



# The psychotomimetic ketamine disrupts the transfer of late sensory information in the corticothalamic network

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## ► To cite this version:

Yi Qin, Ali Mahdavi, Marine Bertschy, Paul M Anderson, Sofya Kulikova, et al.. The psychotomimetic ketamine disrupts the transfer of late sensory information in the corticothalamic network. 2022. inserm-03590649v1

**HAL Id: inserm-03590649**

**<https://inserm.hal.science/inserm-03590649v1>**

Preprint submitted on 28 Feb 2022 (v1), last revised 14 Oct 2022 (v2)

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**STATISTIC DATA**

|                | <b>Delta</b>                   | <b>Theta</b>                   | <b>Sigma</b>                   | <b>Beta</b>                    | <b>Gamma</b>                   |
|----------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| <b>EEG</b>     | F (5, 234) = 8.301<br>P<0.0001 | F (5, 234) = 9.963<br>P<0.0001 | F (5, 234) = 22.94<br>P<0.0001 | F (5, 234) = 42.92<br>P<0.0001 | F (5, 234) = 27.14<br>P<0.0001 |
| <b>Layer 6</b> | F (5, 234) = 44.49<br>P<0.0001 | F (5, 234) = 12.81<br>P<0.0001 | F (5, 234) = 26.41<br>P<0.0001 | F (5, 234) = 31.48<br>P<0.0001 | F (5, 234) = 21.06<br>P<0.0001 |
| <b>VPm</b>     | F (5, 234) = 1.485<br>P=0.1953 | F (5, 234) = 8.219<br>P<0.0001 | F (5, 234) = 23.49<br>P<0.0001 | F (5, 234) = 42.43<br>P<0.0001 | F (5, 234) = 9.657<br>P<0.0001 |
| <b>PoM</b>     | F (5, 234) = 1.106<br>P=0.0867 | F (5, 234) = 2.596<br>P=0.0175 | F (5, 234) = 12.66<br>P<0.0001 | F (5, 234) = 12.37<br>P<0.0001 | F (5, 234) = 8.754<br>P<0.0001 |

**Table 1 (see Fig. 2A):** One-way repeated-measures ANOVA shows significant effects of stimuli in different frequencies under saline condition.

**EEG**

|                     | <b>Delta</b> | <b>Theta</b> | <b>Sigma</b> | <b>Beta</b> | <b>Gamma</b> |
|---------------------|--------------|--------------|--------------|-------------|--------------|
| <b>200-700 ms</b>   | P<0.0001     | P<0.0001     | P<0.0001     | P<0.0001    | P<0.0001     |
| <b>700-1200 ms</b>  | P=0.0005     | P=0.0001     | P=0.0023     | P=0.1935    | P=0.9906     |
| <b>1200-1700 ms</b> | P=0.1177     | P=0.0001     | P=0.1961     | P=0.7959    | P=0.9906     |
| <b>1700-2200 ms</b> | P=0.9818     | P=0.2999     | P=0.4617     | P=0.8546    | P=0.9988     |
| <b>2200-2700 ms</b> | P=0.9818     | P=0.3278     | P=0.5079     | P=0.8546    | P=0.9988     |

**Layer 6**

|                     | <b>Delta</b> | <b>Theta</b> | <b>Sigma</b> | <b>Beta</b> | <b>Gamma</b> |
|---------------------|--------------|--------------|--------------|-------------|--------------|
| <b>200-700 ms</b>   | P<0.0001     | P<0.0038     | P<0.0001     | P<0.0001    | <0.0001      |
| <b>700-1200 ms</b>  | P=0.0059     | P<0.0001     | P=0.0046     | P=0.9624    | P=0.9583     |
| <b>1200-1700 ms</b> | P=0.2774     | P=0.0003     | P=0.0580     | P=0.9965    | P=0.9583     |
| <b>1700-2200 ms</b> | P=0.9549     | P<0.3421     | P=0.4754     | P=0.9967    | P=0.9583     |
| <b>2200-2700 ms</b> | P=0.9549     | P<0.5618     | P=0.4754     | P=0.9965    | P=0.9583     |

**VPm**

|                     | <b>Delta</b> | <b>Theta</b> | <b>Sigma</b> | <b>Beta</b> | <b>Gamma</b> |
|---------------------|--------------|--------------|--------------|-------------|--------------|
| <b>200-700 ms</b>   | P=0.7821     | P<0.0001     | P<0.0001     | P<0.0001    | P<0.0001     |
| <b>700-1200 ms</b>  | P=0.8703     | P=0.0001     | P=0.0140     | P=0.8552    | P=0.1538     |
| <b>1200-1700 ms</b> | P=0.5827     | P=0.0391     | P=0.1492     | P=0.8552    | P=0.7689     |
| <b>1700-2200 ms</b> | P=0.8703     | P=0.5925     | P=0.7579     | P=0.9404    | P=0.9904     |
| <b>2200-2700 ms</b> | P=0.8703     | P=0.7764     | P=0.7579     | P=0.9404    | P=0.9293     |

