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Beyond genetics in Mental Rotation Test performance
The power of effort attribution

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ABSTRACT

This study compares the effects on Mental Rotation Test (MRT) performance of instructions that stress the importance of (a) personal effort, and (b) genetically driven ability. A total of 120 high-school students were assigned to three groups, and administered two sub-tests of the MRT. Between the first and second sub-tests, the groups received one of the following instructions: effort ("anyone can succeed in this task by putting in effort"), ability ("performance on the test depends on genetic determinants"), and neutral for control ("this is an important test used in many countries"). We predicted that effort but not ability instructions would affect performance. Results confirmed the prediction and showed that, after controlling for baseline performance, the effort group outperformed the ability and control groups, which did not differ from each other. Discussion focuses on the mechanisms implied in believing ability to be genetically determined or experientially driven.

1. Introduction

Suppose you have to perform a task and think or are told that the underlying ability has genetic causes. How well do you expect to perform? Very probably you might expect to do well if you perceive yourself as able, and badly if you perceive your ability as low. In any case you would not give importance to the role of effort and strategic behavior in performance.

Instead, suppose you think or are told that experiential causes give rise to individual differences in performance—the more you practice and acquire strategies the better you will perform. Perhaps you would conclude that there is room for improvement and would be motivated to act in a strategic way. Does this result in a positive effect on performance?

To date, this issue has been examined in the realm of mathematics (Dar-Nimrod & Heine, 2006). These authors found that, after having primed the occurrence of gender differences in the test to be performed, women do better if an experiential cause is given than when instructions stress genetic causes. This result suggests that attributing performance to genetic or experiential factor indeed influences performance itself. It would be of interest to examine this speculation on a sample of women and men, using a test for which individual differences—particularly gender differences favoring men (e.g., Voyer, Voyer, & Bryden, 1995)—have been shown to depend very largely on physiology (Yen, Jaffe, & Barbieri, 1999), hormones (Baron-Cohen, 2003), hemispheric specialization and brain organization from prenatal life (e.g., Burton, Henninger, & Hafetz, 2005). The test in question—the Mental Rotation Test (MRT: Vandenberg & Kuse, 1978)—is used to assess ability to mentally manipulate abstract visual configurations; 20 target objects made up of assembled cubes are presented, followed by four similar objects differing in degree of rotation or as mirror images. Instructions require identification of the two figures that are identical to the target but rotated in three-dimensional space (an example is shown in Fig. 1).

Together with this large body of evidence suggesting a genetic explanation for male superiority in mental rotation, research has also shown that MRT accuracy can be raised through training (e.g., Feng, Spence, & Pratt, 2007), practice, exercise and schooling (e.g., Baenninger & Newcombe, 1995; Kirby & Boulter, 1999). While training (e.g., Alington, Leaf, & Monaghan, 1992), exercising with geometry (Kirby & Boulter, 1999) and practice with games involving spatial skills (Bjorklund & Brown, 1998) can indeed raise performance in mental rotation, it has been documented that experience cannot always make a difference. For instance, Quaiser-Pohl, Geiser and Lehmann (2006) have found that computer game preference was unrelated to MRT performance for females, but not for males. Some social factors can help explain this differential effect of practice on performance. Among them, stereotype threat has been examined in previous research, i.e., the fear of performing badly owing to awareness of belonging to a group that is object of negative stereotype (Maass & Cadinu, 2003; Steele, 1997), and was found to have a real effect on women's performance in the MRT (Moè & Pazzaglia, 2006). However, a number of studies have shown that the stereotype negative role can be lessened by self-affirmation (Martens, Johns, Greenberg, & Schimel, 2006), teaching interventions (Johns, Schmader, & Martens, 2005), and positive stereotype messages (Moè, 2009; Wraga, Duncan, Jacobs, Helt, & Church, 2006). All the

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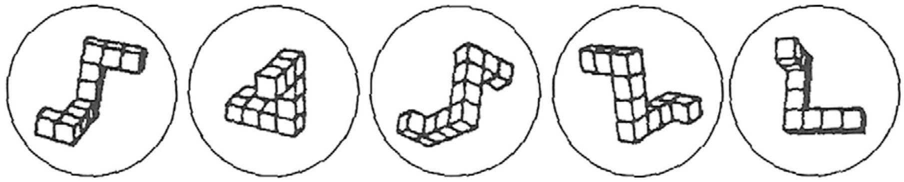

Fig. 1. A sample item from the MRT.

studies support the idea that motivational and social variables can influence performance, beyond and/or in addition to the stereotype threat effect.

