

Save the last dance II: Unwanted serial position effects in figure skating judgments.

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Abstract

Serial position effects may occur whenever options are judged in sequence, as is the case in figure skating competitions. International figure skating competitions consist of at least two rounds, with serial position being randomized in the first round. Figure skaters with better scores in the first round perform later in the second round. Despite the initial randomization of serial position, figure skaters who perform later in the first round receive better scores in first and in the second round. The findings presented here replicate those of Bruine de Bruin (2005), using a larger dataset, and addressing potential concerns about Bruine de Bruin's (2005) analyses.

PsycInfo Classification: 2340.

Key words: Human judgment, judgment and decision making, sequential effects.

1. Introduction

Serial position effects have been found in judgments of competitors in the World Synchronized Swimming Meet (Wilson, 1977), the Nebraska State High School Gymnastic Meet (Scheer, 1973), the Queen Elizabeth Classical Music Competition (Flôres & Ginsburgh, 1996; Glejser & Heyndels, 2001), and the Eurovision Song Contest (Bruine de Bruin, 2005; Haan, Dijkstra, & Dijkstra, 2005). Although in each of these competitions serial position was determined through a random draw, contestants who performed later in the sequence generally received better scores. The benefit of performing later has also been replicated in controlled experiments manipulating the serial position of videotaped gymnastics performances (Plessner, 1999; Scheer & Ansorge, 1975).

Psychological explanations for this serial position effect remain relatively unexplored, in part because the judgment and decision making literature has focused on judgments of simultaneously presented options. Initial insight has been obtained from studying serial position effects in real-world competitions using different judgment procedures. In *end-of-sequence* procedures, for example, judges do not announce their scores until all contestants have performed. Because end-of-sequence judgments rely on memory, one may expect judges to give higher scores to contestants that are remembered better. Research on free recall suggests that first and last appearing options are more likely to be remembered (e.g., Anderson, Bothell, Lebiere & Matessa, 1998). However, end-of-sequence scores tend to increase with serial position -- and, when controlling for this linear serial position effect, show no benefit of performing first or last (Bruine de Bruin, 2005).

Step-by-step judgments are given immediately after each performance, and therefore should not burden judges' memory. Yet, step-by-step judgments show serial position effects that are similar to those found with end-of-sequence procedures (Bruine de Bruin, 2005). These results suggest that initial judgments may be formed step by step, and affect final judgments even if they do not have to be announced until the end of the sequence (Bruine de Bruin, 2005; Bruine de Bruin & Keren, 2003).

Bruine de Bruin (2005) suggests several, not mutually exclusive, explanations for this serial position effect. One possible explanation is that it is due to the direction-of-comparison effect, which has been observed with end-of-sequence and step-by-step judgments (Bruine de Bruin & Keren, 2003). Under both procedures, judges may initially evaluate the first performance on its own, and each subsequent performance in comparison to the ones before it – but not ones after it. When making comparisons in one direction, people tend to overweigh the unique features of each new, focal, performance (Tversky, 1977), such as the first figure skater's outstanding double flip, the second figure skater's impressive double Lutz, and so on. Because world-level figure skaters will have more unique positive than unique negative features, focusing on the unique features of each new performer will produce increasing scores with serial position (Bruine de Bruin & Keren, 2003).

In theory, serial position effects due to direction of comparison may be less strong when sequentially appearing contestants do not have to be compared. Ratings, for example, do not require explicit comparisons, while ranking and voting do. Yet, serial position effects have been observed with different judging systems, including ranking (in the Queen Elizabeth Classical Music Competition), voting (in some editions of the

Eurovision Song Contest), as well as rating (in other editions of the Eurovision Song Contest, the World Synchronized Swimming Meet, and the Nebraska State High School Gymnastic Meet).

The present paper examines serial position effects in international figure skating competitions held before the implementation of the new judging system (USFSA, 2004). Under the old system, figure skating judges make step-by-step judgments using an ordinal scale, which explicitly encourages them to compare the different figure skaters.

International figure skating competitions include at least two rounds, referred to as the short program and the free skating round. Serial position is randomized in the first round. Figure skaters with better scores in the first round perform later in the second round. Despite the initial randomization of serial position, figure skaters who perform later in the first round receive better scores in first and in the second round (Bruine de Bruin, 2005). However, it has recently come to my attention that there are two potential concerns about the results reported by Bruine de Bruin (2005).