**PoM**

|                     | <b>Delta</b> | <b>Theta</b> | <b>Sigma</b> | <b>Beta</b> | <b>Gamma</b> |
|---------------------|--------------|--------------|--------------|-------------|--------------|
| <b>200-700 ms</b>   | P=0.2731     | P=0.0091     | P=<0.0001    | P<0.0001    | P<0.0001     |
| <b>700-1200 ms</b>  | P=0.3881     | P=0.0424     | P=0.3243     | P=0.6621    | P=0.7778     |
| <b>1200-1700 ms</b> | P=0.3881     | P=0.0899     | P=0.3772     | P=0.5365    | P=0.2742     |
| <b>1700-2200 ms</b> | P=0.4415     | P=0.0899     | P=0.4669     | P=0.5365    | P=0.7778     |
| <b>2200-2700 ms</b> | P=0.1947     | P=0.3154     | P=0.4669     | P=0.5566    | P=0.7778     |

**Table 2 (see Fig2A):** Holm-Šidák's multiple comparisons test shows various powers in different periods after stimuli.

|                | Delta                          | Theta                          | Sigma                          | Beta                           | Gamma                           |
|----------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|---------------------------------|
| <b>EEG</b>     | F (5, 234) = 7.175<br>P<0.0001 | F (5, 234) = 17.63<br>P<0.0001 | F (5, 234) = 60.99<br>P<0.0001 | F (5, 234) = 24.78<br>P<0.0001 | F (5, 234) = 3.866<br>P<0.0022  |
| <b>Layer 6</b> | F (5, 234) = 11.41<br>P<0.0001 | F (5, 234) = 14.21<br>P<0.0001 | F (5, 234) = 48.59<br>P<0.0001 | F (5, 234) = 8.772<br>P<0.0001 | F (5, 234) = 12.14<br>P<0.0001  |
| <b>VPm</b>     | F (5, 234) = 1.473<br>P=0.1995 | F (5, 234) = 15.07<br>P<0.0001 | F (5, 234) = 25.60<br>P<0.0001 | F (5, 234) = 11.84<br>P<0.0001 | F (5, 234) = 0.5845<br>P<0.7119 |
| <b>PoM</b>     | F (5, 234) = 13.79<br>P=0.2276 | F (5, 234) = 6.697<br>P<0.0001 | F (5, 234) = 16.22<br>P<0.0001 | F (5, 234) = 7.792<br>P<0.0001 | F (5, 234) = 0.7948<br>P<0.5543 |

**Table 3 (see Fig. 2B):** One-way repeated-measures ANOVA shows significant effects of stimuli in different frequencies under the ketamine condition.

**EEG**

|                     | <b>Delta</b> | <b>Theta</b> | <b>Sigma</b> | <b>Beta</b> | <b>Gamma</b> |
|---------------------|--------------|--------------|--------------|-------------|--------------|
| <b>200-700 ms</b>   | P<0.0031     | P<0.0001     | P<0.0001     | P<0.0001    | P=0.0727     |
| <b>700-1200 ms</b>  | P=0.0011     | P=0.1957     | P=0.9745     | P=0.0892    | P=0.8169     |
| <b>1200-1700 ms</b> | P=0.9862     | P=0.9970     | P=0.9909     | P=0.2047    | P=0.2142     |
| <b>1700-2200 ms</b> | P=0.9862     | P=0.9970     | P=0.9909     | P=0.7108    | P=0.0021     |
| <b>2200-2700 ms</b> | P=0.9862     | P=0.9970     | P=0.9909     | P=0.7793    | P=0.0416     |

**Layer 6**

|                     | <b>Delta</b> | <b>Theta</b> | <b>Sigma</b> | <b>Beta</b> | <b>Gamma</b> |
|---------------------|--------------|--------------|--------------|-------------|--------------|
| <b>200-700 ms</b>   | P<0.0001     | P<0.0001     | P<0.0001     | P=0.0083    | P=0.0612     |
| <b>700-1200 ms</b>  | P<0.0001     | P<0.0071     | P=0.9882     | P=0.0311    | P=0.1237     |
| <b>1200-1700 ms</b> | P=0.9984     | P=0.9938     | P=0.9780     | P=0.0811    | P=0.3672     |
| <b>1700-2200 ms</b> | P=0.9984     | P<0.9938     | P=0.9882     | P=0.6557    | P=0.0016     |
| <b>2200-2700 ms</b> | P=0.9984     | P<0.9938     | P=0.9882     | P=0.4294    | P=0.0101     |

