

## Tekst 3

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### Are mobile phones on trains dangerous?

COMMUTER trains are often stuffy and crowded, and they frequently fail to run on time. As if that were not bad enough, Tsuyoshi Hondou, a physicist at Tohoku University in Japan, published a paper in 2002 that gave commuters yet another reason to feel uncomfortable. Dr Hondou examined mobile-phone usage in enclosed spaces such as railway carriages, buses and lifts, all of which are, in essence, metal boxes. His model predicted that a large number of passengers crowded together, all blathering, sending text messages, or browsing the web on their phones, could produce levels of electromagnetic radiation that exceed international safety standards. That is because the radio waves produced by each phone are reflected off the metal walls of the carriage, bus or lift. Enough radiation escapes to allow the phone to communicate with the network, but the rest bathes the inside of the carriage with bouncing microwaves.

This sounds worrying. But maybe it isn't after all. In a paper published recently in *Applied Physics Letters*, Jaime Ferrer from the University of Oviedo in Spain — along with colleagues from the Polytechnic University of Madrid and Telefónica Móviles, a Spanish mobile operator — dispute Dr Hondou's findings. He concludes that the level of radiation is safe after all.

The key addition to the new research is the effect of the passengers themselves. While each phone produces radiation that bounces around the car, the passengers absorb some of it, which has the effect of reducing the overall intensity, just as the presence of an audience changes the acoustics of a concert hall, making it less reverberant. Dr Hondou's model, in short, was valid only in the case of a single passenger sitting in an empty carriage with an active mobile phone on every seat.

Dr Hondou did not calculate the effect that leaving out the other passengers would have on the radiation level. As a result, says the author of the new paper, he significantly overestimated the level of electromagnetic radiation. When one is sitting on a train, Dr Ferrer and his colleagues found, the most important sources of radiation are one's own phone, and those of one's immediate neighbours. The radiation from these sources far exceeds that from other phones or from waves bouncing around the carriage. And all these sources together produce a level of radiation within the bounds defined by the ICNIRP, the international body that regulates such matters.

People concerned about the effects of mobile-phone radiation are unlikely to take much comfort from Dr Ferrer's results. They worry that even small amounts of microwave radiation — within the ICNIRP's limits — may have adverse health effects. The evidence so far is ambiguous, inconsistent and sparse. Indeed, Dr Ferrer says he was surprised at how little research has been done in this area.

Yet both Dr Hondou's results and Dr Ferrer's are based on mathematical models, not physical measurements. Their models make assumptions about the physical properties of train carriages and their passengers, and both assume that the radiation is uniformly

distributed rather than clumped into "hot spots". But if the debate about the safety of mobile phones is to be resolved, there must be less reliance on models and anecdotes, and more emphasis on hard experimental data.

*<http://www.economist.com>*

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Hieronder staan zes uitspraken. Drie ervan geven elk de opvatting weer van één van de volgende personen: Dr Hondou, Dr Ferrer, en de schrijver van het artikel. (De andere drie uitspraken kunnen dus aan geen van deze drie personen worden toegeschreven.)

- 1 All data on radiation caused by mobile phones so far have been based on theoretical presuppositions only.
- 2 All theoretical models have shown that the radiation levels of mobile phones on trains are below internationally defined safety levels.
- 3 Electromagnetic energy does not increase by reflection off metal surfaces.
- 4 Electromagnetic radiation in enclosed spaces could well be a health hazard.
- 5 International safety standards ensure adequate protection from overexposure to radiowaves from mobile phones.
- 6 The number of passengers in a train compartment affects the level of radiation each person is exposed to.

- 3p **5** Noteer het nummer van elke uitspraak, gevolgd door de naam of aanduiding van de persoon aan wie de betreffende uitspraak moet worden toegeschreven. Schrijf "niemand" op, wanneer de uitspraak aan geen van de drie bovengenoemde personen kan worden toegeschreven.