Penn & Teller – Spelling Cards

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It turns out that Penn and Teller have performed another magic trick recently that is based on mathematical principles and so is more or less self-working. It is a more complicated version of the Cat and Mice puzzle, which I have dubbed the "Spelling Cards" trick ([1]).

What follows is a detailed narration of the trick. But it is easier and more fun to watch the video.

Characters Piff, Pop (Penn), and Squire (Teller), along with Brook carry out the trick. Piff shows 10 cards and then holding them face down asks Brook to name the most important card, and she says an ace. So Piff begins counting 3 cards for each letter in the name of the card. As he removes each face-down card from the top of the pack, he puts it on the bottom. After placing the third face-down card on the bottom, he turns the next card face up and shows it to be the ace of clubs. He tosses it away.

Next Penn takes the pack and counts off 3 cards for "dos" (two) and turns over the next card on top. It is a two of hearts, which he then tosses away. Now it is Teller's turn and he counts off 5 cards for "three" and shows a three of spades. He tosses that away. Finally Brook takes the pack and counts off 4 cards for "four" and turns over the next card. But it is the ten of diamonds! Oops. So Brook puts the ten back on the pack and hands it to Piff.
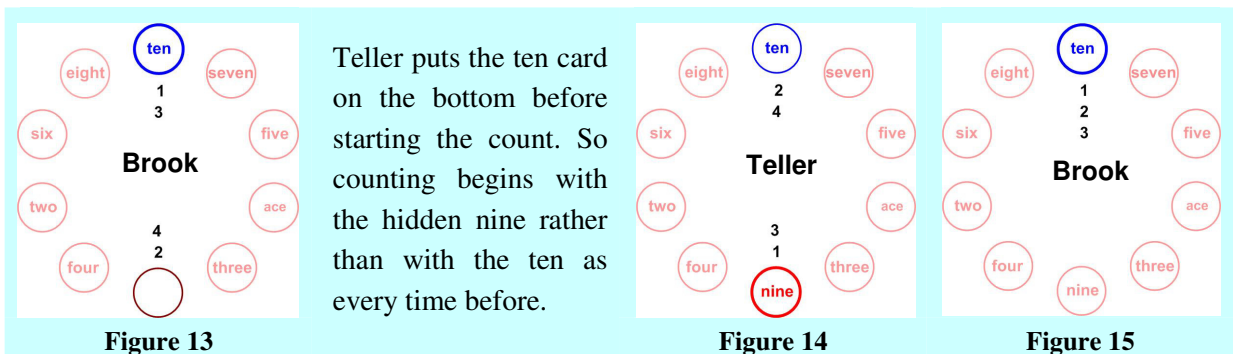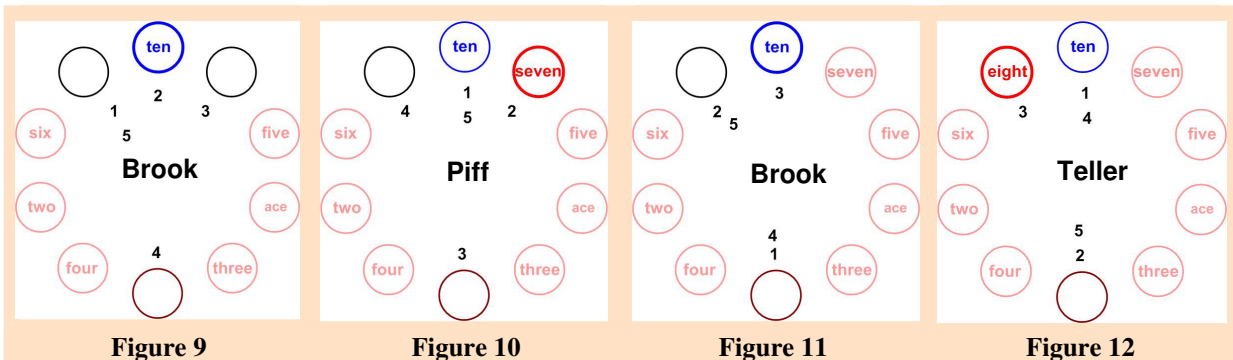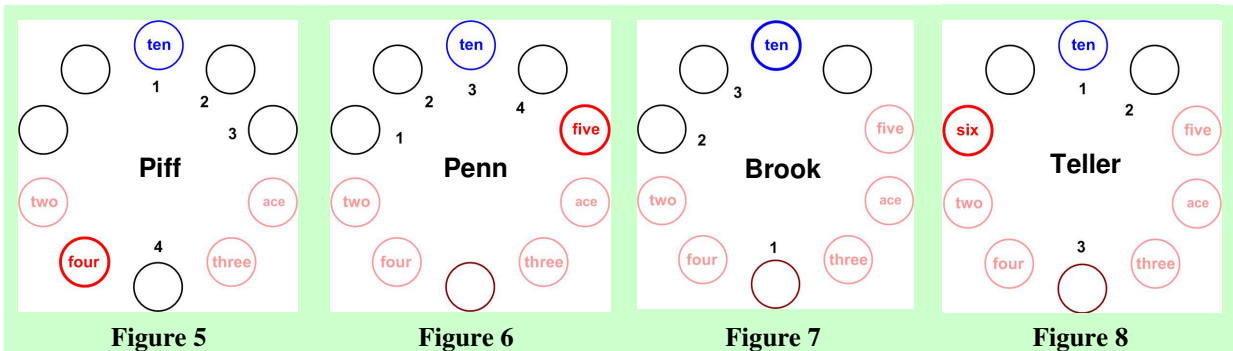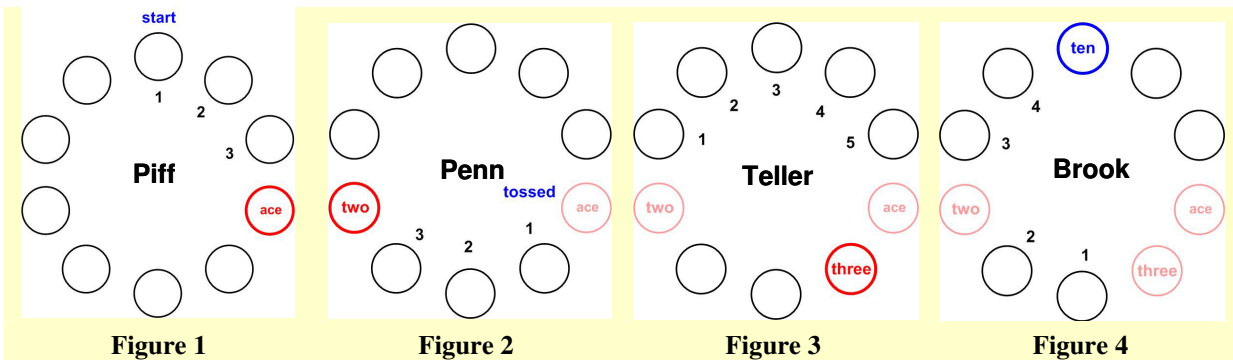
Piff again counts 4 cards and turns over the next revealing the four of clubs, which gets tossed. Penn counts off 4 cards for "five" and turns over the 5 of hearts, and that gets tossed. Brook counts off 3 cards for "six", but again turns over the ten of diamonds. She puts it back on the stack, and Teller has a go. He counts off 3 cards again and turns over the six of hearts, which he tosses.

