The Epolenep Principle (Restacked)

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1 An unadorned self-working impromptu effect

While the performer's back is turned, a participant takes a small packet of cards and begins dealing them into two piles, stopping whenever they like. Tossing one of the piles aside, they remember the top card of the other pile before burying it under the cards remaining in their hand. They pick up this pile and deal it out completely into two piles. The performer divines which piles their card landed in. The participant deals through the cards in this pile until the performer says stop, upon which time the performer divines the selected card. The card the participant was stopped on is revealed to be this card.

2 Background on the principle

Over the years since Alex Elmsley published it, dozens of magicians and mathematicians interested in mathematical card tricks have constructed routines based on Penelope's Principle. If you're not familiar, this is the principle that says that if a selected card begins $\lfloor n/2 \rfloor$ cards from the top of a packet consisting of n cards, and x cards are removed from the top of this packet, then after a "nearly perfect" bottom out-faro of the remaining $n - x$ cards, the selection will be x cards from the top of this packet. See `https://www.vanishingincmagic.com/blog/location-location-location` for a proof of this principle.

The fact that this calls for a perfect faro has scared away some of the more recreational card tinkerers, along with the magicians who like to allow their participants to be a bit more hands-on. And while a partial Klondike (or Milk) shuffle can be substituted for the faro, and a participant can be taught how to do this themselves, they may not find it particularly easy or intuitive.

Here, instead, I will be discussing the *reverse* Penelope's Principle (heretofore called the Epolenep Principle). Ostensibly, this is just Penelope's Principle with the implication in the other direction: If a selection begins x cards from the top of an $n - x$ card packet, then after an out-anti-faro, the selection will be $\lfloor n/2 \rfloor$ cards from the top of the packet. This direction of the principle is best known from the work of John Born (*Seeking the Bridge*, 2012) but has not been given nearly as much attention, which is a shame.

Why? *Because an anti-faro is just dealing into two piles* which means any participant can do it themselves. Of course, dealing reverses the order of the cards, but we can deal with that. So here's the "participant-workable" Epolenep Principle stated:

> EPOLENEP PRINCIPLE: If a card begins x cards from the bottom of a packet of $n - x$ cards, after dealing into two piles and placing the pile that does not contain the card on top of the one that does, the card will be $\lceil n/2 \rceil$ cards from the top of the packet.

3 A proof

Of course, this statement leads to a natural question which we will need to answer before this theorem can be proved: which dealt pile contains the selected card? This is simple enough to answer. As there are $n - 2x$ cards above the selection at the beginning, the card is at position $n - 2x + 1$, which has opposite parity to n: If n is even, the card is at an odd position from the top and will be in the first pile dealt to. If n is odd, the card is at an even position and will be in the second pile dealt to.

So now the proof, which we will handle separately for the even and odd cases. First, we note that after dealing the $n - x$ cards into two piles, the first pile dealt to will contain $\lceil \frac{n-x}{2} \rceil$ cards and the second pile will contain $\lfloor \frac{n-x}{2} \rfloor$.

For n even:

Of the last x cards of the original pile, of which the selection was the first, $\lceil \frac{x}{2} \rceil$ will land on the first pile. Therefore, the selection will be in the first pile, exactly $\lceil \frac{x}{2} \rceil$ cards from the top. If the other pile is placed on top of this pile, the selection will be at position $\lfloor \frac{n-x}{2} \rfloor + \lceil \frac{x}{2} \rceil = \frac{n}{2}$. (Noting that x and $n - x$ have the same parity, so either both are divisible by 2 or neither is, and in the latter case the rounding up of the first term is canceled by the rounding down of the second.)

For n odd:

Of the last x cards of the original pile, of which the selection was the first, $\lceil \frac{x}{2} \rceil$ will land on the second pile. Therefore, the selection will be in the second pile, exactly $\lfloor \frac{x}{2} \rfloor$ cards from the top. If the other pile is placed on top of this pile, the selection will be at position $\lceil \frac{n-x}{2} \rceil + \lceil \frac{x}{2} \rceil = \lceil \frac{n}{2} \rceil$. (Noting that x and $n - x$ have opposite parity, so one of them will always be divisible by 2, so exactly one rounding up always occurs.)

