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How were the five sounds chosen?

Examining the quantum circuit published by Escolà-Gascón and colleagues in 2026.

98.65 %

of runs of the ideal circuit in Figure A3 produce ten zeros or ten ones.

○ ○ ○ ○ ○ ○ ○ ○ ○ ○ All zeros · 49.3239 %

● ● ● ● ● ● ● ● ● ● All ones · 49.3239 %

We have checked the circuit the authors publish. With that circuit, almost always all the sounds would play, or none. Five out of ten playing, as the study says, is almost impossible. The article doesn't explain how they were chosen. The authors may have taken an extra step they don't describe, or we may have missed something.

What we are not saying: that the study is false, or that anyone lied.

Scope: the ideal state, the published angles and measurement in the computational basis. This document does not reconstruct the actual outputs of the IBM processor.

01 · What we checked

The published circuit

This review uses the article and supplement mmc1, focusing on Equations 3-6, Figures A2-A3 and the note to Table 3. [1, 2]

Published description	Location
Each trial corresponds to a qubit: 1 triggers a sound for 20 s; 0 means no sound.	Methods, printed p. 4
A and B use EM1; C uses CM1. The subsequent test contains five targets and five distractors.	Methods, pp. 4-5; Table 3, note a
EM1 prepares a ten-qubit GHZ state and applies small local rotations.	Eqs. 3-5; Figure A3

Angles shown in Figure A3

Qubit	Ry: θ (radians)	Rz: Φ (radians)
q0	0.00701	0.119
q1	0.089	0.12
q2	0.0539	0.0295
q3	0.091	0.0647
q4	0.13	0.126
q5	0.127	0.00674
q6	0.0276	0.0683
q7	0.0289	0.0925
q8	0.0188	0.0342
q9	0.017	0.0914

Gate order. Time flows upwards in the diagram. H acts on q0; the CNOTs connect q0 to q1...q9. On each target, Ry comes before Rz and after its CNOT. On q0, the rotations come after the last CNOT.

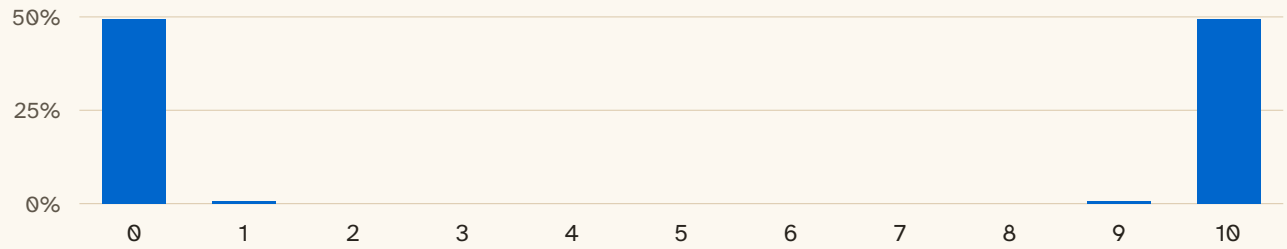
The target rotations commute with the later CNOTs. They can therefore be moved to the end without changing the state. The final Rz gates change only phases, not the probabilities of measuring zeros and ones.

02 · Recalculated results

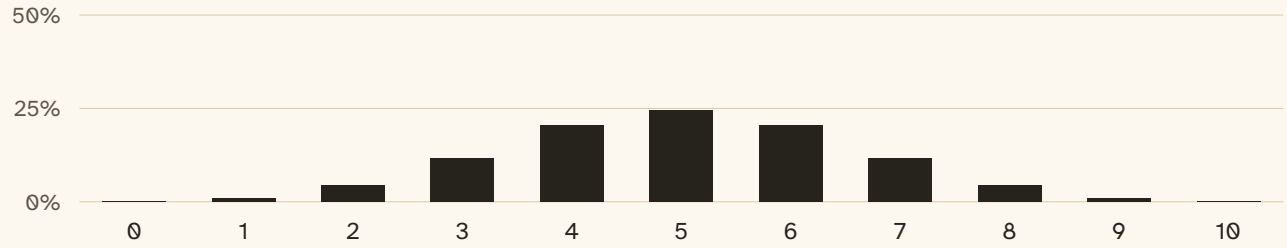
Almost all outcomes lie at the extremes

K is the number of ones when the ten qubits are measured. Both charts use the same scale.

