

# Decision making on the spot

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The scientific study of penalty taking suggests that there are unexploited opportunities for footballers.

The large number of scientific studies of football [penalty](#) taking – a [2013 review](#) cites 87 studies – are not entirely attributable to the

researchers' interest in football. However, the large amount of data on penalties in football provides a unique opportunity to investigate strategic decision making under very high incentives – in effect it is a test bed for understanding more generally how effectively people operate under competitive pressures.

Because penalty takers often kick the ball hard – typically the ball takes 0.2–0.3 seconds to cross the goal line which is less than the [goalkeeper's](#) reaction time plus movement time towards the ball—goalkeepers are obliged to anticipate, rather than react to, the direction of the shot. Penalty takers of course try to conceal or misleadingly signal the direction of their shot resulting in a game of high speed "hide and seek".

## Going for goal

Several lines of enquiry suggest that the strategies adopted by both kickers and goalkeepers could be improved. For example, at [penalty shootouts](#) there is evidence that goalkeepers – though not penalty takers—suffer from a bias akin to the "gamblers' fallacy" – that is the tendency for roulette gamblers to bet on red after a long run of black. A study of the 37 penalty shootouts from the FIFA World Cup and UEFA Euro Cup finals tournaments from 1976 to 2012—comprising 361 penalty kicks—found that following repeated kicks in the same direction, goalkeepers were increasingly likely to dive in the opposite direction on the next kick.

While both goalkeepers and kickers are overall equally likely to aim right or left the direction of the goalkeepers guesses as to the location of the next kick depended on the direction of the previous penalty. While it is surprising that the goalkeepers exhibit such an exploitable pattern of behaviour, it is perhaps even more surprising that the kickers failed to exploit the vulnerability created by this goalkeeper bias – penalty takers did not vary their shots accordingly.

A follow up study adding more data (367 penalties in 38 shootouts) confirmed this exploitable pattern. Although it is not a big bias—goalkeepers dive in the opposite direction of the last kick's direction about 55% of the time—it leads to a simple message for penalty takers: always shoot in the same direction as the previous kicker of your team did.

While it is all too easy to be wise after the event, the England player Jordan Henderson might reflect on this – his penalty in the World Cup shootout against Colombia was directed to the goalkeeper's left, and correctly anticipated—and saved—by the Colombian goalkeeper after the previous two England penalties had been sent to his right.

## Aiming for the centre

Another anomaly in penalty taking is the curious reluctance of players to choose the centre of the goal. In the 1974 [world cup](#) final Dutch player Johan Neeskens shocked the footballing world by aiming – and scoring—a penalty at the centre of the goal. [Neeskens, it turns out, didn't intend to take his kick that way](#) but the cat was out of the bag: as goalkeepers typically dive to the right or the left they leave the centre of the goal unguarded and kickers can exploit the opportunity. Two years later, in the first major international tournament to be decided by a penalty shoot-out, Czech player Antonín [Panenka](#) added a sensational twist to this strategy in the final of the 1976 European Championships by very gently chipping the ball into the middle of the net – creating the eponymous "Panenka".

Before these innovations there were two general locations for a kicker or goalkeeper to choose – left or right; but now there are three – left, right or middle – thereby making the goalkeeper's task harder and allegedly leading to a "Neeskins effect" permanently altering the game. A [study](#) analysing the success rates of penalties in the German Bundesliga found

that the success rate after 1976 was 11% higher than before 1974.

A [2002 paper](#) using data from 459 penalties from the French and Italian Leagues 1997-2000 showed that penalties aimed to the middle of the goal despite being rare (only 17%) have a statistically significantly higher likelihood of success than penalties aimed at either side (81.0% as compared to 70.1% for the right side and 76.7% for the left side.

What about the success rate of World Cup shootout penalties? Data on all [204 penalties taken in World Cup penalty shootouts](#) up until the end of the 2010 Fifa World Cup shows only 15% of penalties (30) were aimed at the middle third of the goal: 3 missed (went over) and only 5 were saved – a success rate of 73.3% - not much higher than the overall rate of 70.6% - but not lower.

