Winning 'Guess Who' with Just One Guess

The game 'Guess Who', first published by Milton Bradley in 1979, has one player (Responder) select a picture at random from a known collection of twenty-four faces, while the other player (Guesser) proceeds to deduce who was selected by a sequence of true-false questions (in fact, both players take on each role, and they take turns guessing).

The usual strategy is to ask questions that eliminate roughly half of the candidates regardless of the answer, taking at most 5 guesses. This game, and variations, have been thoroughly analyzed (see, e.g., [1]).

However here we present a timing attack that allows Guesser to always win with a single question. We impose only these additional rules on Responder: (1) guessing is not allowed; and (2) no needless delays.

Suppose the pictures from which the game is played are $Face_1$, $Face_2$, ..., $Face_n$. Now, generate equations $E_1, E_2, \ldots, E_n$, all of which are true but which take an exponentially increasing time to calculate. For example, E_1 might be $2 \times 3 = 6$ while E_2 might be $26781 \times 45683 = 1223436423$, etc. The question Guesser should ask is:

Is it true that ($Face_1$ and E_1) or ($Face_2$ and E_2) or $\cdots$ or ($Face_n$ and E_n)?

Responder, having selected $Face_j$, will need to calculate E_j to see if the answer is True or False. Provided the difficulties of the equations have been chosen carefully, the time Responder takes to answer (and that answer will always be True) will uniquely correspond to one of the faces. Hence Guesser needs only a stopwatch to guess correctly, every time.

REFERENCES

1. Ben O'Neill (2021) Optimal guessing in 'Guess Who'. PLoS ONE 16(3): e0247361. https://doi.org/10.1371/journal.pone.0247361.

—Submitted by Vadim Ponomarenko, San Diego State University