First, due to a rule change, order of appearance was not randomized in 6 out of the 36 short programs in the 1994-2000 sample used in Bruine de Bruin's (2005) paper (e.g., the 1999 World Championships for men and women, and the 2000 World and European Championships for men and women). It turns out that short programs held since 1999 only randomized starting order if the number of entries did not exceed 30 or 31 (depending on the specific year in which the competition was held.) Independent of whether competitions were held before or after 1999, those with more than 30-31 entries divided figure skaters into two qualifying rounds, aiming to reduce the number of performers. Before 1999, starting order was randomized in the qualifying rounds and in

the short program, with starting order in the subsequent free skating round in part depending on short program scores (see Appendix). Since 1999, serial position has only been randomized in the first round of the competition (i.e., either the qualifying rounds or the short program) with serial position in each subsequent round partly depending on scores obtained in the round before it. The figure skaters who receive better scores in the first round are invited to perform later in the subsequent round (see Appendix), possibly producing the serial position effects in the short programs analyzed by Bruine de Bruin (2005). If so, Bruine de Bruin's (2005) results are biased in the direction of her hypothesis.

To address this concern, the present paper is informed by various publications of the International Skating Union, or ISU (see Appendix). Analyses examine serial position effects in a larger sample of rounds with randomized serial position, including qualifying rounds and short programs. Additional analyses examine the effect of randomized serial position in the first round on scores in subsequent rounds, in which serial position depends on scores in the round with randomized serial position (see Appendix).

A second potential concern about Bruine de Bruin's (2005) analyses refers to the dependent variable, the standardized total, or average, of the scores given by the different judges. Because world-level judges tend to show high agreement with each other (Weekley & Gier, 1989), individual judges' scores can be combined into an average score for each figure skater. Standardization, using a z-transformation, makes figure skaters' average scores comparable across competitions. However, Bruine de Bruin (2005) does not provide evidence that her dependent variable can be used as a proxy for

final ranks, or that analyses on this dependent variable are similar to analyses on final ranks.

This paper addresses these concerns by presenting (a) rank correlations between Bruine de Bruin's (2005) dependent variable and final percentile ranks, which reflect final ranks divided by the number of contestants in a competition, and (b) parametric analyses on z-transformed average scores, as well as nonparametric analyses on percentile ranks, controlling for the nationalistic judging bias (Campbell & Galbraith, 1996; Whissell, Lyons, Wilkinson, & Whissell, 1993) and home advantage (Balmer, Nevill, & Williams, 2001) previously found in figure skating competitions. Although figure skating scores are ordinal, using parametric instead of nonparametric analyses should not seriously affect the type I error rate, especially with larger samples (see Zimmerman & Zumbo, 2005). The analyses test the following hypotheses:

Hypothesis 1: Figure skaters who are randomly assigned to performing later in the *round with randomized serial position*

- a. receive better scores in the *round with randomized serial position*
- b. receive better scores in the *first subsequent round* (in which serial position is in part based on scores in the round with randomized serial position, see Appendix).
- c. receive better scores in the *second subsequent round* (in which serial position is in part based on scores in the previous round, see Appendix).

2. Method

2.1. Contest procedure

Data were obtained from the KNSB (the Dutch office of the International Skating Union), from the World Figure Skating Museum, and online (www.icecalc.com). The complete dataset includes the results from world and European figure skating competitions for men, women, and pairs, held in the years 1994-2004. Results are missing for the short program and free skating rounds of women's and men's European Championship of 1995, and serial position is missing for both qualifying rounds in the men's European Championship of 1996.

In total, the complete dataset includes 120 rounds with randomized serial position (qualifying rounds A and B and the short program in competitions held before 1999, qualifying rounds A and B or the short program in competitions held since 1999), 64 first subsequent rounds in which serial position is based on scores in the round with randomized serial position, and 22 second subsequent rounds in which serial position depends on scores in the first subsequent round (see Appendix). This practice potentially allows the effect of one random draw for serial position in the first round to reverberate through the different rounds.

Various ISU publications provide information about how serial position has been determined in different rounds over the years (see Appendix). A few details are relevant for understanding the analyses. First, if no performers from the host country qualified for the Short Program or the Free Skating rounds, one home contestant was invited to skate first. Thus, serial position for that skater was not randomly determined. Figure skaters from the host country may also benefit from a home advantage (Balmer et al., 2001).