**VPm**

|                     | <b>Delta</b> | <b>Theta</b> | <b>Sigma</b> | <b>Beta</b> | <b>Gamma</b> |
|---------------------|--------------|--------------|--------------|-------------|--------------|
| <b>200-700 ms</b>   | P=0.4336     | P<0.0001     | P<0.0001     | P=0.0004    | P=0.5811     |
| <b>700-1200 ms</b>  | P=0.9740     | P=0.9962     | P=0.8272     | P=0.1091    | P=0.5811     |
| <b>1200-1700 ms</b> | P=0.7018     | P=0.9845     | P=0.8272     | P=0.1091    | P=0.5811     |

|                     |          |          |          |          |          |
|---------------------|----------|----------|----------|----------|----------|
|                     |          |          |          |          |          |
| <b>1700-2200 ms</b> | P=0.9427 | P=0.9973 | P=0.8272 | P=0.1486 | P=0.5811 |
| <b>2200-2700 ms</b> | P=0.9427 | P=0.9973 | P=0.8272 | P=0.1091 | P=0.5811 |

**PoM**

|                     | <b>Delta</b> | <b>Theta</b> | <b>Sigma</b> | <b>Beta</b> | <b>Gamma</b> |
|---------------------|--------------|--------------|--------------|-------------|--------------|
| <b>200-700 ms</b>   | P<0.0001     | P<0.0001     | P=<0.0001    | P=0.0007    | P=0.7127     |
| <b>700-1200 ms</b>  | P=0.9575     | P=0.9638     | P=0.8902     | P=0.6488    | P=0.7127     |
| <b>1200-1700 ms</b> | P=0.9575     | P=0.7490     | P=0.9046     | P=0.4235    | P=0.5446     |
| <b>1700-2200 ms</b> | P=0.7864     | P=0.9938     | P=0.9046     | P=0.6488    | P=0.5446     |
| <b>2200-2700 ms</b> | P=0.7864     | P=0.9938     | P=0.8902     | P=0.6488    | P=0.4017     |

**Table 4 (see Fig. 2B):** Holm-Šidák's multiple comparisons test shows various powers in different periods after stimuli.

| <b>EEG</b>              | <b>Layer 6</b>          | <b>VPm</b>              | <b>PoM</b>              |
|-------------------------|-------------------------|-------------------------|-------------------------|
| t(39)=8.359<br>P<0.0001 | t(39)=8.343<br>P<0.0001 | t(39)=9.852<br>P<0.0001 | t(39)=10.99<br>P<0.0001 |

**Table 5 (see S4):** Paired t-test shows that gamma oscillations of ketamine differ from the saline condition.

|                       | EEG                            | Layer 6                        | VPm                            | PoM                         |
|-----------------------|--------------------------------|--------------------------------|--------------------------------|-----------------------------|
| <b>Condition</b>      | F(1, 78)=2.175<br>P=0.1443     | F(1, 78)=5.652<br>P=0.0199     | F(1, 78)=9.363<br>P=0.0030     | F(1, 78)=14.51<br>P=0.0003  |
| <b>Time</b>           | F(4, 312)=23.07<br>P<0.0001    | F(4,312)=13.07,<br>P<0.0001    | F(4,312)=5.863,<br>P=0.0001    | F(4, 312)=8.296<br>P<0.0001 |
| <b>condition*time</b> | F (4, 312) = 21.85<br>P<0.0001 | F (4, 312) = 27.11<br>P<0.0001 | F (4, 312) = 6.036<br>P<0.0001 | F(4, 312)=6.247<br>P<0.0001 |

**Table 6 (see Fig. 3):** Two-way repeated-measures ANOVA shows significant effects of ketamine administration, time, and time-drug interaction of ketamine in the induced gamma oscillation power.

|                     | EEG      | Layer6   | VPm      | PoM      |
|---------------------|----------|----------|----------|----------|
| <b>200-700 ms</b>   | P<0.0001 | P<0.0001 | P<0.0001 | P<0.0001 |
| <b>700-1200 ms</b>  | P=0.8645 | P=0.8244 | P=0.5084 | P=0.6855 |
| <b>1200-1700 ms</b> | P=0.3041 | P=0.6764 | P=0.1529 | P=0.0268 |
| <b>1700-2200 ms</b> | P=0.1177 | P=0.0646 | P=0.5084 | P=0.1742 |
| <b>2200-2700 ms</b> | P=0.3041 | P=0.1995 | P=0.5084 | P=0.1742 |

**Table 7 (see Fig. 3):** Holm-Šidák's multiple comparisons test shows ketamine substantially affects induced gamma oscillations during the post-stimulus 200-500 ms window.



| Layer 6                 | VPm                      |
|-------------------------|--------------------------|
| t(39)=-2.5509<br>P<0.05 | t(39)= -2.2930<br>P<0.05 |

**Table 8 (see Fig. 4):** Paired t-test shows that multi-scale entropy of VPm and layer 6 were changed by ketamine.

|                                        | Layer 6-VPm        | Layer 6-PoM       | VPm-PoM           |
|----------------------------------------|--------------------|-------------------|-------------------|
| <b>Sum of positive, negative ranks</b> | 236.0,<br>-584.0   | 520.0<br>-300.0   | 463.0<br>-357.0   |
| <b>Sum of signed ranks</b>             | -348.0<br>P=0.0185 | 220.0<br>P=0.1423 | 106.0<br>P=0.4845 |

**Table 9 (see Fig. 5):** Wilcoxon test shows that coherence between layer 6 and VPm were decreased significantly by ketamine.