The present research was designed to investigate the effect of instructions that stress the role of effort or ability on performance. The first induces the belief that experiential causes, such as strategies used, can affect performance, and that anyone can improve if they make enough effort. The second gives the message that aptitude plays a substantial role. These instructions affect attributions made in the specific task, being context-based causal messages given to people who already have a personal explanatory style, conceived as an enduring characteristic that affects performance and the evaluations of personal results (Weiner, 1985). However, explanatory styles for positive events are less stable than those for negative events (Burns & Seligman, 1989; Seligman, 1994) and can be influenced by experimental manipulation (e.g., Mueller & Dweck, 1998), as carried out in our research, by inducing the belief that what makes the difference in performance is putting in effort or being able.

Effort or ability instructions could lead to development of incremental or entity theory about personal ability, respectively (Dweck, 1999). The former concerns the belief that improvement is always possible, while the latter leads to the belief that abilities are fixed and can only be demonstrated, not improved. Incremental theory aids performance, as recently demonstrated (Moè, Meneghetti, & Cadinu, 2009), since it sustains a strategic approach to the task and the motivation for a person to do their best. In contrast, believing that what matters is ability leads to vulnerability when dealing with difficulties or failures, and favors emotions that stimulate disengagement from the task, for example shame (Weiner, 2000, 2005). Thus for both attributional and Dweck's theory, effort instructions, focused on experiential causes as origin of individual differences, should affect performance more than ability instructions.

In mathematics it has been found that gender differences in performance depend on the attributional style (Stipek & Gralinski, 1991). These authors reported that females recognized lack of effort as a cause of failure and hence tend to experience guilt, while males recognize ability and natural aptitude as the source of success and so tend to experience pride when tackling mathematics-type tasks. These emotions affect expectations and disposition toward the subject as well as performance. This is what happens in natural settings. Research exploring effects of instructions on males and females found no difference in the size of increase due to the experimental manipulation. This has been demonstrated both in suggesting that effort or ability make the difference (Mueller & Dweck, 1998) and in priming a positive stereotype (Wraga et al., 2006). In line with the results of these studies we also speculated that both sexes would improve to the same extent following effort or ability instructions, i.e., we expected 'manipulated' females to perform better than the non-manipulated, the difference with male performance being maintained.

On the basis outlined above, we postulate that instructions on effort or on ability can affect performance. In particular, we expect that when experiential causes are suggested, there should be greater improvement in performance than when performance is attributed to genetic factors; this is so because the tasks are more likely to be approached with an expectation of doing well, since this sustains an incremental view of abilities, an attributional style focused mainly on effort and emotions that favor engagement. Instead, suggesting that genetic causes underlie individual differences in performance is likely to lead to concerns about being able to perform well enough, development of an entity view of abilities, an attributional style focused on lack of ability and emotions that impair willingness to carry out the task and favor low persistence.

To test the effects resulting from instructions on effort or on ability (implying experiential vs. genetic reasons of individual differences in performance), our study used a modified version of the MRT comprising two halves of equal difficulty. The first was administered before instructions as baseline measure; the second was given after instructions, to verify any changes in performance due to the experimental manipulation.

Our aim was to induce participants to believe that what matters is:

a) Putting in effort and using the right strategies. This way anyone can manage to perform well on the task (effort instructions) and
b) Having the right abilities, for which research has demonstrated a genetic origin. Without the right genes, success on the task will be difficult (ability instructions).

We predicted that effort instructions would increase performance more than instructions stressing ability. In accordance with earlier research (Mueller & Dweck, 1998; Wraga et al., 2006), we expected to observe this increase due to instructions given for both genders. However—in line with a large body of literature—we expected males to score higher than females.

2. Method

2.1. Participants

A total of 120 high-school students (68 females), mean age 17.02, *SD* 1.03, volunteered to participate. They attended two different schools. The first ($n=57$, 26 females) had mainly technical orientation ('istituto tecnico'), the second ($n=63$, 42 females) scientific ('liceo scientifico'). There was no particular emphasis on aptitude in spatial abilities in any of the school syllabuses. Participants were randomly assigned to one of two groups, given instructions relating to effort or ability, respectively. A third (control) group was given neutral instructions.

