

Are grunTERS cheaters? The effects of grunting when judging the direction of a tennis shot

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Abstract

There is a chorus of complaints that many professional tennis players who grunt when striking the ball gain an unfair advantage because the sound of the grunt distracts their opponent. However, scientific investigations of human attention and performance, specifically with regard to sound-vision interactions, would seem to predict that a grunting sound should help because it will draw attention to the visual event of a ball being struck. We tested the argument that a grunt has a negative impact by requiring participants to view videos of a professional hitting a ball to either side of a tennis court with or without a grunt. The task was to respond as quickly as possible to the ball's direction. Grunting interfered with performance making responses slower and less accurate. The competitive advantage afforded to the grunting player is potentially profound. The findings will be discussed in relation to current theory on multisensory integration.

Keywords: Attention; multisensory integration; distraction; tennis; action perception.

Introduction

Last year, for the first time, a Portuguese women's tennis player, Michelle Larcher de Brito, made it to the third round of the 2009 French Open. Unfortunately for Michelle she lost to Frenchwoman Aravane Rezai in a match where Michelle was heavily criticized for executing a loud and long grunt each time she hit the ball. The complaint is that Michelle, and many of the best players in tennis like her, such as Maria Sharapova (who grunts at over 100 decibels) and the Williams sisters, gain an unfair advantage by distracting their opponents with their grunts. Indeed, there is a growing chorus of critics who complain that many of the top-ranked professional women tennis players are cheating when they grunt. This complaint has been voiced not only by the media and fans, but also by the athletes themselves

(Flatman, 2009; Navratilova, 2009). Indeed, further exemplifying the notion that grunting might distract an opponent, the governing body of the rules of tennis (International Tennis Federation, ITF) explicitly states (rule 26) that purposeful and excessive grunting is a hindrance and reason for a point penalty (International Tennis Federation, 2009).

Unfortunately, the scientific evidence to support these complaints and rules is less than compelling. While there is evidence that performance on a visually based task can be interfered with when a rare and unexpected distracting sound occurs, such as a phone ringing during an exam (Shelton, Elliott, Eaves, & Exner, 2009), a predominant complaint is that tennis players grunt too frequently (i.e., on every shot), so the grunts can hardly be unexpected. Furthermore, there is also evidence that when a sound and visual event occur at different moments and/or locations, attention may be drawn to the sound and away from the visual event (Morein-Zamir, Soto-Faraco, & Kingstone, 2003; Sekuler & Sekuler, 1997). However, that situation does not apply to tennis, as the sound of a grunt and the visual of a ball being struck share a common place in time and space. Accordingly, laboratory research indicates that when audio-visual events share a common origin, they are often integrated, thereby helping to focus attention on the visual event (Calvert & Thesen, 2004; Stein, London, Wilkinson, & Price, 1996). In fact, in some situations a certain degree of temporal and spatial disparity in the multimodal signals can actually be tolerated (Jones & Jarick, 2006). The science therefore suggests that a player who grunts while making a shot may help their opponent focus attention on the shot. This notion can be further bolstered by evidence that having a sudden, short sound can increase one's general level of alertness (Nickerson, 1973). Thus past research does not support the complaint that grunting puts an opponent at a competitive disadvantage.

Nevertheless, it would be the height of arrogance to dismiss the complaints from opponents and experts alike that the grunts have a negative impact. Indeed, past audio-visual studies have generally been limited to detecting flashes of light, and may not apply to the more complex situation of perceiving a tennis ball being struck. To take an initial step toward studying the effect of grunting in tennis we presented videos of a tennis player executing a forehand or backhand groundstroke to the left or right side of the court. Critically, half of the videos included a grunt whereas the other half did not. If the sound of the grunt is indeed distracting, longer response latencies and higher error rates would be expected when participants judged the direction of the tennis shot when a grunt was included.

Method

Participants

Thirty-three undergraduate students from the University of British Columbia participated in exchange for course credit. All reported normal hearing and normal or corrected-to-normal vision.

Materials

Participants sat approximately 60 cm from a computer screen in a dimly lit and sound attenuated testing room. The experiment was programmed and presented using DMDX software (<http://www.u.arizona.edu/~jforster/dmdx.htm>).

A total of 384 video clips were made of a professional tennis player hitting the ball (either forehand or backhand) to either the left or right of a video camera (Canon ZR10 digital video (DV) camera; 10x optical zoom, 200x digital zoom, image stabilizer, and 460K CCD pixel level) set up on the baseline of the court opposite the player. To be included as a video clip, the player had to hit the ball in a 2 X 2 meter target extending from the sideline and the baseline. The video clips were edited so as to include forehands hit crosscourt and down the line, and backhands hit crosscourt and down the line. There was a total of four clips for each shot type that were then edited such that each clip was played with or without a grunt and ended either at contact or 100 ms after contact. Each clip type (i.e., 32 total for each shot type, total of 128 video clips ranging in length from 1230 ms – 1666 ms) was repeated three times for a total of 384 trials. To mimic the sound of the grunt, while at the same time controlling for individual grunt types, white noise (500 ms; a very conservative and uniform grunt) was played for the last portion of the clips that included the 'grunt'.

Procedure

Participants were required to respond as quickly and accurately as possible indicating the direction of the shot in each video clip (3 blocks of 128 separated by breaks for rest). They were required to use the M key on a keyboard

with their right hand if they thought that the shot was going to their right, and the X on a keyboard with their left hand if they thought that the shot was going to their left. Each trial began with a fixation cross (1250 ms), followed by the video. The experiment lasted approximately 25 minutes.

