RADIOFREQUENCIES AND BRAIN
An overview

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If we launch a literature search on «radiofrequency and brain functions» on PubMed database, we retrieve more than 2850 items (only in humans).

Scientists were interested at different outcomes of brain functioning and activity:

- Cognition and behavior
- Waking EEG activity
- Sleeping EEG activity
Brain functioning: cognition & behavior

Effect of a 915-MHz simulated mobile phone signal on cognitive function in man

A. W. PREECE†*, G. IW†, A. DAVIES-SMITH†, K. WESNES‡, S. BUTLER§, E. LIM¶ and A. VAREY¶

A speeding up of performance was observed more strongly during analogue than digital RF exposure.
There is a facilitatory effect on brain functioning, especially in some tasks requiring attention and manipulation of information in working memory.
Facilitatory effect on both vigilance and attention
### Effect of a 902 MHz Electromagnetic Field Emitted by Mobile Phones on Human Cognitive Function: A Replication Study

Christian Haarala,1,2* Linda Björnberg,3,4 Maria Ek,1,2 Matti Laine,1,4 Antti Revonsuo,1,5 Mika Koivisto,1,2 and Heikki Hämäläinen1,2

<table>
<thead>
<tr>
<th>Test</th>
<th>Finland (n = 32)</th>
<th></th>
<th>Sweden (n = 32)</th>
<th></th>
<th></th>
<th>Sig. (non-corrected)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EMF OFF (ms)</td>
<td>EMF ON (ms)</td>
<td>EMF OFF (ms)</td>
<td>EMF ON (ms)</td>
<td>F</td>
<td>P-value</td>
</tr>
<tr>
<td>SRT</td>
<td>281 (31)</td>
<td>281 (38)</td>
<td>278 (24)</td>
<td>278 (29)</td>
<td>0.001</td>
<td>.981</td>
</tr>
<tr>
<td>2CRT</td>
<td>416 (53)</td>
<td>426 (56)</td>
<td>417 (36)</td>
<td>417 (39)</td>
<td>1.734</td>
<td>.193</td>
</tr>
<tr>
<td>10CRT</td>
<td>668 (93)</td>
<td>669 (92)</td>
<td>683 (96)</td>
<td>676 (98)</td>
<td>0.260</td>
<td>.611</td>
</tr>
<tr>
<td>SUB</td>
<td>896 (125)</td>
<td>901 (121)</td>
<td>928 (133)</td>
<td>918 (142)</td>
<td>0.096</td>
<td>.758</td>
</tr>
<tr>
<td>Subtraction time</td>
<td>227 (79)</td>
<td>232 (96)</td>
<td>244 (94)</td>
<td>233 (100)</td>
<td>0.135</td>
<td>.75</td>
</tr>
<tr>
<td>VER</td>
<td>657 (147)</td>
<td>686 (152)</td>
<td>685 (193)</td>
<td>694 (184)</td>
<td>3.552</td>
<td>.06</td>
</tr>
<tr>
<td>Verification time</td>
<td>241 (108)</td>
<td>260 (116)</td>
<td>268 (173)</td>
<td>277 (167)</td>
<td>2.244</td>
<td>.10</td>
</tr>
<tr>
<td>VIG</td>
<td>515 (56)</td>
<td>515 (49)</td>
<td>494 (46)</td>
<td>502 (41)</td>
<td>0.959</td>
<td>.331</td>
</tr>
<tr>
<td>CON</td>
<td>394 (43)</td>
<td>397 (53)</td>
<td>400 (36)</td>
<td>414 (43)</td>
<td>2.782</td>
<td>.10</td>
</tr>
<tr>
<td>IN1</td>
<td>429 (74)</td>
<td>427 (70)</td>
<td>465 (78)</td>
<td>473 (73)</td>
<td>0.421</td>
<td>.516</td>
</tr>
<tr>
<td>IN2</td>
<td>427 (58)</td>
<td>429 (45)</td>
<td>439 (57)</td>
<td>447 (56)</td>
<td>0.636</td>
<td>.420</td>
</tr>
<tr>
<td>Stroop1</td>
<td>21 (37)</td>
<td>34 (48)</td>
<td>61 (68)</td>
<td>57 (43)</td>
<td>0.359</td>
<td>.551</td>
</tr>
<tr>
<td>Stroop2</td>
<td>20 (38)</td>
<td>35 (43)</td>
<td>32 (37)</td>
<td>31 (39)</td>
<td>1.010</td>
<td>.319</td>
</tr>
</tbody>
</table>