4 Working the principle into an effect

It is tempting to apply the principle in the fashion of Marlo's Automatic Placement: The participant cuts off and secretly counts a small pile of cards. The performer deals off another pile of cards while counting, having the participant remember the card at their secret number. After counting $\lfloor \frac{n}{2} \rfloor$ cards in this fashion, the performer drops the remaining cards on top. Now the selected card is x cards from the bottom of the packet as desired. This is functional and justifiable, but it is time-consuming and draws attention to the mathematical nature of the method by directly involving numbers. The simple effect described at the beginning of this article points to another way:

> I'm going to look away while you start dealing these cards one to your left then one to your right, back and forth. Go ahead and start, but don't deal out the whole pile. Make sure you leave some cards in your hand. And for the last two cards you deal, turn one face up onto the left pile and then the other one face up onto the right pile. Study these two cards and decide which you like better. The one you don't like, get rid of it and all the cards under it. Throw them on the floor. Sit on them. Put them in the box. Whatever. We don't need them. The one you do like, memorize it, turn it card face down on top of its pile, and drop all the cards remaining in your hand on top of it to bury it somewhere in the middle of the pile.

Given a pile of about twenty cards, this procedure achieves the same result, takes about a minute, and gives a lot of opportunities for byplay: for example, consider having them brutally reject the card they card they don't want with a declaration of hatred before confessing their undying love to the one they do. You never touch or look at the cards the whole time, so you can drive home that the card and its position was selected by a combination of their deliberate choice and randomness such that you had no say in the outcome. With this done, you can turn around and watch again. Next, still without touching the cards, have the participant perform the anti-faro:

> It's not true that I have no idea whatsoever where your card is. I know it's not close to the top because those are the cards you kept in your hand. So, just to make this as fair as possible, go ahead and deal the whole pile out into two separate piles. Since the two piles will be about equal, there's a roughly 50-50 chance your card will land in either pile.

Of course, that's a bald-faced lie. You know exactly which pile the card will land in as described above. But you have a job to do during this dealing. You're going to count how many cards are dealt into the pile that does not contain the selection, which you can then use to infer where in the other pile the selection is. For example, let's say the participant started with 20 cards. (Much more than this and the whole effect becomes tedious.) You know the card will be in the first pile, and you count five cards dealt to the second pile. The Epolenep Principle says that if the second pile were placed on the first, the selection would be $\frac{20}{2} = 10$ cards from the top. Thus, you know the selection is now $10 - 5 = 5$ cards from the top of the first pile. You can now use whatever method you want to "divine" which pile the card ended up in. (Or use equivoque to have the participant do it.)

> I'm sure now. I'm getting nothing from that pile and a strong feeling from this one. Go ahead and turn it over. Spread them out. I'm right, aren't I? Your card's here isn't it?

Of course, you already know what position the card is in, so having the cards spread face up is just so that you can see which card is in that position. With the pile face-down again, have the participant deal the cards one at a time while you "divine" which one is the selection, and then, without them even turning it over yet, which card it is. Or skip this last dealing down and just "divine" the selection directly from the face-up pile.

But... what if you don't want to *ever* look at the faces of the cards and still be able to divine the selection?

5 Combining the principle with a stack

Well, you have to sacrifice something, so we'll have to give up letting the participant shuffle so we can have the deck stacked. For the sake of simplicity, let's assume the deck is set up in Si Stebbins stack, but the facts discussed herein are equally applicable to other stack systems. If you've got Mnemonica down cold, use that instead. We'll assume the participant-driven selection procedure described in the previous section is used and the participant put the rejected pile of cards into the tuck case.

FACTS:

- The card on top of the selection in its final pile is the one that was originally four cards above it in the deck. In the case of Si Stebbins, this card will be the card of the same suit that is greater in value by one (where K+1=A and A+1=2).
- The bottom cards of the two final piles will be the two cards following the selected and rejected cards in the original stack. That is, they will be the first, second, or third card after the selection in the stack. For example, in Si Stebbins, if the selection was the 3♠, the bottom card of either of the final piles will be from among the 6♦, 9♣, or Q♥.

