

# **THE EMOTIONAL CAR**

**EXMOVERE LLC.**

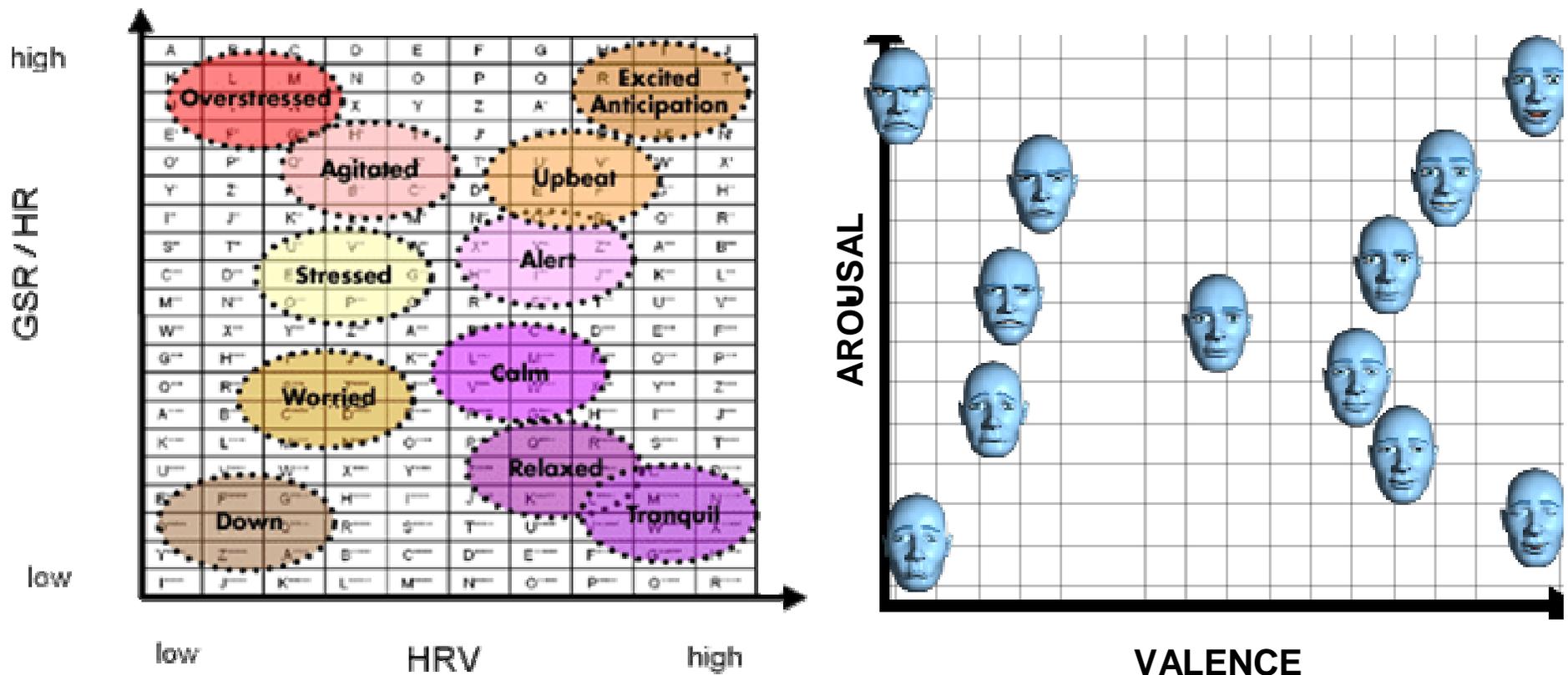
**[exmovere.com](http://exmovere.com)**



## The Concept

Exmovere LLC. is the world's only company to produce and market biosensor products that can collect reliable psychophysiological and vehicle data for driver emotion detection.

Exmovere is also the only company working on artificial emotion: vehicle biofeedback that can keep drivers focused and even-tempered on the road, kids entertained and seniors safe and healthy.



## Detecting Emotion

Emotion can be detected by comparing two types of autonomic nervous function data: **arousal** (stress) and **valence** (mood).