Brook tries again and counts off 5 cards for "seven", but again turns up the ten of diamonds. Returning the ten to the pack she gives it to Piff, who counts of 5 cards again and turns over the seven of spades. Piff tosses the card. Brook tries once more by counting off 5 cards for "eight", but again turns over the ten of diamonds. Teller has a go and counting off 5 cards arrives at the eight of clubs, which he tosses. Frustrated Brook tries a final time and counts off 4 cards for "nine". And of course she turns over the ten of diamonds again. Teller again takes the pack (watch the video carefully here) and counts the four cards turning over the nine of hearts, which he tosses. With only one card left, Teller gives it to Brook to "count" the card 3 times for "ten" to reveal again the ten of diamonds, but this time appropriately.

So the question is, what is the initial arrangement of the cards so that this trick will work automatically?

Solution

I put together 15 diagrams showing each stage of the trick (Figure 1 – Figure 15), using the circular counting and elimination scheme in the solution of the Cat and Mice puzzle. This is a bit more complicated since the counts vary and the ten of diamonds is not eliminated each time it turns up. I fill in the numerical value of each card when it is turned over, so that at the end I have the order of all ten cards.

Figure 1

Piff — start, 1, 2, 3, ace

Figure 2

Penn — tossed, two, 3, 2, 1, ace

Figure 3

Teller — 2, 3, 4, 1, 5, two, ace, three

Figure 4

Brook — ten, 4, 3, 2, 1, two, ace, three

Figure 5

Piff — ten, 1, 2, 3, two, ace, four, 4, three

Figure 6

Penn — ten, 2, 3, 4, 1, five, two, ace, four, three

Figure 7

Brook — ten, 3, five, 2, two, ace, four, 1, three

Figure 8

Teller — ten, 1, 2, six, five, two, ace, four, 3, three

Figure 9

Brook — ten, 1, 2, 3, 5, six, five, two, ace, four, 4, three

Figure 10

Piff — ten, seven, 4, 1, 5, 2, six, five, two, ace, four, 3, three

Figure 11

Brook — ten, seven, 3, 2, 5, six, five, two, ace, four, 4, 1, three

Figure 12

Teller — eight, ten, seven, 3, 1, 4, six, five, two, ace, four, 5, 2, three

Figure 13

Brook — ten, eight, seven, 1, 3, six, five, two, ace, four, 4, 2, three

Teller puts the ten card on the bottom before starting the count. So counting begins with the hidden nine rather than with the ten as every time before.

Figure 14

Teller — ten, eight, seven, 2, 4, six, five, two, ace, four, 3, 1, three, nine

Figure 15

Brook — ten, eight, seven, 1, 2, 3, six, five, two, ace, four, three, nine

So the initial order of the face-down cards from top to bottom is

10D 7S 5H 1C 3S 9H 4C 2H 6H 8C.

This is confirmed in the (blurry) screen capture (Figure 16) of the face-up cards at the beginning of the trick (read the above list from right to left).

Again, I am impressed that someone figured this out. And this is yet another example of how math and magic are cousins of one another.

Figure 16

Math, Magic, and Mystery

Another cousin to math and magic is mystery, in particular mystery stories written in the 20th century, especially the first half, that were considered "fair play", that is, all the clues necessary to solve them were included in the story. So the stories were like puzzles. I especially loved these. One of the great practitioners was the writing duo Ellery Queen. John Dickson Carr was famous for his locked-room puzzles, but I found he often did not provide enough clues to solve them and had to resort to lengthy explanations at the end. Agatha Christie's novels never seemed fair, though they were very ingenious, so I was not a fan.

But a great example that is relevant here is Clayton Rawson,[1] who was also a magician. He wrote four excellent fair-play novels that included a number of magic tropes.

- *Death from a Top Hat* (1938) (locked room)
- *The Footprints on the Ceiling* (1939) (locked room)
- *The Headless Lady* (1940)
- *No Coffin for the Corpse* (1942)

References

[1] Penn & Teller, "Spelling Cards", *Fool Us,* Season 11, Episode 3, 11 February 2025 (https://www.youtube.com/watch?v=b9wzDwmhdH4&t=36m)

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[1] https://en.wikipedia.org/wiki/Clayton_Rawson