EM1 · A and B · angles from A3



CM1 · C · ten Hadamard gates



K	EM1 · probability	CM1 · probability
0	0.493239444664	0.0009765625
1	0.006725258112	0.009765625
2	$3.52076362054 \cdot 10^{-5}$	0.0439453125
3	$8.94720147106 \cdot 10^{-8}$	0.1171875
4	$1.16050301634 \cdot 10^{-10}$	0.205078125
5	$1.46767268220 \cdot 10^{-13}$	0.24609375
6	$1.16050301634 \cdot 10^{-10}$	0.205078125
7	$8.94720147106 \cdot 10^{-8}$	0.1171875
8	$3.52076362054 \cdot 10^{-5}$	0.0439453125
9	0.006725258112	0.009765625
10	0.493239444664	0.0009765625

The table gives probabilities, not percentages. For EM1, P(K = 5) corresponds to one run in $6.81 \cdot 10^{12}$ (6.81 trillion). For CM1 it is 24.609375 %. CM1 does not guarantee exactly five ones either.

03 · Proof

The calculation and its maximum

Let x be a ten-bit string and K its number of ones. Define $c_j = \cos(\theta_j/2)$ and $s_j = \sin(\theta_j/2)$. The two GHZ branches contribute these real amplitudes before the Rz gates:

$$A(x) = \prod_{xj=0} c_j \prod_{xj=1} s_j$$
$$B(x) = (-1)^{10-K} \prod_{xj=0} s_j \prod_{xj=1} c_j$$
$$P(x) = [A(x) + B(x)]^2 / 2;\ P(K=k) = \sum_{|x|=k} P(x)$$

The Rz gates multiply both contributions by the same phase for each x. The calculation includes interference: for K = 5 the two contributions have opposite signs. For CM1, each string has probability 1/1024 and P(K=k) = C(10,k)/1024.

Maximum for any θ and Φ in [0, π/20]

With nine angles fixed, the dependence of P(K=5) on the remaining angle is $f(\theta) = a\cos^2(\theta/2) + b\sin^2(\theta/2) - d\sin\theta$, where $d \geq 0$. Its derivative is $[(b-a)/2]\sin\theta - d\cos\theta$. If $b \leq a$, it is nonpositive; if $b > a$, it can only change from negative to positive on this interval. There is no strict interior maximum. It therefore suffices to examine the vertices: θ = 0 or π/20.

If m < 10 angles equal π/20 and the rest are zero, with $p = \sin^2(\pi/40)$:

$$P(K=5) = 0 \text{ if } m < 5;\ C(m,5)\, p^5(1-p)^{m-5} \text{ if } 5 \leq m \leq 9.$$

From m = 5 to m = 9 the expression increases: the ratio of successive terms is (m+1)(1-p)/(m-4), which exceeds 1. If m = 10, symmetry produces exact cancellation and P(K=5) = 0.

Global maximum: $1.08661753102 \cdot 10^{-9}$
It is attained with nine Ry angles equal to π/20 and one equal to zero, in any order. No choice of angles within the stated interval exceeds this probability for the ideal circuit.

Precision: the angles shown in the figure are rounded. The individual numerical results refer to those decimal values. The global bound remains valid for all angles within the stated interval.

04 · Limits of the conclusion

Purity does not mean fidelity

The article reports von Neumann entropies of 0.0025 and 0.0054. Low entropy indicates that a state is nearly pure, but does not identify which state has been prepared. A coherent error can greatly change the state while preserving its purity. [1]

> **What the calculation does not establish**
> We cannot conclude that the actual probability of five ones remains negligible solely because the reported state is almost pure.

A simple counterexample

$$|\chi\rangle = (|1111100000\rangle + |0000011111\rangle) / \sqrt{2}$$

This state has zero entropy and always yields five ones. It can be obtained from a GHZ state by local bit flips. It is a counterexample to the inference based on purity alone; it is not offered as a reconstruction of the experiment.