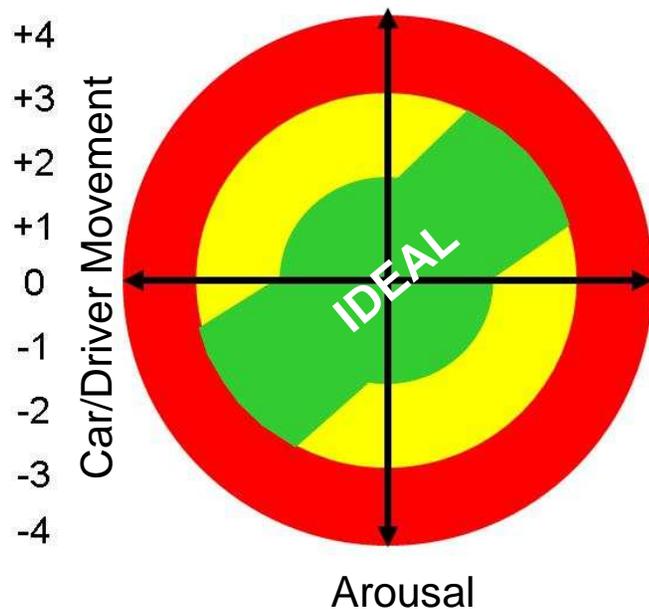
Arousal relates to heart rate, respiration and galvanic skin response, whereas Valence refers to longer-term changes such as heart rate variability and skin temperature.



## Steering Wheel Prototype

We removed a complete steering column from a Lexus ES300 and mounted it to a base-plate and enclosure. Our steering wheel was then retrofitted with peripheral galvanic skin response electrodes and coupled to a dynamometer which were then interfaced via data acquisition card and biasing network to a PC.

We wrote software continuously display signals while interpreting emotional state, and providing audio/visual cues and biofeedback to help the driver reach his/her **ideal state**. The software's bar graphs and a color coded visual of the steering wheel itself showed the driver percentual changes in dynamometer and GSR, limited at 100%.



## The Ideal Driver State

In the case of our steering wheel prototype, the ideal driver would have arousal levels proportional to the activity of the vehicle, as gauged by the dynamometer. The goal of the prototype is to demonstrate how audio and visual cues can help maintain this proportionality. In an actual vehicle, driver activity would be defined more specifically in terms of the stability control system of the car.

The steering wheel by itself is sufficient for monitoring driver vigilance and alertness. Because it does not measure heart rate variability, we cannot gauge valence and therefore higher order emotions from it.



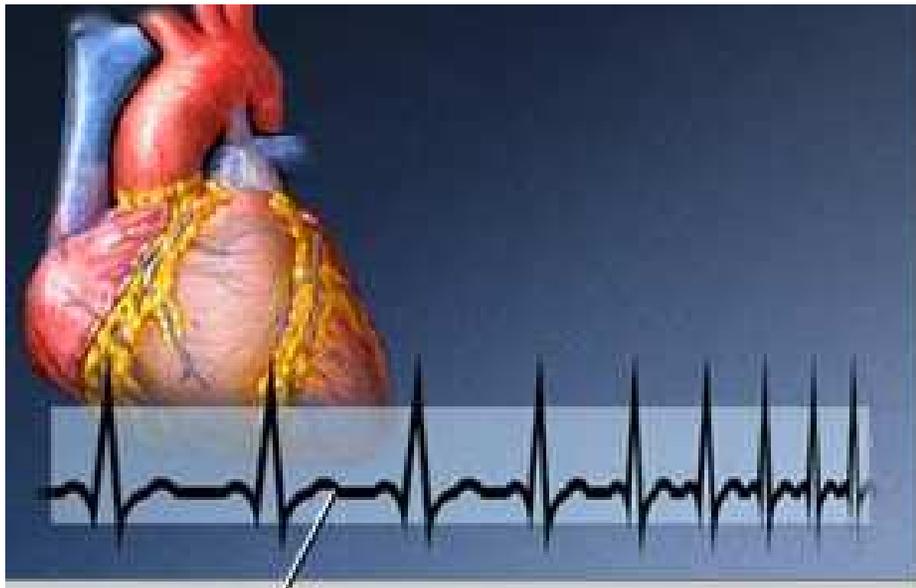
## Watching the Wrist

Exmovere's Exmocare Bluetooth Biosensor wristwatch is the first ever wearable device that simultaneously measures heart rate, heart rate variability, galvanic skin response, skin temperature and relative movement.

Thanks to Bluetooth, we sell it bundled with a GPS PDA-phone that enables elderly care givers and fleet managers to monitor driver emotional states and vehicle speed.

In the future, the Exmocare Carkit will be compatible with OEM telematics systems, such as OnStar.