Second, a panel of 7 to 14 professional judges from different countries evaluated the competing figure skaters by giving them a maximum of 12 points on an ordinal scale (see Appendix). Judges' scores are then combined into final ranks using a complex scoring rule that has changed over the years (see Truchon, 2004). World-level judges tend to have many years of international judging experience and show high agreement with each other (Weekley & Gier, 1989). Nevertheless, figure skating judges may be subject to nationalistic bias (Campbell & Galbraith, 1996; Whissell et al., 1993).

2.2. Analyses

Two dependent variables are used for each figure skater in each round: (a) final percentile rank, representing the publicized final rank as calculated by the contest's organization, divided by the number of contestants in each competition, and (b) the z-transformed average score across judges, as explained above, and used by Bruine de Bruin (2005). For brevity, the latter will be referred to as z-transformed scores.

Spearman rank correlations explore whether final (percentile) ranks are approximated by Bruine de Bruin's (2005) dependent variable. (Spearman rank correlations between final ranks and final percentile ranks will be 1.00, because both variables use the same rank order across figure skaters.) Because higher values on each variable reflect better scores, positive correlations are expected.

To test each hypothesis about serial position effects, four comparable analyses are conducted: (a) a meta-analysis using the Stouffer method (see Rosenthal & Rosnow, 1991, p. 496) combines Spearman rank correlations between figure skaters' serial position and final percentile rank as calculated separately for each round, using Fisher z-

transformations to calculate average correlations across rounds (Rosenthal & Rosnow, 1991, p. 505), (b) the same meta-analysis procedure combines Spearman rank correlations between serial position and z-transformed scores, (b) an ordinal probit regression predicts figure skaters' percentile ranks across competitions, and (c) a linear regression predicts figure skaters' z-transformed scores across competitions. Both regression analyses predict the dependent variable from serial position in the round with randomized serial position, whether the figure skater performed first in the round with randomized serial position, and whether the figure skater performed last in round with randomized serial position, controlling for a primacy and recency effect, respectively. Both regression analyses also control for whether a judge and a figure skater share the same nationality (or nationality bias) and whether a figure skater performed in his or her home country (or home advantage.) Dummy variables are included for the figure skater's nationality, and for each individual competition entered into the regression.

Figure skaters from the host country who performed first in a short program or a free skating round are removed from the analyses of that round, because their serial position is likely not based on a random draw. As explained above, a figure skater from the host country was invited to perform first in these rounds if no performers from the host country qualified. The five home contestants who performed first in short programs with randomized serial position are removed from all analyses that use that round's randomized serial position as a predictor. An additional four figure skaters are removed from analyses of the subsequent rounds, because they were from the host country and were invited to skate first in those rounds.

3. Results

The number of participants in the analyses ranges from 13 to 30 ($m=20.25$; $sd=4.47$) across the 120 rounds with randomized serial position, from 13 to 30 ($m=23.77$, $sd=5.24$) across the 64 first subsequent rounds, and from 23 to 24 ($m=23.77$, $sd=.43$) across the 22 second subsequent rounds. In each round, final ranks and final percentile ranks are highly correlated with z-transformed scores, the dependent variable used by Bruine de Bruin (2005) ($r_s \geq .96$, all $p < .001$). (Because percentile ranks retain the rank order of final ranks, these variables show a Spearman rank correlation of 1.00 in each round.)

Fig. 1 shows the average percentile rank in the round with randomized serial position, and the first and second subsequent rounds, by serial position in the round with randomized serial position. Because the number of figure skaters varies across competitions, fewer figure skaters contribute to the average percentile ranks for later serial positions (e.g., with only two appearing as the thirty-first performer in the sequence) leading to potentially less reliable estimates for later serial positions (Fig. 2).

3.1. Round with randomized serial position. A meta-analysis using Stouffer's method reveals that, when combining Spearman rank correlations across the 120 rounds with randomized serial position, final percentile ranks and z-transformed scores increase with serial position (mean $r_s = .07$, Stouffer $z = 3.21$, $p < .01$; mean $r_s = .07$, Stouffer $z = 3.23$, $p < .01$). The left-hand side of Table 1 shows the results of the ordinal regression predicting percentile ranks across rounds with randomized serial position. The left-hand side of Table 2 shows the results of the comparable linear regression predicting z-transformed scores across rounds with randomized serial position. Both analyses reveal a

significant effect of serial position, with figure skaters who are randomly assigned to performing later receiving better scores. Neither analysis shows a significant benefit of appearing first or last, being evaluated by a judge from one's own country, or performing in one's home country. Removing these four variables from the analyses does not affect the estimates or significant level for the reported serial position effect.