What the Mermin values add

For the operator in Equation 6, only the coherence between the strings of ten zeros and ten ones contributes. If P_{ext} is their combined probability:

$$|\langle M_{10}\rangle| = 1024\ |\mathrm{Re}\ \rho_{0,1023}| \le 512\ P_{ext}$$

$$P(K=5) \le 1 - |\langle M_{10}\rangle| / 512$$

Group	Reported Mermin value	Upper bound on P(K=5)
A	368.7117	0.279859961
B	347.6603	0.320975977

These are upper bounds, not estimates of the actual probability, and they are not negligible. Low entropy alone does not reduce them: for r = M/512, the pure state $\sqrt{r}\,|GHZ\rangle + \sqrt{(1-r)}\,|1111100000\rangle$ attains P(K=5) = 1-r and $\langle M\rangle = 512r$.

Condition. The bound applies to the same state and ideal Z measurement, before any postselection. Readout errors and classical filtering require their own data. Without an operational definition and fidelity to the target state, concurrence values are insufficient to reconstruct the distribution.

05 · From circuit outputs to sounds

How could five targets be selected?

The following methods are possible in principle. The article does not specify an operational rule in enough detail.

Possible interpretation	What it resolves and what is missing
Several shots per patient	This could work if followed by a selection step. Multiple shots alone do not guarantee five distinct sounds.
Repeat until five ones occur	This is possible in principle. With A3, it would require an average of $6.81 \cdot 10^{12}$ runs per accepted result. No such rule is described.
One bit from a fresh shot per trial	The ten selected bits would be independent in the ideal model: P(K=5) = 24.609375 %. The GHZ correlations between trials would be lost.
Average the results	The note in mmc1 discusses estimating Pauli operators through averages. It does not explain how those averages select five sounds.
Take the first five ones	This caps the number of ones used at five, but does not address outputs with fewer than five. An additional rule is needed.
“up to 5 different environmental sounds”	This may indicate a playback limit. It does not explain why the subsequent test would always contain five previously presented sounds.
Repeat sounds or select targets afterwards	Ten trials could reuse five sounds, or the test could select five from a larger pool. The mapping between bits, sounds and targets is missing. All-zero outcomes still need to be addressed.
Use angles in [0, 2π]	The phrase “Local collapse generation” is ambiguous. It does not justify simply replacing the interval and gates in A3; that would change the calculation.
Use another algorithm to select five	This could explain the selection, but the role of the quantum circuit would then need to be explained.

Patients exposed to no sounds. With a single ten-bit outcome per patient and the literal rule 1 = playback, 49.3239 % of ideal runs would yield silence in all ten trials. No specific rule has been found for rerunning the circuit, excluding these cases or adding sounds. This does not establish that any patient experienced this.

06 · Further checks

Additional checks

The article states that ΔQ = 0.126 and 0.132 are significant at p < 0.01 under ΔQ ~ N(0,1). Taking that distribution literally, the p-values are: [1]

ΔQ	Right-tailed p	Two-sided p
0.126	0.449866	0.899732
0.132	0.447492	0.894984

Confirmed: they are not significant under N(0,1).
If the intention was to divide ΔQ by a standard error, that step and its justification are not specified in the published claim.

What holds and what needs clarifying

Q calculation: confirmed. Equation 14 gives Q_A = 0.4984673444 and Q_B = 0.5212335163, which round to the published values. Subtracting the printed values gives 0.1265 and 0.1322; using these does not fix the significance claim.

Equivalence and bias: the interpretation needs correction. Failing to reject an A-B difference does not demonstrate equivalence or the absence of false memories. Substantial overlap can also arise if both groups share a bias. A p-value near 1 is not in itself an error: it may correspond to the one-sided test B > A.

Mermin: the local bound in Equation 6 is 32. The text prints 23. For a local assignment in which x_j and y_j each take values ±1, each factor $x_j + i\,y_j$ has modulus √2. Their product has modulus 32 and can have a real part of ±32. The published values still exceed this bound. Failure to violate this inequality does not establish the absence of entanglement.