2.2. Materials

We used a modified version of the MRT by Vandenberg and Kuse (1978). The original version comprises 20 items of increasing difficulty. Two sub-tests of equal difficulty were needed, one for use before the experimental manipulation, the other after. To this end, we administered the original version of the MRT to a group of 20 high-school students, and then matched items equal in percentage of correct answers, i.e., level of difficulty. This adapted version had proved reliable in previous studies (Moè, 2009; Moè & Pazzaglia, 2006).

2.3. Design

A mixed design was applied: 3 instructions (ability, effort and control) × 2 gender (male vs. female) × 2 times (before vs. after instructions) with the first two factors between-subjects and the third within-subject.

2.4. Procedure

Participants were tested in groups of about 20. They were presented with the test instructions and three practice items. They were then allowed 4 min to complete the first half of the test, after which the experimenter reads out the instructions for the second part from an instruction sheet that had also been distributed to participants.

All groups were given this general statement "The test you are performing measures spatial abilities".

The effort instructions group (37 participants, 19 females) was then told: 'Much research has demonstrated that spatial abilities differ from subject to subject. It has been suggested, and research has also demonstrated, that anyone can succeed in this kind of task, independently of initial level of performance, by putting in effort and using the right strategies'.

The ability instructions group (45 participants, 28 females) was told: 'Much research has demonstrated that spatial abilities differ from subject to subject. A genetic explanation has been proposed. This means that some can succeed in this task with no effort, while others, notwithstanding the effort put in, are unable to improve their performance in this kind of task'.

The control group (38 participants, 21 females) was told: 'Much research has demonstrated that spatial abilities are important in many everyday tasks, for instance in orienting. This test has been used in the USA, Europe and Italy. Research in Italy confirmed the results found in other countries'.

The groups were then allowed 4 min to perform the second half of the MRT. Finally, all participants were debriefed.

2.5. Scoring

One point was assigned for each response item correctly identified. Since there were 10 target items for each half of the MRT and two correct response items for each, the maximum theoretical score was 20. The maximum effective score was 19 in the first half (baseline) and 20 in the second.

3. Results

3.1. Preliminary analysis

Given that various studies have revealed differences due to the spatial content of the main subjects on the syllabus of different schools (Peters, Lehmann, Takahira, Takeuchi & Jordan, 2006) and differences between summer time and school-year time (Baenninger & Newcombe, 1995) as an effect of practice on spatial tasks, baseline mental rotation scores of participants attending the two schools were compared. In consideration of the nature–nurture hypothesis (Casey, Nutall & Pezaris, 1999), gender was included in the analysis. A 2 (schools: technical vs. scientific) × 2 (gender: males vs. females) analysis of variance (ANOVA) showed a main effect due to gender, $F(1, 116) = 12.21$, $p = .001$, $\eta^2 = 0.09$ (males $M = 12.10$, $SD = 3.75$, females $M = 10.01$, $SD = 3.25$), but no significant effects due to school or interaction school by gender ($Fs < 2.30$, $p > .10$). Consequently effects due to school were not considered further.

We then compared the three groups and the two gender baseline performances in order to verify if these were equal in pre-experimental manipulation. The gender effect was confirmed, $F(1, 114) = 11.92$, $p = .001$, $\eta^2 = 0.09$, a significant difference being found among the three groups, $F(2, 114) = 3.50$, $p = .03$, $\eta^2 = 0.06$. LSD post-hoc analysis showed that participants in the control condition ($M = 12.00$, $SD = 3.40$) had higher scores than those in the effort ($M = 10.32$, $SD = 3.47$) and ability instruction ($M = 10.49$, $SD = 3.76$) conditions, which did not differ from each other. We consequently designed a way to include the baseline performance in the following analysis.

3.2. Effects due to instructions

A 3 groups (effort, ability, control) × 2 gender (male vs. female) × 2 times (before vs. after instructions) ANOVA was run on the accuracy scores. Results confirmed the main effect due to gender, $F(1, 114) = 14.43$, $p < .001$, $\eta^2 = 0.11$, and showed that time was significant alone, $F(1, 114) = 31.82$, $p < .001$, $\eta^2 = 0.22$, and in interaction with groups, $F(2, 114) = 11.73$, $p < .001$, $\eta^2 = 0.17$. No other significant effect emerged. Tukey—a post-hoc analysis for paired comparisons showed a critical value of 0.82: both effort and ability groups increased performance after instructions. Table 1 shows the mean values obtained before and after instructions by the three groups.