Results

Clips that ended at contact (Hard decision) were analyzed separately from clips ending 100 ms after contact (Easy decision). The data were analyzed for reaction time (RT) and accuracy. When the grunt was present and the video stopped at the time of contact, the participants were consistently 33 ms slower to respond to the direction of the ball (496 ms versus 463 ms; $t(32) = 3.7$, $p = .001$), and they made 4% more decision errors (39% vs. 35%; $t(32) = 2.7$, $p = .012$; see Figure).

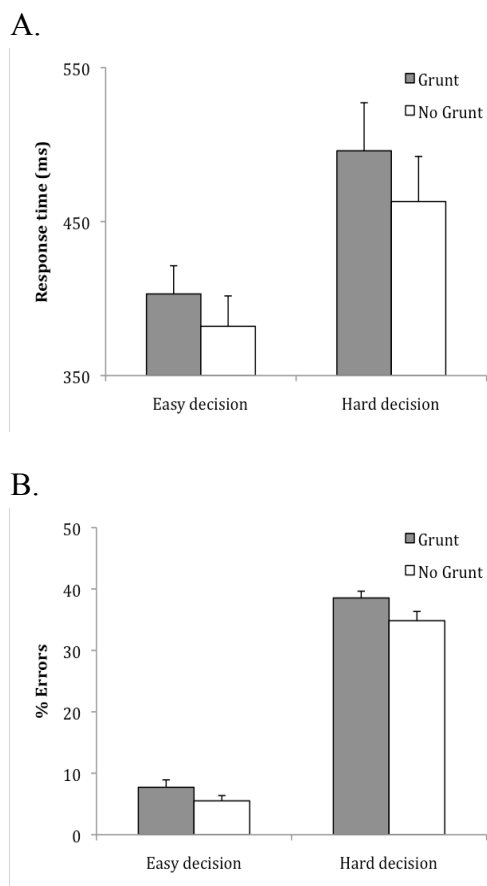


Figure: Dark grey bars represent when the grunt was present and clear bars when the grunt was absent for easy- and hard-shot decisions (A – response time in ms; B – total percentage of decision errors). All differences are significant.

When the video ended 100 ms after contact the exact same pattern was observed. If the grunt was present, participants

were 21 ms slower to respond to the direction of the ball (403 ms vs. 382 ms; $t(32) = 3.7$, $p = .001$), and they made 3% more errors (8% vs. 5%; $t(32) = 3.5$, $p = .001$). That a grunt had the same effect for hard and easy judgements was confirmed by analyses of variance of the overall RT and error data, which directly compared Grunt (Present vs. Absent) and Decision (Hard vs. Easy). The RT results revealed main effects of Grunt and Decision, reflecting the fact that participants were slower to respond when a grunt was present, $F(1,32) = 31.1$, $p < .001$, and the decision was hard, $F(1,32) = 21.8$, $p < .001$, but there was no interaction between grunt and decision, $F(1,32) = 1.74$, $p = .196$. Similarly, for response accuracy, there were more errors for grunts $F(1,32) = 16.0$, $p < .001$, and hard decisions, $F(1,32) = 525.8$, $p < .001$, but no interaction, $F < 1$.

Discussion

The findings are clear-cut. When a grunt occurs opponents are significantly slower (21-33ms) and make significantly more decision errors (3-4%) regarding the direction of the ball both for easy and hard decisions alike. Despite serve speeds now frequently exceeding 100mph (Miller, 2006), if a very conservative estimate that a professional tennis shot travels at 50mph during a rally, a 21-33ms response delay equates to a ball travelling two extra feet on every shot before an opponent can respond. This is a tremendous advantage given that rallies on average last five to seven seconds, with opponents executing generally four directional changes per point with approximately three strokes per rally (the precise values will of course vary with factors like game strategy and court surface; Fernandez, Mendez-Villanueva, & Pluim, 2006). Furthermore, based on data focusing exclusively on 481 matches played at Wimbledon from 1992-1995, an average of 6.4 points played per game can be calculated (Magnus, & Klaasen, 1999). Therefore, between the average number of points played per game and the average number of strokes per point, the additional 3-4% errors observed here could be equivalent to an opponent being wrong footed by a grunting-shot nearly once every game. Given that only four points are required to win a game, this is a definite advantage.

One can only speculate at present as to why a grunt affects the speed and accuracy of responding to a tennis shot. Because a tennis shot and grunt originate from the same location (i.e., the same person), contemporary evidence suggests that visual perception of the shot should be enhanced (see for example Calvert & Thesen, 2004; Sekuler & Sekuler, 1997). Yet we found the opposite. One possibility, suggested by past and present players, is that the sound of a ball making contact with a racket helps to indicate where a shot is going, and a grunt masks this crucial audio-visual integration. We are currently pursuing this issue by manipulating systematically the time of a grunt and the moment that a ball strikes a racket; benchmarking the data against past studies of audio-visual integration. An

additional avenue for future research is to manipulate the sound of the grunt and the expertise of the observer. The latter idea is of particular interest, as it might be possible that tennis experts may attempt unique strategies to circumvent the negative impact of a grunt that we have demonstrated here. However, given the self-reports from the tennis players that an opponent's grunting interferes with their play, and our data showing that negative effects of grunting arise for both response latency and accuracy measures regardless of decision difficulty, it is likely that the negative effect of grunting persists for expert tennis players. Indeed, current research suggests that many multisensory phenomena are highly resistant to top-down processes (Driver, & Noesselt, 2008).

It is difficult to ascertain whether many of the most prolific grunTERS intentionally grunt to distract their opponent. There is little doubt, however, that they are cheating their opponents. Grunting not only decreases their opponent's ability to judge the direction of a shot, it also reduces the amount of time they have to respond to every shot. These consequences on faster tennis surfaces, such as the grass courts of Wimbledon, or the hard courts of the Australian and US Open, are likely to be profound.

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