T1 and T2: their meaning needs correction. They are relaxation and decoherence times, not processor response latencies. They must be compared with gate durations; small values do not in themselves indicate better processing. [3]

This review does not recalculate the clinical analyses, regressions or every statistical test in the article. The observations above are limited to the expressions and arguments that could be checked.

07 · Reproducibility

The core calculation

Python 3, using only the standard library. The code enumerates every outcome rather than sampling random shots.

```
from itertools import product
from math import sin, cos, prod, comb, sqrt, pi, erfc

theta = [.00701, .089, .0539, .091, .13,
         .127, .0276, .0289, .0188, .017]
c = [cos(t / 2) for t in theta]
s = [sin(t / 2) for t in theta]
em1 = [0.0] * 11

# Final Rz gates are diagonal: probabilities are unchanged.
for bits in product((0, 1), repeat=10):
    a = prod(s[j] if bit else c[j]
             for j, bit in enumerate(bits))
    b = prod(c[j] if bit else -s[j]
             for j, bit in enumerate(bits))
    em1[sum(bits)] += (a + b)**2 / 2

assert abs(sum(em1) - 1) < 1e-12
cm1 = [comb(10, k) / 1024 for k in range(11)]
for k in range(11):
    print(k, em1[k], cm1[k])

# Global maximum: vertex proof on page 4.
p = sin(pi / 40)**2
maximum = comb(9, 5) * p**5 * (1 - p)**4
print("Maximum P(K=5):", maximum)

# P-values under the stated standard normal distribution.
for z in (.126, .132):
    one_sided = erfc(z / sqrt(2)) / 2
    print("Delta, one-sided p, two-sided p:",
          z, one_sided, 2 * one_sided)

# Bounds conditional on the operator in Equation 6.
for m in (368.7117, 347.6603):
    print("Upper bound P(K=5):", 1 - m / 512)
```

The file **calculo_em1.py** adds an independent implementation: it applies H, the nine CNOTs, Ry and Rz to a vector of 1,024 amplitudes. It also checks the interleaved order, CM1 and the 1,024 vertices of the angle domain.

The file **verificar_precision.py** repeats the formula with 80 decimal digits using mpmath. Full results are provided in JSON and CSV.

08 · Sources and traceability

What supports this document

Checks performed

Check	Result
Formula versus gates, amplitude by amplitude	Difference < $1.25 \cdot 10^{-16}$
Interleaved order versus rotations at the end	Difference < $2.49 \cdot 10^{-16}$
P(K=5) calculated with 80 digits	Relative error < $7 \cdot 10^{-16}$
Global maximum	Analytical proof and 1,024 vertices checked

Primary sources and locations

[1] Escolà-Gascón, Á., Drinkwater, K., Denovan, A., Dagnall, N. and Benito-León, J. (2026). Quantum evidence of nonlocal consciousness during clinical death. The Innovation, 7(9), 101355.
Open access, CC BY.
doi.org/10.1016/j.xinn.2026.101355
Locations: printed pp. 4-5 (circuits and sounds); Table 3, note a; “Quantum properties”; Equation 14 and the paragraph on ΔQ.

[2] Supplement mmc1 to the same article. Figure A2 and methodological note (file page 4); Figure A3 (file page 5). The angles were read visually from A3. The note concerns averages of Pauli operators.

[3] IBM Quantum Documentation. View backend details; documentation for RYGate and RZGate. Definitions of T1, T2 and rotation matrices. Accessed: 20 October 2026.

Note on Rz. Equation 4 prints the same negative sign in both diagonal entries of Rz. The standard gate has opposite signs. This discrepancy does not change the Z distribution calculated here: both versions are diagonal and occur at the end of each qubit line.

Confirmed: the ideal circuit distribution and the error in the significance claim for ΔQ under the stated normal distribution.
Limit of the calculation: low entropy does not guarantee proximity to the ideal state.
Cannot be determined: which actual outputs were used and which rule converted those outputs into five sounds.