To explore effects due to instructions, an analysis of covariance with baseline performance as covariate was run on the accuracy scores after instructions. Results showed a significant main effect of groups $F(2, 113) = 9.31$, $p < .001$, $\eta^2 = 0.14$ (effort instructions $M = 13.32$, $SD = 3.46$, ability instructions $M = 11.58$, $SD = 4.00$, control condition $M = 12.03$, $SD = 3.76$) and of the covariate, $F(1, 113) = 112.11$, $p < .001$, $\eta^2 = 0.50$ (baseline $M = 10.92$, $SD = 3.61$, after instructions $M = 12.26$, $SD = 3.81$). Gender was not significant, either as single effect or in interaction with instructions.

Post-hoc analyses carried out through the LSD test showed that effort instructions resulted in higher performance than ability instructions. The effect had a medium-size (Cohen, 1988) practical significance of Cohen d 0.45 (see Fig. 2). The confidence intervals were 12.17–14.48, 10.38–12.78 and 10.79–13.26 for effort instructions, ability instructions and control condition, respectively.

3.3. Effects due to gender

Previous analysis revealed a significant gender effect, but showed that gender did not interact with instructions, meaning that effects of instructions were the same for males and females. However, for a closer exploration of the occurrence of gender differences after instructions a 3 (groups) × 2 (gender) ANOVA was run on accuracy scores after instructions. A main effect due to gender was confirmed, $F(1, 114) = 12.68$, $p = .001$, $\eta^2 = 0.10$ (males $M = 13.62$, $SD = 3.53$, females $M = 11.22$, $SD = 3.71$).

4. Discussion

The three main findings are summarized as follows: effort instructions increased performance more than ability, and effects due to instructions occurred independently of gender, although males scored higher than females. These are discussed below, starting from general effects due to instructions, then considering gender effects both alone and in conjunction with instructions.

Both effort and ability instructions bring about an increase in performance not attributable to practice and familiarization with the task, since these did not occur in the control condition. As predicted, effort instructions had a substantial positive effect on performance,

Table 1
Mean scores and standard deviations of the three groups before and after instructions.

	Before		After	
Instructions	*M*	*SD*	*M*	*SD*
Effort	10.32	3.47	13.32	3.46
Ability	10.49	3.76	11.58	4.00
Control	12.00	3.40	12.03	3.76

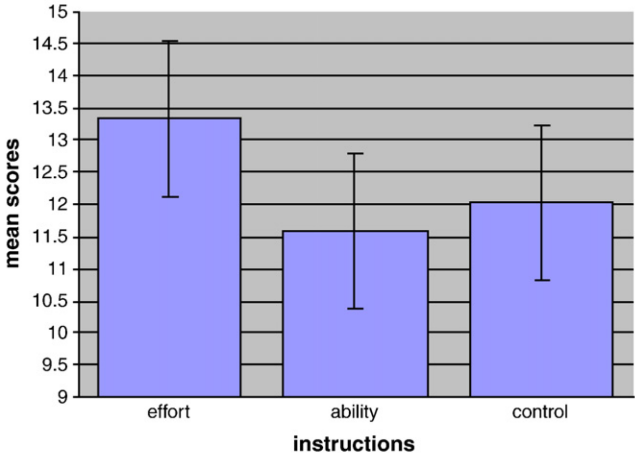

Fig. 2. Accuracy scores in MRT following instructions on effort, instructions on ability, and in control condition.

higher than that observed for ability, as revealed by the covariance analysis. This analysis eliminates effects due to baseline performance, i.e., any difference due to causal distributions of participants in the three groups corresponding to instructions, and any due to overall gender differences. Both differed in baseline skills, the control group and males showing scores higher than the other groups. Broadly speaking, effects of instructions might be affected by the high/low baseline performance resulting from individual differences among participants. Having considered the score before instructions as covariate eliminated this risk and showed that the increase reached statistical significance just for effort instructions, as predicted.

The overall main gender effect was confirmed both before and after experimental manipulation. Males scored better than females, 2.09 points higher before and 2.4 points after manipulation. At all times, the size of the difference was just the same, i.e., 21% (from 10.01 to 12.10 and from 11.22 to 13.62). These results confirmed data already presented in the literature (e.g., Linn & Petersen, 1985) on gender differences in MRT performance.