## **Part 2: Future Sensors**



Heart rate



## Driver Blood

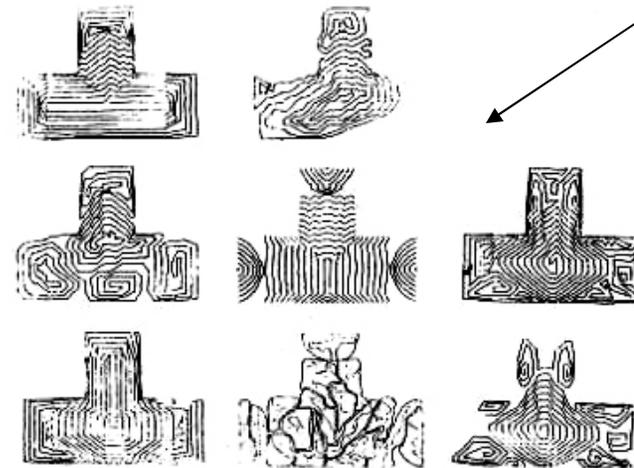
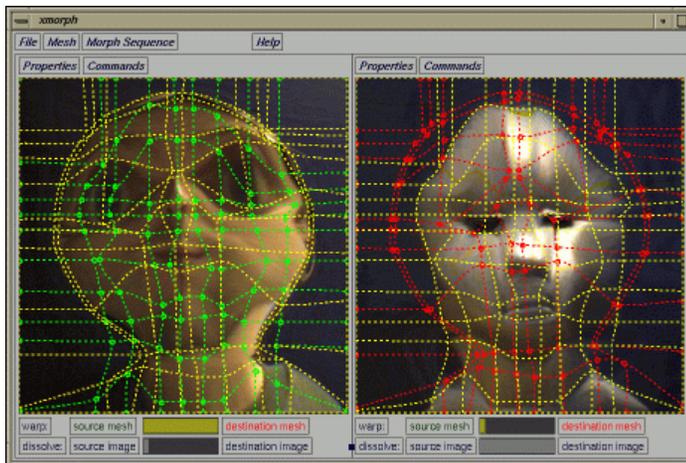
Exmovere can use infrared cameras to monitor core body temperature, blood flow, heart rate and heart rate variability. Infrared cameras can be installed in dummy vents on the dash board, or behind flip-down DVD players in the backseat for ideal positioning.

Exmovere's idea is also to install infrared sensors directly into the steering wheel to non-invasively monitor blood sugar levels for diabetic drivers.

# Driver Voices

Voice recognition will also help make our cars more secure. It will also make it possible for our cars to figure out when we're joking, when we're arguing and when we want silence. Exmovere's idea is to embed microphones and software that enable the vehicle to better identify the driver and passengers, and even analyze vocal chord and facial muscles.

8 different voices say "YOU"



stress



anxiety

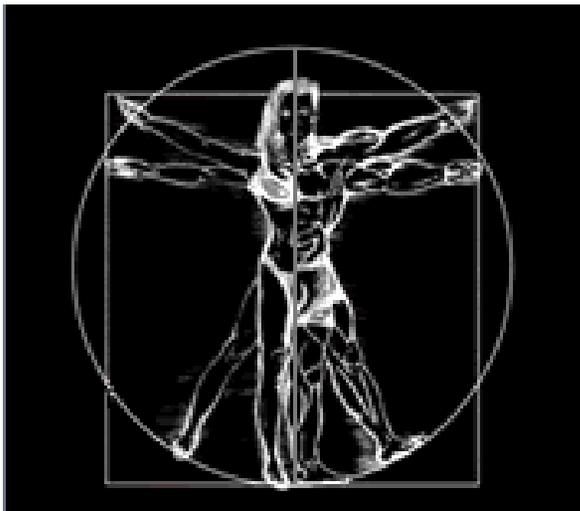


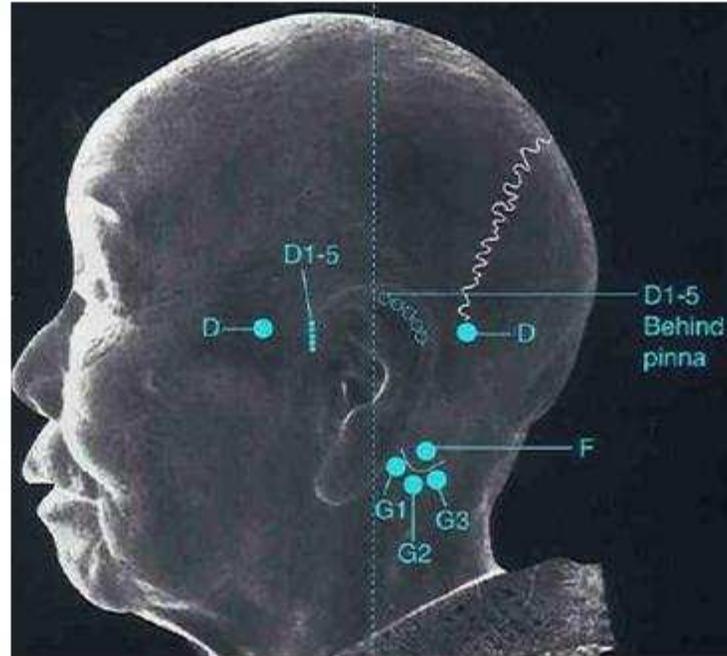
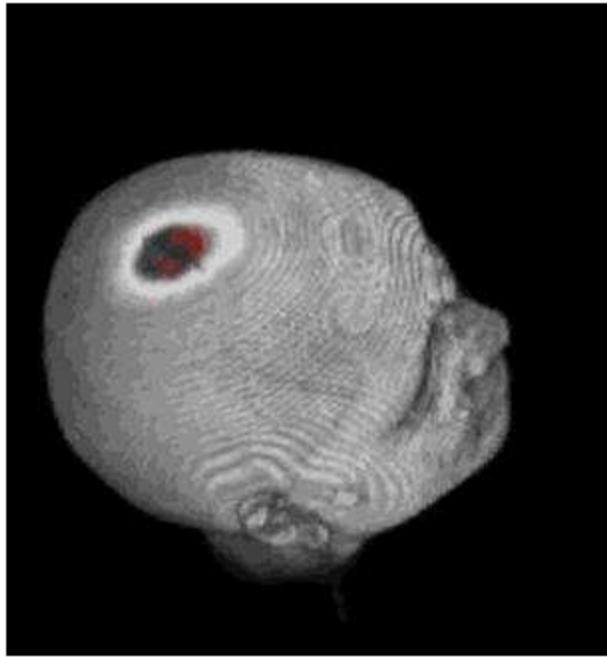
fun