3.2. First round following the round with randomized serial position. A meta-analysis using Stouffer's method shows that, across the 64 Spearman rank correlations, figure skaters who perform later in the round with randomized serial position obtain better percentile ranks in the first subsequent round (mean $r_s=.07$, Stouffer $z=2.12$, $p<.05$). The z-transformed scores shows the same pattern (mean $r_s=.07$, Stouffer $z=2.10$, $p<.05$). The middle panel of Table 1 shows the results of the ordinal regression predicting percentile ranks in the round immediately following the round with randomized serial position, in which serial position depended in part on scores obtained in the preceding round (see Appendix). Table 2 shows the corresponding analysis on z-transformed scores. Both analyses show a small yet significant effect of serial position in the round with randomized serial position on scores obtained in the first subsequent round, with figure skaters who perform later in the initial round receiving better scores in the first subsequent round. The ordinal regression shows a marginally significant effect of performing first in the round with randomized serial position. Because analyses control for overall serial position, the marginally significant effect suggests that the first skater suffers somewhat less from the overall serial position effect than other early skaters. However, the linear regression does not replicate this primacy effect. Neither analysis shows a significant effect of performing last in the round with randomized serial

position, having a judge from one's own country on the panel, or performing in one's home country. Removing all of these variables from either analysis has no effect on the estimates for overall serial position, though it does reduce the significance level to $\alpha=.05$.

3.3. Second round following the round with randomized serial position. A meta-analysis using Stouffer's method reveals that, overall, the 22 Spearman rank correlations between serial position in the round with randomized serial position and final percentile rank in the second subsequent round are not significant (mean $r_s=-.03$, Stouffer $z=-.73$, $p=.46$). The same is true for the z-transformed scores (mean $r_s=-.03$, Stouffer $z=-.73$, $p=.46$). The left-hand panel of Tables 1 and 2 shows the predicted estimates for scores in the second subsequent round, in which serial position is based on scores in the preceding round. There is no significant effect of serial position in the round with randomized serial position, appearing first or last in the round with randomized serial position, or performing in one's own country. Neither analysis shows a significant effect of performing first or last in the round with randomized serial position, being evaluated by a judge from one's own country, or performing in one's home country. Removing these variables from either analysis has no effect on the estimates or significance levels for overall serial position.

4. Discussion

Despite being randomly assigned to their starting number in the initial round, figure skaters who perform later receive better scores in the first round, and in the second round, in which figure skaters with better scores in the first round are invited to skate later (see Appendix). This serial position effect does not seem to persist in the third

round, if any is held, possibly because it dissipates, or because there is reduced power in that analysis due to the limited number of third rounds. Thus, Hypotheses 1a and 1b are supported, but Hypothesis 1c is not.

This paper replicates Bruine de Bruin's (2005) main finding, even after addressing concerns about the sample and the dependent variable. A serial position effect is reported in a larger sample of qualifying rounds and short programs with randomized serial position. The effect holds in analyses using percentile ranks and z-transformed scores across judges – two dependent variables that are highly correlated and reveal a similar pattern of results.

The present analyses reveal serial position effects in figure skating rounds with randomized serial position, with no additional benefit to performing first or last. Thus, the analyses do not replicate the serial position effects found in free recall (Anderson, et al., 1998). Like Bruine de Bruin (2005), this paper does not find evidence for a nationalistic bias or a home advantage in figure skating competitions. Possibly, these results are stronger in the Olympics – the competition analyzed in previous papers on these topics (Balmer et al., 2001; Campbell & Galbraith, 1996; Whissell et al., 1993).

Several, not mutually exclusive, explanations may account for the observed serial position effect. One possible explanation refers to the direction-of-comparison effect (Bruine de Bruin & Keren, 2003). When sequentially appearing options are judged by comparison, judges are initially forced to compare each performance to ones before it – but not ones after it. Such unidirectional comparisons tend to overweigh the unique features of each new, focal, performance (Tversky, 1977). Because world-level figure skaters will have more unique positive than unique negative features, focusing on the

unique features of each new performer will increase scores with serial position (Bruine de Bruin & Keren, 2003).

Second, judges may feel uncertain about how to judge the first few performers. To be safe, they may initially use scores from the middle of the scale, saving more extreme scores for later contestants. Because determining a winner is ultimately the goal of a competition, judges may be especially reluctant to give high scores to early contestants, in case a better performer may come along. Bruine de Bruin (2005) shows that figure skating judges follow this pattern while Eurovision judges do not, suggesting that uncertainty about the quality of early performances does not fully explain the reported serial position effects.