As expected, there was no significant interaction between gender and instructions. This meant that instructions affected performance irrespective of gender. Despite the well documented biologically-rooted gender differences in MRT (e.g., Burton et al., 2005), females can improve on a task if they are induced to believe that what matters above all is effort and practice. More generally, this result suggests that even when genetic constraints actually affect performance, the belief that abilities improve through effort helps to raise performance in all cases.

5. Conclusions

Mental rotation ability is crucial for success in areas such as mathematics and science (Linn & Petersen, 1986), and male superiority in performance over females has been largely demonstrated. Very many biological explanations have been given, along with some nature–nurture aspects (Casey, 1996). Furthermore, research has recently also explored the role of social factors such as stereotyping. We considered a further possible explanation derived from studies on the role of motivational factors in cognitive performance (e.g., Dweck, 1999; Weiner, 1985), and found that causal attributions to effort or ability can differently affect MRT performance. Similar results were obtained in past studies based on an intelligence test (Mueller & Dweck, 1998) or on mathematics tasks (Stipek & Gralinski, 1991). Effort instructions favor an increase in performance, while no differential effect occurs for males or females.

Our study has shown that inducing effort attribution appears to be a way of raising performance, even if the initial level is low, as for females in the MRT. Instructions focused on effort helps people to improve their performance. The mechanisms implicated in this effect still need clarification, though previous research speculates on the involvement of strategic and emotional factors.

Stable, uncontrollable and global causes such as perceived lack of ability or of aptitude negatively affect expectations to succeed and hence the search for the best strategies to apply (Peterson & Seligman, 1984). Instead, causes that are more controllable, such as effort, have a positive effect on both expectations and strategic approach (Borkowsky & Muthuskrishna, 1992). Attribution to lack of effort gives rise to guilt or anger, in an interpersonal view, while blaming low attitude as a cause of failure induces shame as self-directed emotion or sympathy by others (Weiner, 2000, 2005). Both guilt and anger are emotions that motivate toward engaging with the situation, while shame encourages disengagement.

As well as furnishing possible explanations for this phenomenon, our findings highlight its importance in terms of educational implications. Being instructed that anyone can succeed in a certain task, independently of initial level of performance, by putting in effort and using the right strategies resulted in an improvement in performance, even when, as in the case of MRT, individual differences might be ascribed to genetic causes. In conclusion we can affirm that whereas genetics explain the initial level and baseline, and tell us how much ability a person has, functional beliefs tell us how much a person can improve, and, as a corollary, that improvement is possible.

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References

Alington, D. E., Leaf, R. C., & Monaghan, J. R. (1992). Effects of stimulus color, pattern, and practice on sex differences in mental rotation task performance. *Journal of Psychology*, *126*, 539−553.

Baenninger, M., & Newcombe, N. (1995). Environmental input to the development of sex-related differences in spatial and mathematical ability. *Learning and Individual Differences*, *7*, 363−379.

Baron-Cohen, S. (2003). The essential difference. *Men, women and the extreme male brain*. Allan Lane: Penguin Books.

Bjorklund, D. F., & Brown, R. D. (1998). Physical play and cognitive development: Interacting activity, cognition, and education. *Child Development*, *69*, 604−606.

Borkowsky, J., & Muthuskrishna, N. (1992). Moving metacognition into the classroom: "Working models" and effective strategy teaching. In J. T. Guthrie, M. Pressley, & K. R. Harris (Eds.), *Promoting academic competence and literacy in school* (pp. 67−101). San Diego, CA, US: Academic Press.

Burns, M. O., & Seligman, M. E. (1989). Explanatory style across the life span: Evidence for stability over 52 years. *Journal of Personality and Social Psychology*, *56*(3), 471−477.

Burton, L., Henninger, D., & Hafetz, J. (2005). Gender differences in mental rotation, verbal fluency and SAT scores to finger length ratios as hormonal indexes. *Developmental Neuropsychology*, *28*, 493−505.

Casey, M. B. (1996). Understanding individual differences in spatial ability with females: A nature/nurture interactionist framework. *Developmental Review*, *16*, 241−260.

Casey, M. B., Nuttall, R. L., & Pezaris, E. (1999). Evidence in support of a model that predicts how biological and environmental factors interact to influence spatial skills. *Developmental Psychology*, *35*, 1217−1247.

Cohen, J. (1988). *Statistical power analysis for the behavioural sciences*, 2nd ed Hillsdale, N.J.: Lawrence Erlbaum Associates.