5.1 A richer effect

Let's build on the basic effect using these principles.

To begin, allow the participant to cut to a random part of the deck and cut off "maybe around half of the cards." Restacking the remaining cards to set them aside, you glimpse the top and bottom cards and calculate exactly how many cards were cut. Si Stebbins describes how to do this for his stack in *Card Tricks And The Way They Are Performed.* Direct the selection procedure described above followed by the dealing into two piles. You can now add "I don't even know how many cards you started with" to your list of false claims when recapping the procedure, but of course, you still know which pile their card will land in and where it will be in that pile. Have them deal the cards out face-up one at a time from that pile. Stop them before they deal their card. Using the card they just dealt, go four cards past it in stack order (in Si Stebbins, just subtract one from its value) to calculate what card they are now holding. Reveal it.

And now for the kicker: you can now turn both face-down piles face-up and spread them out–no apparent order is visible even to those who are aware of Stebbins stack. And yet you have one more revelation up your sleeve:

> At the beginning, you put another pile of cards inside the box didn't you? Yep, I hear them rattling around in there. In fact, it sounds like...five cards...and I think the card on top, the one you decided you didn't want...is the four of clubs.

How do you get this information?

The number of cards in the box you can easily determine from the selected card and the card you glimpsed on the bottom of the deck earlier—it is simply half (rounded up) the number of cards to get from the latter to the former in stack order. For Si Stebbins, you can use the same calculus you used to find how many cards were cut off.

The identity of the rejected card you will determine using the second fact above. You've just flipped over the two piles, so you know the two cards on the bottoms of the two piles. You also know the selection. The rejected card is simply the card that completes the group of four cards in order. In more detail, if the two cards on the bottoms of the piles are the two that come directly after the selection in stack order, the rejected card came immediately before it. If the two cards on the bottoms of the piles come second and third after the selection in stack order, the rejected card is the one that fills that gap by coming immediately after it.

If you really want to go above and beyond, you can also name all the other cards in the box. They are simply every other card that came before the rejected card in stack order—work your way backwards through the stack and name every other card until you've named enough to match the number you determined.

5.2 Or just do it all verbally

You could also use the second fact above to determine the identity of the selection before you've even seen any of the cards in the pile the selection is in at the end. Simply flip over the pile that doesn't contain the selection and spread it out to prove it isn't there. You know that the selection is one of the three cards that come before (in stack order) the card on the face of this pile, so you only need two fishing questions to narrow down which one it is. For example, let's continue with the example from the second fact. You were in Stebbins stack and you see a Q♥ on the bottom of the "wrong" pile. You know the selection must be 3♠, a 6♦, or a 9♣.

> Go back in time mentally to when you finally made that decision between those face up cards. I'm sensing it was a black card you were looking at...

If you get a head shake here, you know the selected card was the 6♦ and that in deciding on it, the participant rejected either the 3 or the 9:

> ...when you put its pile in the box because you had finally decided on the six of diamonds.

A nod on the other hand narrows you down to the 3 or 9.

> ...it wasn't a low-valued card, was it?

For a no:

> But it wasn't particularly high either... the nine of clubs, right?

For a yes:

> Yeah, I thought so. Like... maybe the three of spades? Wasn't that it?

At this point, you still have not found the card despite knowing exactly where it is. You have a lot of options. For example, you could deal the other pile out and have the participant stop *you* on a card using a timing force. Or eliminate some of the remaining pile and force the selection with equivoque. Or note that their name or yours spells in the number of letters equal to the position. It's a great time to improvise because it's basically a bonus effect.

(You could also arrange to glimpse the bottom card of *both* piles and, in so doing, narrow the selection down to just two cards so that you need only one question.)

6 Other presentational ideas

6.1 Video calls

The original impromptu unstacked version of the effect is great for performance over the phone or in a Zoom call because 100% of the card handling can be done by the participant. The only consideration is that you will need to know how many cards the participant begins with *somehow.* You don't want to use a full deck due to the tedium of dealing the whole thing out, and you can be honest about this fact:

> This experiment would take too long if we use the whole deck, so cut off a pile, half the deck or less. Good. Can you quickly count those for me? 23 cards? Yeah, I think we can work with that. Now, move aside from the camera or turn it so I can't see the cards while you do this next part. You have a table or desk nearby, I hope?