Third, the observed serial position effect may also reflect an actual increase in performance over the course of the competition. Having seen others give stellar performances may motivate figure skaters to put extra effort into their performance. Effects of serial position on actual performance can not be tested in judged competitions, because they provide no objective measure of performance quality. However, controlled experiments suggest that videotaped gymnastics performances are judged as better when they are viewed later in the sequence (Plessner, 1999; Scheer & Ansorge, 1975).

It should be noted that the reported serial position effects have a small effect size. Yet, Rosenthal (1990) has argued that even results with small effect sizes can have serious consequences. A small change in serial position can arguably make a large difference. Selection for subsequent competitions may depend on final ranking in the preceding year. International recognition and endorsements may mostly go to the winners of a competition. Through its effect on final scores, a random draw for serial

position may therefore have lasting effects on the subsequent careers of contestants (e.g., Ginsburgh & van Ours, 2003).

Many competitions use randomization to give contestants an equal chance to perform in preferred serial positions. A random draw does not remove the artificial advantage of performing later in the sequence, but, rather, gives every contestant an equal chance to obtaining it. The observed serial position effect may be reduced by asking figure skaters to skate one of the later rounds in reverse order compared to the round in which order was determined at random. Organizers may be opposed to changing their current system, however, because competitions may be more exciting to watch if better skaters perform last. Indeed, this is why the International Skating Union has skaters who received higher scores in previous rounds perform later in subsequent rounds (ISU, 2002). Unfortunately, this practice allows serial position effects to reverberate throughout multiple rounds, giving figure skaters who performed later in the round with randomized serial position an artificial advantage in multiple rounds of figure skating competitions.

Recently, international figure skating competitions have switched to a new judging system, which no longer encourages judges to produce ordinal scores. Rather, each figure skater is judged without making an explicit comparison to others, possibly aiming to reduce order effects due to direction-of-comparison effects (Bruine de Bruin & Keren, 2003). A press release by the United States Figure Skating Association expects that, as a result, the new judging system should not produce serial position effects (USFSA, 2004). There are not yet enough data to evaluate whether the new judging system does indeed prevent serial position effects. Serial position effects may still occur,

however, because they have appeared under various judging systems, including ones that do not explicitly encourage judges to compare candidates (e.g., Bruine de Bruin, 2005; Flôres & Ginsburgh, 1996; Glejser & Heyndels, 2001; Haan et al., 1995; Wilson, 1977). If so, figure skaters may still hum The Drifters' 1961 hit song "Save the last dance for me" while participating in the random draw for their starting order.

References

- Anderson, J.R., Bothell, D., Lebiere, C., & Matessa, M. (1998). An integrated theory of list memory. *Journal of Memory and Language*, 38, 341-480.
- Balmer, N.J., Nevill, A.M., & Williams, A.M. (2001). Home advantage in the winter Olympics (1908-1998). *Journal of Sports Sciences*, 19, 129-139.
- Bruine de Bruin, W. (2005). Save the last dance for me: Unwanted serial position effects in jury evaluations. *Acta Psychologica*, 118, 245-260.
- Bruine de Bruin, W., & Keren, G.B. (2003). Order effects in sequentially judged options due to the direction of comparison. *Organizational Behavior and Human Decision Processes*, 92, 91-101.
- Campbell, B., & Galbraith, J.W. (1996). Nonparametric tests of the unbiasedness of Olympic figure skating judgments. *The Statistician*, 45, 521-526.
- Flôres, R.G., Jr., & Ginsburgh, V.A. (1996). The Queen Elisabeth musical competition: How fair is the final ranking? *The Statistician*, 45, 97-104.
- Ginsburgh, V.A., & van Ours, J.C. (2003). Expert opinion and compensation: Evidence from a musical competition. *American Economic Review*, 93, 289-296.