NOT REPLICATED !!!
**Brief Communication**

*Psychomotor Performance is Not Influenced by Brief Repeated Exposures to Mobile Phones*

G. Curcio,¹,²* E. Valentini,¹ F. Moroni,¹ M. Ferrara,³ L. De Gennaro,¹ and M. Bertini¹

<table>
<thead>
<tr>
<th>Task</th>
<th>Measure</th>
<th>Effect</th>
<th>Mean ± SE</th>
<th>F</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
</table>
| SRTT  | Speed⁹ | Condition | ON 248.01 ± 9.43  
OFF 257.17 ± 9.89 | 2.10  | 1.23 | 0.16 |
| SFTT  | Speed⁹ | Condition | ON 2126.74 ± 125.23  
OFF 2248.06 ± 163.08 | 0.56  | 1.23 | 0.6  |
|       | Accuracy | Condition | ON 12.99 ± 0.83  
OFF 11.80 ± 0.85 | 1.56  | 1.23 | 0.23 |

NOT REPLICATED !!!
In conclusion: (1) cognition & behavior

Systematic review and meta-analysis of psychomotor effects of mobile phone electromagnetic fields

Elia Valvano, Giuseppina Fadda

Review

Acute effects emitted by mobile telephones

Jun Zhang, Alexander Leggett

First published: 20 April 2018

Exposure to Mobile Phone-Emitted Electromagnetic Fields and Human Attention: No Evidence of a Causal Relationship

Giuseppe Curcio*
Brain functioning: waking & sleeping EEG activity

Awake — low voltage — random, fast

Drowsy — 8 to 12 cps — alpha waves

Stage 1 — 3 to 7 cps — theta waves

Stage 2 — 12 to 14 cps — sleep spindles and K complexes

Delta Sleep — 1 to 2 cps — delta waves >75 μV

REM Sleep — low voltage — random, fast with sawtooth waves
Brain functioning: waking EEG activity

Active MPs affect neural function in humans and do so as a function of exposure duration.
Is the brain influenced by a phone call? An EEG study of resting wakefulness

G. Curcio a,b, M. Ferrara b, F. Moroni a, G. D’Inzeo c, M. Bertini a, L. De Gennaro a

Alpha band influenced by real exposure
Pulsed radio frequency radiation affects cognitive performance and the waking electroencephalogram

Sabine J. Regel¹, Julie M. Gottselig², Jürgen Schuderer⁴, Gilberte Tinguely³, Julia V. Rétey³, Niels Kuster⁴, Hans-Peter Landolt¹,²,³ and Peter Achermann¹,²,³

Increased spectral power in the waking electroencephalogram in the alpha range
In conclusion: (2) waking EEG activity
Brain functioning: sleep EEG activity

After exposure sleep latency and REM sleep percentage were reduced, and all frequency bands resulted increased.
Waking after sleep onset was reduced and spectral power in the alpha and sleep spindle ranges increased under exposure.
Electromagnetic fields, such as those from mobile phones, alter regional cerebral blood flow and sleep and waking EEG

R. Huber\textsuperscript{1}, V. Treyer\textsuperscript{2}, A. A. Borbély\textsuperscript{1}, J. Schuderer\textsuperscript{3}, J. M. Gottselig\textsuperscript{1}, H.-P. Landolt\textsuperscript{1}, E. Werth\textsuperscript{1}, T. Berthold\textsuperscript{2}, N. Kuster\textsuperscript{3}, A. Buck\textsuperscript{2} and P. Achermann\textsuperscript{1}

Alpha and sigma EEG resulted enhanced in the first 30 minutes of NREM sleep
In conclusion: (3) sleeping EEG activity
Open points for future research

- Other type of signals (e.g., radio-base stations, 5G)
- Environmental exposure
- Cumulative effects (from chronic exposure)
- Individual sensitivity (e.g., Idiopathic Environmental Intolerance attributed to Electromagnetic Fields: IEI-EMF)
- Particular vulnerability of some groups of people (e.g., elderly, children and adolescents, epileptic patients)
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https://labscoc.wordpress.com/