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Soccer goalies process the world differently, muti-sensory integration tests show

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In the game of soccer (association football), goalkeepers have a unique role. To do the job well, they must be ready to make split-second decisions based on incomplete information to stop their opponents from

scoring a goal.

Now researchers reporting in *Current Biology* have some of the first solid scientific evidence that goalkeepers show fundamental differences in the way they perceive the world and process multi-sensory information.

"Unlike other football players, goalkeepers are required to make thousands of very fast decisions based on limited or incomplete sensory information," says Michael Quinn, the study's first author at Dublin City University who is also a retired professional goalkeeper and son of former Irish international Niall Quinn. "This led us to predict that goalkeepers would possess an enhanced capacity to combine information from the different senses, and this hypothesis was confirmed by our results."

"While many football players and fans worldwide will be familiar with the idea that goalkeepers are just 'different' from the rest of us, this study may actually be the first time that we have proven scientific evidence to back up this claim," says David McGovern, the study's lead investigator also from Dublin City University.

Based on his own history as a professional goalkeeper, Quinn already had a feeling that goalkeepers experience the world in a distinctive way. In his final year working on a psychology degree, he wanted to put this notion to the test.

To do it, the researchers enlisted 60 volunteers, including professional goalkeepers, professional outfield players, and age-matched controls who don't play soccer. They decided to look for differences among the three groups in what's known as temporal binding windows—that is the time window within which signals from the different senses are likely to be perceptually fused or integrated.

In each trial, participants were presented with one or two images (visual stimuli) on a screen. Those images could be presented along with one, two, or no beeps (auditory stimuli). Those stimuli were presented with different amounts of time in between.

In these tests, trials with one flash and two beeps generally led to the mistaken perception of two flashes, providing evidence that the auditory and visual stimuli have been integrated. This mistaken perception declines as the amount of time between stimuli increases, allowing researchers to measure the width of a person's temporal binding window, with a narrower temporal binding window indicating more efficient multi-sensory processing.

Overall, their tests showed that goalkeepers had marked differences in their multi-sensory processing ability. More specifically, goalkeepers had a narrower temporal binding window relative to outfielders and non-soccer players, indicating a more precise and speedy estimation of the timing of audiovisual cues.

The test results revealed another difference too. Goalkeepers didn't show as much interaction between the visual and auditory information. The finding suggests that the goalies had a greater tendency to separate sensory signals. In other words, they integrated the flashes and beeps to a lesser degree.

"We propose that these differences stem from the idiosyncratic nature of the goalkeeping position that puts a premium on the ability of goalkeepers to make quick decisions, often based on partial or incomplete sensory information," the researchers write.

They speculate that the tendency to segregate sensory information stems from goalies need to make quick decisions based on visual and auditory information coming in at different times. For example, goalkeepers

watch how a ball is moving in the air and also make use of the sound of the ball being kicked. But the relationship between those cues in time will depend on where the outfielder making the shot is on the field. After repeated exposure to those scenarios, goalkeepers may start to process sensory cues separately rather than combining them.

The researchers say they hope to explore other questions in future studies, including whether players with other highly specialized positions, such as strikers and center-backs, may also show perceptual differences. They're also curious to know which comes first.

"Could the narrower temporal binding window observed in goalkeepers stem from the rigorous training regimens that goalkeepers engage in from an early age?" McGovern asks. "Or could it be that these differences in multi-sensory processing reflect an inherent, natural ability that draws young players to the goalkeeping position? Further research that tracks the developmental trajectory of aspiring goalkeepers will be required to tease between these possibilities."

More information: , Distinct profiles of multisensory processing between professional goalkeepers and outfield football players, *Current Biology* (2023). DOI: 10.1016/j.cub.2023.08.050. www.cell.com/current-biology/f … 0960-9822(23)01130-2

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