For a Zoom call, another possibility is to have the selected pile of cards spread face up on a table in view of the camera to take a screenshot. Then you not only know the number but you have a full stack to work with too. This can be arranged in advance of the actual performance if possible with the justification of making sure the cards show up on camera.

6.2 Lie Detector

One possible method to use to "divine" the thought-of card is along these lines:

> I will ask you a series of yes or no questions. No matter what the correct answer is, say "no," but as you do, think about whether you're telling the truth or lying. Try to feel bad about lying when you do. Is this your card? That seems true. Is this your card? Yep, truth again. Is your card somewhere in this pile? Yep, I believe you. Let's try the other pile just to be sure. Is your card anywhere in this pile? Yep, that was definitely a lie. Okay, here I don't even need to look at the cards. Just take them one at a time off the top. Just look at it and tell me "This is not my card." I'll stop you when I hear a lie. Okay, that was true. That was true again. Oh, you were definitely lying that time. Wait, just tell me "yes" every time now, but again, be conscious of whether you're lying or not. Is your card red? That was true. Is it a heart? Hmmm... sounded like a lie. Is your card high? True. Is it a court card? True again. Is it female? That was a lie. Is it a king? Nope, you lied. Show me the jack of diamonds!

7 And now for something completely different! (But we'll circle back, I promise)

7.1 Another lie detector effect

A participant cuts off a pile of cards from a deck in which each card which has a word written on it and looks at the word written on the face card of that pile. The performer turns the other way.

> I'm going to ask you a series of questions, and to avoid asking things I could possibly have known about in advance, I'm only going to ask about the word you've selected—nothing personal, don't worry. But my goal here is not to guess what word you picked, but merely to try and determine from the sound of your voice when you're lying. I can't tell anything without a good control sample, so for seven of the eight questions I'm going to ask, I want you to tell the truth, but for one, I want to to tell a cold, premeditated lie. It can be the first question if you want to catch me unawares. Or you could try to trick me early by telling the truth like it's a lie and tell

> the real lie at the end. Or you could really try to throw me for a loop by not telling a lie at all. To make it as hard as possible for me, I'm only going to ask whether the word contains one of the 8 most common English letters—in other words, only yes or no questions where the answer is equally likely to go either way. And I can only use the sound of your voice. I'll face away the whole time so I can't look for you to give away a lie with your facial expression or body movement. All I can do is take notes on the sound of your voice and hope I can pick out the one that sounds off.

After asking about and noting down whether the selected word contains eight specific letters, the performer reveals whether the participant lied, how many times, and about which letters.

7.2 The method

You'll need a deck of cards with words on them, with the 16 in the middle being a very carefully chosen set. In a deck of 36 word cards (which I've simply written with a felt-tip pen on blank tarot-size cards), the 10th through 26nd cards should be precisely these words in this order:

1. murmur
2. softball
3. therapy
4. gumshoe
5. uncouth
6. husband
7. lemonade
8. nests
9. biography
10. physicist
11. exploit
12. aimless
13. dainty
14. fusion
15. children
16. relationship

So, a participant cuts into the middle of this deck of words and as long as they are in the middle third of the pile, they will get one of the above words. What's so special about these words? Well, they just so happen to form a Hamming(8,4) code on the letters INESTAOH. This means that we can correct any one incorrect bit (lie) and at least detect if there was more than one. But don't worry, we can figure out where the lie was without having to try to match up the set of yeses and nos with a word directly. We can just calculate it without worrying about the words.

With the answers to those 8 questions in hand, first we need to determine how many lies there were. If the number of "yes" answers is odd, the number of lies is odd, so we assume there was only one. If the number of "yes" answers is even, the number of lies is even, so we assume there were zero or two. (In general, the above script of insisting on a "yes" answer to "H" should only be followed if you're confident that the participant will not make a mistake because there is no way of recovering from three incorrect answers.)

