles in the first round of the contest, and they knew that everyone else was pre-selected. Both facts should have resulted in the pretty high depth of reasoning. The large interval (with 1,000,000,000 instead of 100 as the upper bound) could also have played a role - an untested hypothesis suggested to us by Rosemarie Nagel.

In 1983, Jeux & Stratégie held another readers' contest. There was a reference to the first experiment but not to its result. However, some readers might have remembered or looked up the result of the previous round. Again, the Beauty Contest was used as a tie break between equal players on the previous questions - 2898 participants if or reading of Ledoux (1983) is correct. The target number in 1983 (two third of the average guess) was 67,329,453, or 6.73 percent of the maximum number.

Our preliminary conclusion is that Alain Ledoux should be given some credit for starting this fascinating line of research, though no one is to blame for the fact that researchers have previously overlooked him. He did not even sign the articles in Jeux & Stratégie with his name, and not a single public or scientific library in Germany holds this journal. We would be glad to receive hints on similar cases already known; the best one that occurred to us so far is the balanced budget multiplier, typically credited to Haavelmo, but see Gelting (1941), written in a language alien to almost any economist.

Appendix: Some further remarks by Rosemarie Nagel

1. In November 1990 in the LSE Tore Ellingsen presented a one shot guessing game in his master student IO class. I chose 22, according to 50*2/3*2/3. I did not further think about this game.
2. Shortly thereafter I saw the game again in Gueneries' Phd game theory class, like some other students who were also in Tore's class. I chose a number a bit lower than in the other class and won. Then Guenerie asked us to play again. And again I won. I also saw the choices and saw some numbers near and at 33 and 22. I asked Guenerie for the data set and analyzed it, and I also did a pilot in LSE. …. I find this important to add because it shows that sometimes you need to have been your own subject to see the beauty of some idea. Remember, the game was around for some years, but nobody thought it was interesting to do an experiment. First of all at that time grade students were not interested/educated in experiments. And the theorists only saw that behaviour is not in equilibrium which is of course trivial. I needed two inputs of classes to see its beauty. At the time I was already a researcher-phd student in experimental economics and searching for a topic far away from ultimatum games which I had done in my first

paper. Guenerie used this game as a demonstration experiment to show that rationalizability doesn't work in this game while I used this game to test the $50*p^n$ model, which I had actually used in Tore Ellingsen's class. However, I needed this second class by Guenerie to appreciate the game.

3. One Phd student (I forgot his name, but he is now an economic professor in Finland) in the LSE in 1991 pointed out to me that the game (maybe my reasoning process) is also due to Keynes beauty contest.

4. Reinhard Selten, my supervisor, was against the name beauty contest as Keynes´ contest has multiple equilibria and so we named it guessing game. (John Duffy insisted to call it Keynes beauty contest in Duffy and Nagel (EJ 1997)), which indeed is also correct since it is just a special case with the parameter equal 1 (1*average).

5. In Pittsburgh in 1995 Oliver Schulte a graduate student in Computer science and philosophy in Carnegie Mellon (now computer science prof.) found the guess the average game in Moulin's book which Oliver used for teaching purposes.

6. I saw in 1995 in a public choice conference (I think) Moulin and told him that I had done experiments in his game. He then referred me to *Pour la Science* as his original source, which now actually turned out to be Jeux & Stratégie.

Now finally the game has found his founding father, who, however, saw no special interest in it besides providing a tie breaker.

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