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Notes

1. The second author presented portions of this work at the 2001 meeting of the Southeastern Teaching of Psychology Conference, Atlanta, GA.
2. We are grateful to Matthew Schultz, Michelle Schmidt, Suzanne Albright, and our peer reviewers for comments on an earlier draft of this article.
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Demonstrating the Monty Hall Dilemma

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This article describes 2 simple and effective classroom demonstrations of the Monty Hall Dilemma (MHD). The MHD is based on a choice scenario from the game show Let's Make A Deal *(1975–1985) in which a contestant attempts to select the winning door from a set of 3 alternatives. The dilemma emerges when, after the initial selection, 1 of the nonwinning doors is revealed and the contestant must choose whether to stay with the initial selection or switch to the remaining door. Although intuitively it seems that the odds of winning are now 50–50, in reality, switching produces more wins than staying. The MHD illustrates the pitfalls associated with the use of cognitive shortcuts or heuristics and can be used to demonstrate the importance of empirical observation and experimentation.*

Central to any discussion of human reasoning and decision making is the idea that humans do not process information objectively. Humans are cognitive misers who typically base their decisions on mental shortcuts and heuristics instead of on the laws of logic, statistics, or probability (e.g., Kahneman & Tversky, 1973, 1982, 2000). Although heuristics are generally quick, efficient, and accurate; they occasionally produce systematic errors in people's reasoning and decision-making processes. Generally, textbook authors (e.g., Nairne, 2003; Weiten, 2003) choose to illustrate this concept using standard heuristics such as availability and representativeness (Kahneman & Tversky, 1973, 1982, 2000). Although these are excellent demonstrations, I have found that a demonstration of the Monty Hall Dilemma (MHD) clearly illustrates the aforementioned principles and can be used effectively in any course that includes coverage of thought processes (e.g., introductory psychology, cognitive, social), research methodology, or probability (e.g., research methods, statistics).

The Monty Hall Dilemma is based on the classic game show *Let's Make a Deal* (1975–1985), which starred Monty Hall as the amiable host. On the show, Hall invited a contestant to participate in a game of chance in the hope of winning a magnificent prize. The contestant chose one of three doors (1, 2, or 3) and knew that there was a prize behind only one of the doors. The contestant tried to select the winning door (e.g., choose 3). Monty Hall, always the showman, then made the game more interesting by revealing that no prize resided behind one of the remaining doors (e.g., 2). At this point, only two doors remained (1 and 3), and the contestant made a crucial choice—to stay with the original selection (3) or to switch to the remaining door (1).

When the game began, most contestants realized that they had a 1 in 3 chance to pick the correct door (33.3%). When Monty offered the final choice, however, many contestants believed that the odds had changed in their favor. Given that only two doors remained, they assumed there was now a 1 in 2 chance to pick the correct door (50.0%). Thus, when asked to stay or switch, the contestants argued that the choice was irrelevant—after all, they appeared to have a 50–50 chance either way. Unfortunately for the contestants, their reasoning was flawed—the switch strategy actually leads to more wins than the stay strategy (e.g., Granberg & Brown, 1995; Mosteller, 1965; Selvin, 1975).

Most contestants, and indeed people from all over the world (Granberg, 1999), have difficulty accepting that either strategy should have an advantage in this situation. One, however, can clearly demonstrate that the switch strategy is more profitable. At the beginning of the game, the contestant picked a door randomly (e.g., 3) and had a 33.3% chance of being correct. Consequently, there was a 67.6% chance that the prize was *not* behind the selected door (i.e., it is behind one of the remaining doors—1 or 2). If the contestant did nothing or stayed, he or she would be correct 33.3% of the time. When Monty eliminated a door (2), the original prob-

lem state did not change. There was still only a 33% chance that original choice was correct; however, now there was a 67.6% chance the remaining door (1) was correct. This solution has been proven mathematically (e.g., Selvin, 1975), using Bayes Theorem (e.g., Diaconis & Zabell, 1986), and through computer simulation (Shaughnessy & Dick, 1991). It can also be demonstrated experimentally in a class using a sample of students as contestants.

Activity Materials and Procedure

Typically, I employ two different versions of this demonstration—one for my research methods and statistics laboratory and one for my cognitive class. However, one can easily adapt this activity for almost any class, regardless of its size.

In my research methods and statistics laboratory, I use the MHD as I introduce the importance of gaining knowledge via empirical observation and experimentation as compared to relying on simple reasoning or intuition. After introducing the game and having a student participate as a contestant, I ask the class to predict whether one strategy would be more effective than another. Without fail, the class responds that the choice is moot because the odds are 50–50 with either strategy. Following a thorough explanation of the true nature of the MHD, I typically find that most of the class continues to trust their intuition and reasoning over my explanation. At this point, I suggest that the class resolve the issue by conducting an experiment in which they systematically compare the two strategies by simulating the game show and recording their own data.

In advance, I prepare a general data collection sheet that consists of six columns (trial number, winning door, contestant's first choice, door opened by host, contestant's final choice, and contestant's outcome). Each student receives two data sheets (one for each strategy) and completes 84 game simulations (42 trials for each strategy). Although I prefer to use a larger number of trials in my laboratory, one can use as few as 20 trials for each strategy to demonstrate the MHD. Prior to the start of the experiment, each student prepares the information required for his or her turn as host by selecting a winning door for each trial using a random numbers table. Once the doors are determined, one student serves as host (solicits initial door choice from contestant; reveals nonwinning door; solicits final door choice; reveals outcome) and records all the relevant data for each trial; the other student serves as the contestant (randomly selects first door, adopts strategy, makes final choice). At the completion of the 84 trials, the students switch roles and repeat the procedure. Finally, the students calculate their individual percentages of wins produced by each strategy to determine whether the switch strategy was indeed more effective than the stay strategy; these percentages are then pooled for the class and used in the discussion and lab report. On average, switching should produce wins 67% of the time and staying should produce wins only 33% of the time.