Dar-Nimrod, I., & Heine, S. J. (2006). Exposure to scientific theories affects women's math performance. *Science*, *314*, 435.

Dweck, C. S. (1999). *Self-theories: Their role in motivation, personality, and development.* London: Taylor & Francis.

Feng, J., Spence, I., & Pratt, J. (2007). Playing an action video game reduces gender differences in spatial cognition. *Psychological Science*, *18*(10), 850−855.

Johns, M., Schmader, T., & Martens, A. (2005). Knowing is half the battle. Teaching stereotype threat as a means of improving women's math performance. *Psychological Science*, *16*, 175−179.

Kirby, J. R., & Boulter, D. R. (1999). Spatial ability and transformational geometry. *European Journal of Psychology of Education*, *14*, 283−294.

Linn, M. C., & Petersen, A. C. (1985). Emergence and characterization of sex differences in spatial ability: A meta-analysis. *Child Development*, *56*, 1479−1498.

Linn, M. C., & Petersen, A. C. (1986). A meta-analysis of gender differences in spatial ability: Implications for mathematics and science achievement. In S. Hyde, & M. C. Linn (Eds.), *The psychology of gender* (pp. 67−101). Baltimore: Johns Hopkins Univ. Press.

Maass, A., & Cadinu, M. (2003). Stereotype threat: When minority members underperform. *European Review of Social Psychology*, *14*, 243−275.

Martens, A., Johns, J., Greenberg, J., & Schimel, J. (2006). Combating stereotype threat: The effect of self-affirmation on women's intellectual performance. *Journal of Experimental Social Psychology*, *42*, 236−243.

Moè, A. (2009). Are males always better than females in mental rotation? Exploring a gender belief explanation. *Learning and Individual Differences*, *19*(1), 21−27.

Moè, A., Meneghetti, C., & Cadinu, M. (2009). Women and mental rotation: Incremental theory and spatial strategy use enhance performance. *Personality and Individual Differences*, *46*(2), 187−191.

Moè, A., & Pazzaglia, F. (2006). Following the instructions! Effects of gender beliefs in mental rotation. *Learning and Individual Differences*, *16*, 369−377.

Mueller, C. M., & Dweck, C. S. (1998). Intelligence praise can undermine motivation and performance. *Journal of Personality and Social Psychology*, *75*, 33−52.

Peters, M., Lehmann, W., Takahira, S., Takeuchi, Y., & Jordan, K. (2006). Mental rotation test performance in four cross-cultural samples ($n = 3367$): Overall sex differences and the role of academic program in performance. *Cortex*, *42*(7), 1005−1014.

Peterson, C., & Seligman, M. E. (1984). Causal explanations as a risk factor for depression: Theory and evidence. *Psychological Review*, *91*, 347−374.

Quaiser-Pohl, C., Geiser, C., & Lehmann, W. (2006). The relationship between computer-game preference, gender, and mental rotation ability. *Personality and Individual Differences*, *40*, 609−619.

Seligman, M. E. P. (1994). *Apprendre l'Optimisme.* Paris: Inter Editions.

Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist*, *52*, 613−629.

Stipek, D. J., & Gralinski, J. H. (1991). Gender differences in children's achievement related beliefs and emotional responses to success and failure in mathematics. *Journal of Educational Psychology*, *83*, 361−371.

Vandenberg, S. G., & Kuse, A. R. (1978). Mental rotations: A group test of three-dimensional spatial visualization. *Perceptual & Motor Skills*, *47*, 599−604.

Voyer, D., Voyer, S., & Bryden, M. P. (1995). Magnitude of sex differences in spatial abilities: A meta-analysis and consideration of critical variables. *Psychological Bulletin*, *117*, 250−270.

Yen, S. S. C., Jaffe, R. B., & Barbieri, R. L. (1999). *Reproductive endocrinology: Physiology, pathophysiology, and clinical management.* Philadelphia: Saunders.

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, *92*, 548−573.

Weiner, B. (2000). Intrapersonal and interpersonal theories of motivation from an attributional perspective. *Educational Psychology Review*, *12*, 1−14.

Weiner, B. (2005). Motivation from an attribution perspective and the social psychology of perceived competence. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 73−84). New York: Guilford.

Wraga, M., Duncan, L., Jacobs, E. C., Helt, M., & Church, J. (2006). Stereotype susceptibility narrows the gender gap in imagined self-rotation performance. *Psychonomic Bulletin & Review*, *13*(5), 813−819.