- Glejser, H., & Heyndels, B. (2001). Efficiency and inefficiency in the ranking in competitions: The case of the Queen Elisabeth Music Contest. *Journal of Cultural Economics*, 25, 109-129.
- Haan, M. & Dijkstra, S. & Dijkstra, P. (2005). Expert Judgment Versus Public Opinion – Evidence from the Eurovision Song Contest. *Journal of Cultural Economics*, 29, 59-78.
- ISU (2002). Urgent proposal No. 30. In: *Communication No. 1160. 2002 ISU Congress – Urgent Matters*. Lausanne, Switzerland, pp. 8.
- Plessner, H. (1999). Expectation biases in gymnastics judging. *Journal of Sport & Exercise Psychology*, 21, 131-144.
- Rosenthal, R. (1990). How are we doing in soft psychology? *American Psychologist*, 45, 775-776.
- Rosenthal, R., & Rosnow, R.L. (1991). *Essentials of behavioral research: Methods and data analysis*. New York, NY: McGraw-Hill.
- Scheer, J.K. (1973). Effect of placement in the order of competition on scores of Nebraska high school students. *Research Quarterly*, 44, 79-85.
- Scheer, J.K., & Ansorge, C.J. (1975). Effects of naturally induced judges' expectations on the ratings of physical performances. *Research Quarterly*, 46, 463-470.
- Truchon, M. (2004). *Aggregation of rankings in figure skating*. Québec, Canada: Université Laval, Département d'économique.
- Tversky, A. (1977). Features of similarity. *Psychological Review*, 84, 327-352.

USFSA (2004). ISU New Judging System - 2004-05 International Usage.

<http://www.usfigureskating.org/Shell.asp?sid=26747> last accessed January 21st, 2006.

Weekley, J.A., & Gier, J.A. (1989). Ceilings in the reliability and validity of performance ratings: The case of expert raters. *Academy of Management Journal*, 32, 213-222.

Whissell, R., Lyons, S., Wilkinson, D., & Whissell, C. (1993). National bias in judgments of Olympic-level skating. *Perceptual and Motor Skills*, 77, 355-358.

Wilson, V.E. (1977). Objectivity and effect of order of appearance in judging of synchronized swimming meets. *Perceptual and Motor Skills*, 44, 295-298.

Zimmerman, D.W., & Bruno, B.D. (2005). Can percentiles replace raw scores in the statistical analysis of test data? *Educational and Psychological Measurement*, 65, 616-638.

Table 1: Estimates of percentile ranks in the initial and subsequent rounds of international figure skating competitions.

Predictor variables	Round with randomized serial position (Nagelkerke $R^2=.54$)			First subsequent round (Nagelkerke $R^2=.49$)			Second subsequent round (Nagelkerke $R^2=.51$)		
	B	se	Wald (1)	B	se	Wald (1)	B	se	Wald (1)
Serial position in <i>round with randomized serial position</i>	.02	.00	27.84 ^{***}	.01	.01	7.27 ^{**}	.00	.01	.03
Appeared first in <i>round with randomized serial position</i>	.12	.10	1.32	.23	.13	3.02 ⁺	.08	.21	.14
Appeared last in <i>round with randomized serial position</i>	-.15	.10	2.25	-.09	.13	.45	.00	.25	.00
Judge from own country	.05	.05	.98	-.08	.06	1.60	-.17	.11	2.28
Home advantage	.07	.11	.40	.17	.13	1.87	.18	.22	.64

*** $p < .001$; ** $p < .01$; + $p < .10$.

Note: Serial position in subsequent rounds depended on scores in the immediately preceding round (see Appendix).

Table 2: Estimates of z-transformed scores in the initial and subsequent rounds of international figure skating competitions.

Predictor variables	Round with randomized serial position ($R^2=.57$)				First subsequent round ($R^2=.51$)				Second subsequent round ($R^2=.52$)			
	Partial correla tion	B	se	t(1)	Partial correla tion	B	se	t(1)	Partial correla tion	B	se	t(1)
Serial position in <i>round with randomized serial position</i>	.11	.01	.00	5.25***	.07	.01	.00	2.60**	-.01	.00	.01	-.20
Appeared first in <i>round with randomized serial position</i>	.02	.06	.07	.85	.02	.07	.10	.72	.00	-.01	.15	-.08
Appeared last in <i>round with randomized serial position</i>	-.03	-.11	.07	-1.61	-.03	-.12	.10	-1.22	-.01	-.05	.18	-.26
Judge from own country	.03	.04	.03	1.21	-.04	-.06	.04	-1.42	-.07	-.12	.08	-1.54
Home advantage	.01	.03	.07	.44	.04	.15	.09	1.62	.03	.09	.16	.58

*** $p < .001$; ** $p < .01$.

Note: Serial position in subsequent rounds depended on scores in the immediately preceding round (see Appendix).

Fig. 1. Average percentile rank across (A) rounds with randomized serial position, (B) the first subsequent round, and (C) the second subsequent round, by serial position in the round with randomized serial position.

