When is Size-One Memory Mastermind harder than original Mastermind?

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Mastermind is a classical two-player board game, where the two players are usually called *codemaker* and *codebreaker*. The codemaker chooses a secret code consisting of 4 pegs and 6 possible colors for each peg. The codebreaker does not know this code and has to give several questions about the code, until he has found the correct secret. The codemaker has to evaluate each question by giving an answer consisting of black and white pegs, where each black peg corresponds to a peg of the codebreaker's question which is correct in position and color, and each white peg corresponds to another peg which is correct only in color. One important variant is black-peg Mastermind, where the codemaker only gives black-peg information and not white-peg information. One possible aim of the codebreaker is to minimize the number of questions needed to find the secret in the worst case. Clearly, original Mastermind can easily be extended to *Generalized Mastermind* with p pegs and c colors.

Consider a version of the generalized Mastermind game with p pegs and c colors, where the codebreaker may only store one question and answer, called Size-One Memory Mastermind. In [1] we have shown both for the black-white-peg variant and for the black-peg variant that Size-One Memory Mastermind is not harder than original Mastermind for several pairs (p, c), but up to now, in literature no pair has been found, where it *is* harder.

The open problem is now to find such a pair (p, c), where the size-one memory version needs more questions than the original version of Mastermind with unbounded memory. The first candidates are $(4, 4)$ for the black-white-peg variant, and $(4, 3)$ for the black-peg variant [1].

References

[1] Gerold Jäger, Marcin Peczarski. Playing several variants of Mastermind with constant-size memory is not harder than with unbounded memory. Proc. of 25th International Workshop on Combinatorial Algorithms (IWOCA 2014), Lecture Notes in Comput. Sci., Springer, 2014.