Next, we calculate where any lies were. The key to this lies in the three words "exploit", "lemonade", and "softball". Or rather, to the subsets of letters in these words that are on the question list, namely, EOIT, EONA, and SOTA. An odd number of "yes" answers in the first set, EOIT, is worth 1 point. An odd number of "yes" answers in the second set, EONA, is worth two points. An odd number of "yes" answers in the third set, SOTA, is worth 4 points. A "yes" to H is worth 8 points. Even numbers of "yes" answers in any set are worth nothing. Add up all the points to get your index.

If you know there was only one lie, this index is precisely an index into the list {I,N,E,S,T,A,O,H} telling you which letter was the lie. For example, if you calculated 5 as the index, you know the lie was regarding T.

If you get zero for the sum and the original "yes" answer total parity was even, you know there were no lies.

If you get a nonzero value and the original parity was even, you know there were two lies/mistakes. The index you calculated is the bitwise exclusive-or of the indices of the two lies. If you're lucky, you get a number from 9 to 15, and you know that the lies were H and whatever letter is at the index 8 below your calculated index. Otherwise, you'll have to ask what one of the lies was and xor its index with the calculated one to find the other lie.

7.3 And now we circle back to the Epolenep Principle

> Now that I know which letters you were lying about, I know enough about which letters are in your word that I could figure out which of those words you actually selected. In other words, that word is no longer a useful piece of secret information. So, I'm going to have you select another, but this time we'll use a process that gives you a little bit more deliberate choice. Since words are often connected to emotion, I want to use your emotional connection to a different word to actually figure out which word you've selected in spite of *any* lies you will try to tell me about it, and the baseline I've just established should make that even easier. So I want you to take that pile of cards in your hand and deal it out onto the table into two piles, one card to the left, then one to the right, back and forth...

In order to use the Epolenep Principle, you do need to know how many cards the participant started with. Luckily, as described, this deck is stacked to make that easy to calculate. Simply construct a binary number from the correct answers to the first four letter questions (I, N, E, S) in that order, where yes=1 and no=0. Add 10 to this number. This is the number of cards the participant is holding. For example, if we know the word has an I and an E but no N or S, we make the binary number 1010=10, add 10 to it to get the 20th position, which is where their chosen word "exploit" will be. We can now lead right into the lie detector routine described in section 6.2 above but for words.

7.4 And we can stack it too.

If you have the deck of words memorized, you can use the stack principles described above to identify which word was selected without ever seeing it. I recommend coming up with 10 words starting with the letters B,P,E,A,D,F,C,R,I,O to start the deck of words, and another 10 that start with I,O,M,S,T,G,U,H,L,N to end the deck. That way the deck consists of two repeats of the 18 initial letters B,P,E,A,D,F,C,R,I,O,M,S,T,G,U,H,L,N, and you only have to remember that letter sequence, the two words for each letter, and which one comes first. Perhaps just make it so the shorter of the two always comes first. It's much easier to go forward four cards in stack order when that only entails going forward four letters in your 18 letter sequence and recalling the first word that started with that letter (since you're never going to have to deal with the words on the bottom of the deck anyway).

8 Conclusion

While nothing you've read here is completely original, the Epolenep Principle has spent a lot of time buried in books with too few readers. And not that many either. Dozens of effects have been released based on Penelope's Principle, while only a handful have exploited its inverse operation. And while I've suggested a few possible applications for it here, my true goal is just to get more people thinking about it by understanding what it does: a card in a position selected by a participant ends up in a known pile in a known position in that pile *without the performer ever having to touch the cards*. And every step of that process is easy for even the most inexperienced card handler to pull off. In short, I want to see more people coming up with ways to apply it. Is there a way to use it with objects other than cards? Are there alternate selection procedures that exploit it while rearranging a stack in even more favorable ways? Does it combine nicely with any other self-working effects?

For a video explanation of the Epolenep Principle, along with a performance of a basic effect, see `https://youtu.be/gpxtqmdhg_c`

For a performance of the Lie Detector trick with the Hamming Code, see `https://youtu.be/jNOUiyHIMlE`

For a new use of the more popular Penelope's Principle, see `https://youtu.be/hzFyyfrnC-c`