In my cognitive class, I use the MHD, along with other common heuristics and fallacies (e.g., availability, anchoring, conjunction fallacy, base rate neglect), to demonstrate that humans are not rational decision makers. After gathering predictions and explaining the true nature of the MHD, I provide a short demonstration of the effect by randomly selecting 20 students to serve as contestants and 1 student to serve as my cohost (to record the data and to ensure that I run an honest game). I quickly administer two rounds of the game for each student—one in which the student is instructed to stay and one to switch. In a group of 20 students, one should expect between 12 to 14 wins for the switch strategy and between 6 to 8 wins for the stay strategy.

Table 1. Student Evaluation for Monty Hall Dilemma Demonstration

Statement	*M*	*SD*
1. This exercise was an interesting learning experience	4.28	0.57
2. Doing this exercise was a valuable way to learn	4.28	0.67
3. This exercise helped me to understand the importance of systematic observation in gaining knowledge	4.28	0.57
4. I would recommend this exercise for future classes.	4.50	0.51

Note. Each statement was rated on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

In a recent research methods and statistics course, I surveyed my students about their perceptions of the Monty Hall Dilemma demonstration using a survey modeled after Munro and Munro (2000). They rated the activity on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), for each of four statements (see Table 1). Overall, the students considered the MHD to be highly interesting and useful and clearly recommended the use of the activity in future classes.

The MHD demonstration is easily adaptable to the needs of any class, requiring as little as 10 min of class time and as much as 50 min (lab activity). In place of an in-class demonstration, one could assign the task as a homework assignment or point students toward a Web-based simulation of the MHD (e.g., CogLab; Francis, Neath, & Surprenant, 2000). Regardless of the specific procedure used to demonstrate the MHD, it will serve as an interesting, enjoyable, and effective demonstration for any discussion of human thought processes, research methodology, or probability.

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Note

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Themes and Principles of Child Development Illustrated in Music

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To encourage students to experience key themes and principles of child development in a popular medium, we played musical selections ranging from contemporary rock to children's pieces before each session of a child development class. Simultaneously, visual projection of the lyrics along with text and pictures highlighted the relevance of the music to that day's discussion. Students indicated the audio–visual presentations were interesting and pertinent and should continue in future offerings of the course. The activity provides students with opportunities to become aware of themes and principles of development from a socially and culturally significant resource not routinely considered by instructors.

Instructors teaching large sections of courses on child development and related topics may seek to identify opportunities for students to become acquainted with themes and principles of behavior from contemporary media. Anthologies recount the experiences and functioning of children as seen through the eyes of literary experts (e.g., Landau, Epstein, & Stone, 1972; Sattler, Kramer, Shabatay, & Bernstein, 2000), and commentaries discuss how film and television portray children (e.g., Tylim, 1997; Wolfenstein, 1955). Documenting the benefits of both live-action and animated feature films, Boyatzis (1994) and Kirsh (1998) reported positive student interest and pedagogical value in promoting greater understanding of social and personality development from these media. Green (2003) highlighted effective ways to use film and video both within and as a supplement to the classroom. However, no published information addresses the use of contemporary music as a resource to instructors of child development courses.

Although they may have preferences, many students are familiar with a wide variety of styles of music. We identified and used assorted musical pieces to highlight concepts under discussion in the child development class. The purposes were not only to reveal to students themes and principles relevant to child development in music but also to prepare them for the course content for that day. We played a musical selection immediately prior to the start of each class period. Accompanying each selection were PowerPoint™ slides showing the lyrics of the song along with images and other text accentuating ideas relating to the day's topic. We report students' interest in and perceived value of this effort.

Musical Selections and Presentation

We first identified 13 primary topics typically included in child development textbooks and likely to be covered in class. Library resources and Internet searches of lyrics of songs (using, e.g., key words such as *music*, *child*, and *baby* and a relevant psychological term), as well as our personal knowledge and that of our colleagues, usually led to identifying several pieces of music related to each topic. Selections represented a wide range of songs performed by popular artists, classic and contemporary rock stars, folk singers, and country musicians, pieces produced in Broadway musicals, and a few songs specifically designed for children selected from Sesame Street© or from the creative works of other performers. Table 1 lists topics, a relevant song and artist for each, and a brief indication of how each of the pieces relates to the course content.

We played one selection immediately prior to the start of each class. The length of the selection dictated when the music and slides began, but each piece ended by the scheduled beginning of class. Students were free to listen and watch the slides or to engage in other activity including socializing with classmates or communicating with the instructor as the music played. Thus, we designed the activity to supplement rather than be a required component of the course.

Anywhere from 5 to 12 PowerPoint© slides accompanied the various selections depending on lyrics and the duration of the music. On average, slides were projected for about 20 sec each, but typically ranged from 10 to 40 sec. To illustrate the kinds of information shown on the slides, the material accompanying the playing of "Luka," a song about a physically abused child, included definitions of and statistics relating to the frequency of child abuse in the United States as well as factors correlated with the occurrence of child abuse in families. The slides accompanying "Do-Re-Mi" described developmental differences in the use of mnemonic techniques with emphasis on elaboration, the technique evident in this piece. The slides shown with "Itsy Bitsy Spider/Coming Around Again" outlined the distinction between perceived helplessness and mastery orientation and highlighted the necessary role of effort for achievement and success. In the case of "Mairzy Doats," the slides included spectrograms of an individual saying the text of the song to illustrate the cues associated with, and the difficulty of identifying, segmental phonemes in the stream of speech.