### Going against the norm

So why, given the higher success rate of penalties aimed at the middle of the goal, are there so few of them? [Norm theory proposed by Nobel prize winning psychologist Daniel Kahneman](#) with his colleague Dale Miller claims that norms are broken emotions. are enhanced. Outcomes associated with unusual or untypical events produce enhanced emotions – good outcomes will be especially good but bad outcomes will be especially bad. Accordingly, because the norm for penalty takers is to shoot to one side, aiming at the centre risks greater humiliation. While a successful Panenka makes the kicker look good, a failed Panenka that the goalkeeper easily saves [leaves the penalty taker looking especially foolish](#).

Goalkeepers too also suffer an irrational aversion to the middle – a [study](#) of 311 goal bound penalty kicks taken during different matches in the top leagues and championships worldwide that divided the goal area into three equal sections – left, right and middle—found that goalkeepers

would be more successful if they stayed in the middle and didn't dive to either side.

While, unsurprisingly, most penalty saves occur when the goalkeeper chooses the same direction in which the ball was kicked, save rates are still modest. Diving the wrong way resulted in no saves – but in some cases a goalkeeper who dived to one of the sides was still able to stop a ball directed towards the center. However goalkeepers who didn't dive to either side stopped most (60%) of shots to the middle and were also sometimes able to stop shots directed to the sides. Overall when goalkeepers didn't dive they had a save rate of 33% - double the rate achieved by diving to either side. However, despite the advantage of not diving to either side, goalkeepers choose to dive to their right or left in 94% of penalties – thereby creating the Panenka opportunity for kickers.

[A survey of professional goalkeepers](#) confirms that, consistent with norm theory, goalkeepers would feel worse about conceding a goal after standing in the middle than after diving to either side. Diving and missing –even diving the wrong way – at least shows you made an effort. Not moving looks suspiciously like not caring.

Curiously it looks like some goalkeepers at least adopt a strategy that compromises their effectiveness in order to maintain a perception that they are doing their best. Anyone who has faked looking busy when the boss walks into the office may recognise the pattern.

Do footballers appreciate the strategic opportunities in football penalties?

In England's final warm up game before the 2006 World Cup an incident occurred which, despite its comically trivial appearance, revealed more about strategic thinking than any of the participants in the game seemed to realise. England won the game against Jamaica easily – 6-0 – but, in

the 82nd minute with the score at 5-0, England were awarded a penalty which Peter Crouch took and missed. After the match the England [Manager Sven-Goran Eriksson criticised the player for the way he took the penalty.](#)

Anticipating that the goalkeeper would probably dive one way or the other Crouch had attempted to chip the ball in the centre of the goal – but ended up chipping the ball over the goal. Asked about a future World Cup spot-kick, Eriksson said: "If it was a penalty shootout, I doubt he will take it in that way. I hope not. It was his only mistake today—he should have taken it seriously. You can always miss a penalty, but not in that way."

However, Eriksson seems to have failed to appreciate that signalling before a world cup tournament that you might take a penalty "down the middle" would add to opposition goalkeepers' uncertainty in the tournament – to the advantage of the kicker and the detriment of goalkeepers. The penalty Crouch missed was hardly of any consequence – England were 5-0 up in the last few minutes– a friendly of no real significance; accordingly the costs of the signal were "cheap". Missing the goal was a minor embarrassment for Crouch—he even completed his "hat-trick" by scoring his 3rd goal in the 88th minute—but otherwise this event was a triviality.

However Eriksson's public criticisms of Crouch undermined the value of that signal – now goalkeepers could be quite confident that Crouch would not chip a ball at the centre of the goal. But—hold on a minute – perhaps this was a brilliant bluff: perhaps Eriksson and Crouch had worked out a cunning plan to increase the surprise value of a chipped penalty at the centre of the [goal](#) by pre-arranging for Crouch to deliberately miss one and have Eriksson publicly condemn him?

Sadly this charitable hypothesis is hard to sustain in light of the

subsequent facts. Four weeks after the Jamaica game England were knocked out of the World Cup in a penalty shootout with Portugal. Despite being on the pitch and available to take penalties in the shootout Crouch was not used.

**More information:** Daniel Memmert et al. Dueling in the penalty box: evidence-based recommendations on how shooters and goalkeepers can win penalty shootouts in soccer, *International Review of Sport and Exercise Psychology* (2013). [DOI: 10.1080/1750984X.2013.811533](https://doi.org/10.1080/1750984X.2013.811533)

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