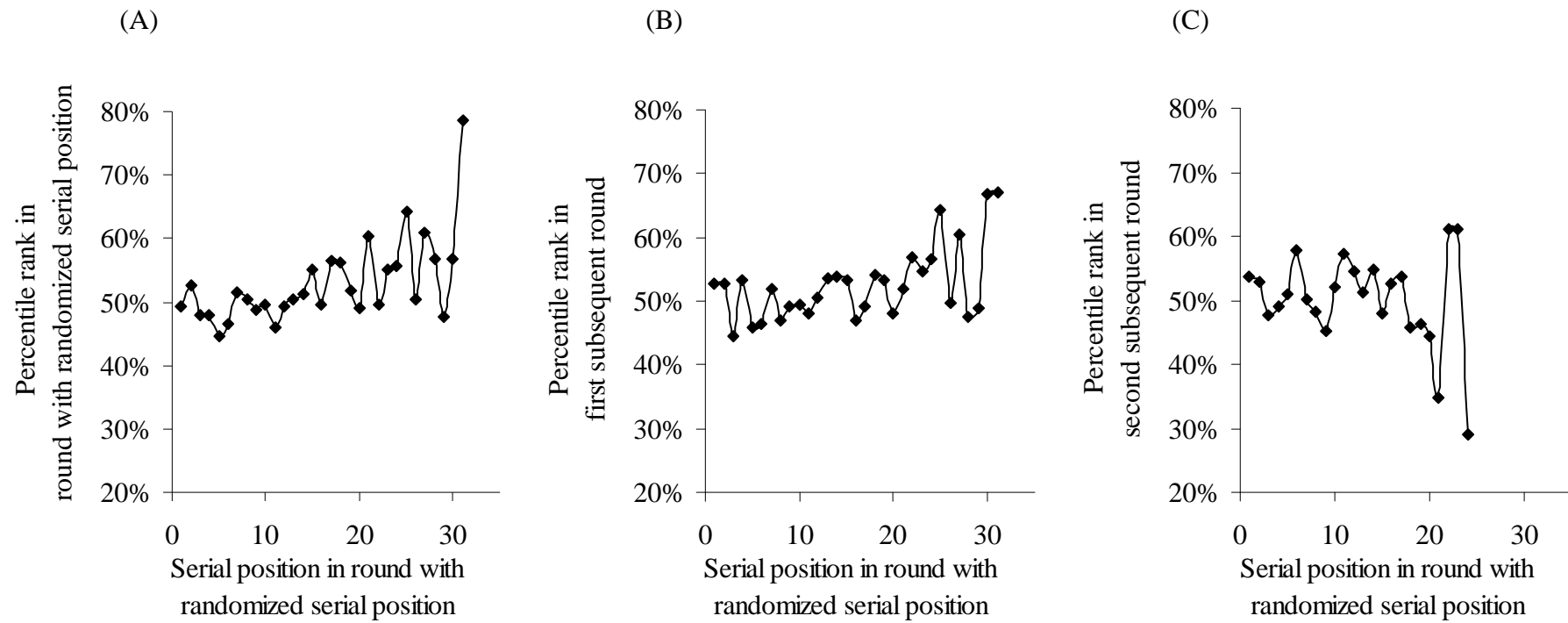
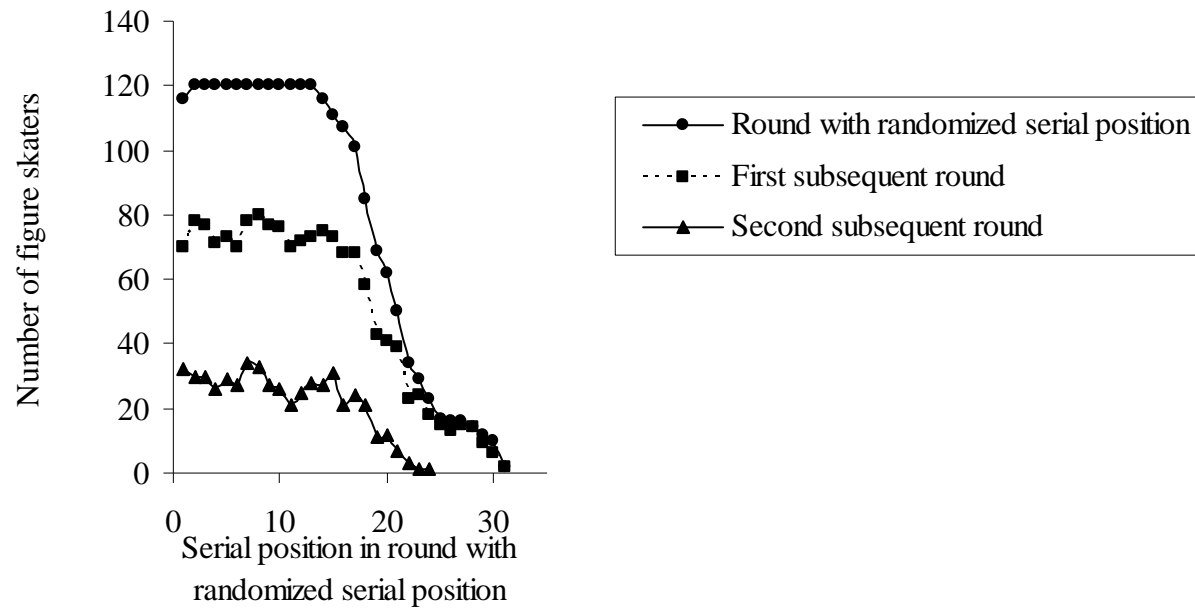


Fig. 2. Number of observations in each round, by serial position in the round with randomized serial position.



Note: Figure skaters from the host country were excluded from the analyses if they were invited to skate first despite not actually qualifying.

Appendix: More detailed rules for the different figure skating rounds

Qualifying rounds

If the number of entries in competitions with for men or women exceeds 30 (ISU, 1994) or 31 (ISU, 1996, 1998a, 2000, 2004), a qualifying round is held. Participants are divided into two groups (A and B) of approximately equal quality and size. To this end, skaters who ended in the top 24 of the same championship in the immediately preceding year are listed by their final placement, followed by the remaining skaters in alphabetical order. Listed skaters receive alternating assignments to qualifying rounds A and B. Serial position in both qualifying rounds is determined by a random draw. The top ten in each qualifying round, in addition to the top ten of the same championship in the previous year (ISU, 1994), or the top fifteen in each round (ISU, 1996, 1998a, 2000, 2004) qualify for the short program. Figure skaters in the qualifying rounds perform a free skating routine, which does not include require elements. Performers are judged for technical merit and artistic impression. Judges give up to 12 points on an ordinal scale, reflecting a maximum of 6.0 for each of the two dimensions.

Short program

A maximum of 30 (ISU, 1994) or 31 (ISU, 1996, 1998a, 2000, 2004) figure skaters can enter the short program. Whether or not a qualifying round is held to reduce the number of entries, serial position in the short program has been randomized in all competitions held between 1994 and 1998. Before 1999, serial position in the short program was randomized (ISU, 1994, 1996). Starting in 1999, serial position in the short program has only been randomized if no qualifying rounds are needed (ISU, 1998b). If there are qualifying rounds in these competitions, the three best figure skaters from each

qualifying round randomly draw lots for the last six serial positions in the short program. The next three best performers in each round draw for the next six serial positions near the end. If no skater from the host country qualified for the Short Program, one home contestant is added to skate first.

Figure skaters in the short program are judged on required elements and presentation, which includes the beauty of the routine. Judges give up to 12 points on an ordinal scale, reflecting a maximum of 6.0 for each of the two dimensions.

Free skating

A maximum of 24 figure skaters have typically been allowed to proceed to the free skating round. Serial position in the free skating round is based on scores in the short program, with the best six drawing lots for the six highest serial positions, the next six drawing lots for the next six serial positions, and so on. If no skater from the host country qualified for the free skating round, one home contestant is added to skate first. Unlike short programs, free skating routines do not include required elements. Instead, figure skaters are judged for technical merit and artistic impression, as in the qualifying rounds (if any.)

References

ISU (1994). Rule 404. *Special Regulations Single & Pair Skating*. Lausanne, Switzerland: International Skating Union, pp. 183-184.

ISU (1996). Rule 379. *Special Regulations Single & Pair Skating*. Lausanne, Switzerland: International Skating Union. pp. 55-57.

ISU (1998b). *Actions from the 1998 ISU congress*. Lausanne, Switzerland: International Skating Union.

ISU (1998a). Rule 379. In: *Special Regulations Single & Pair Skating*. Lausanne, Switzerland: International Skating Union, pp. 55-57.

ISU (1998c). *Communication No. 997. New ISU Figure Skating Results System*. Lausanne, Switzerland: International Skating Union.

ISU (2000). Rule 379. In: *Special Regulations Single & Pair Skating*. Lausanne, Switzerland: International Skating Union, pp. 53-56.

ISU (2004). *Special Regulations Single & Pair Skating*. Lausanne, Switzerland: International Skating Union.