## Hand Muscles

With Exmove embedded EMG steering wheel sensors, cars will be able to predict our performance levels by monitoring the muscle tension in our hands. They'll also be able to use this data to predict driver fatigue and road rage. This also means that car seating surfaces will be able to offer targeted massage and the steering wheel may need to be built with squeezable anti-stress foam.

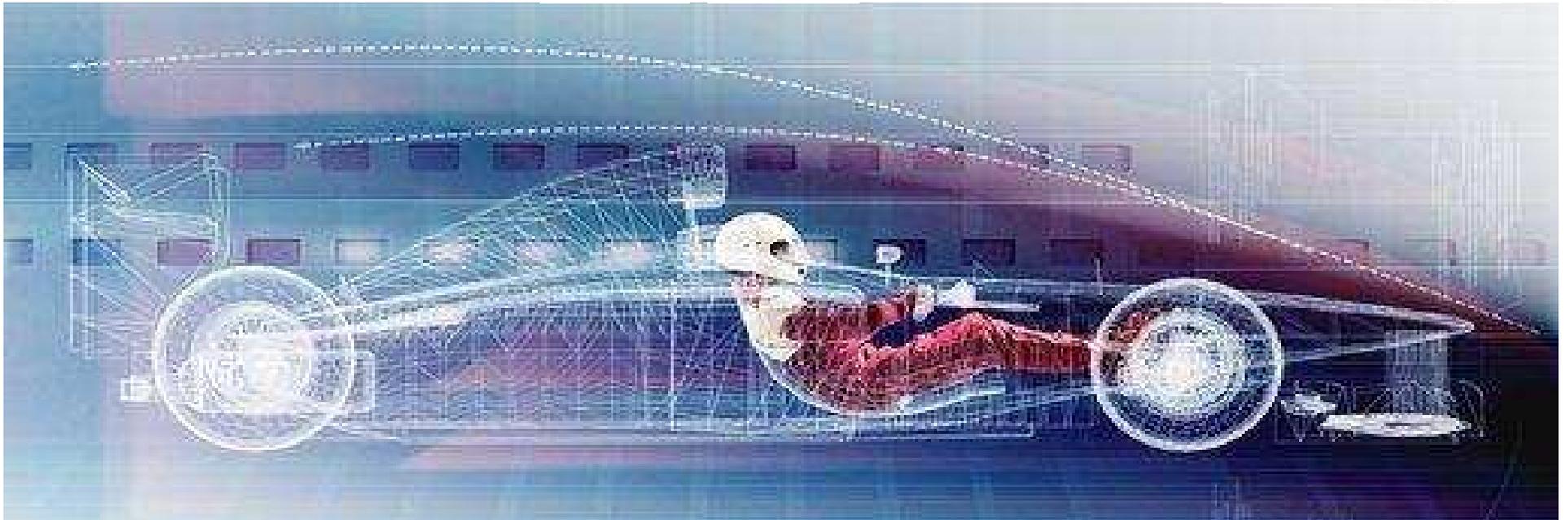




## Driver Brain Waves

Exmovere LLC.'s patent-pending design for earbud sensors is based on the popular wrap-around headset style for easy access to brain waves and blood vessels near the skin surface. The Exmovere earbud monitors: blood pulse, blood flow and EEG. The earbud also can be programmed to accept additional input based on ambient sound, voice stress, body movement sensors and other environmental factors. It converts this data into information processed by the cell phone's software (Symbian, Palm OS, Pocket PC, etc). A signal may then be sent back to the user to warn of danger. No other company offers so many sensor features in such an unobtrusive package.

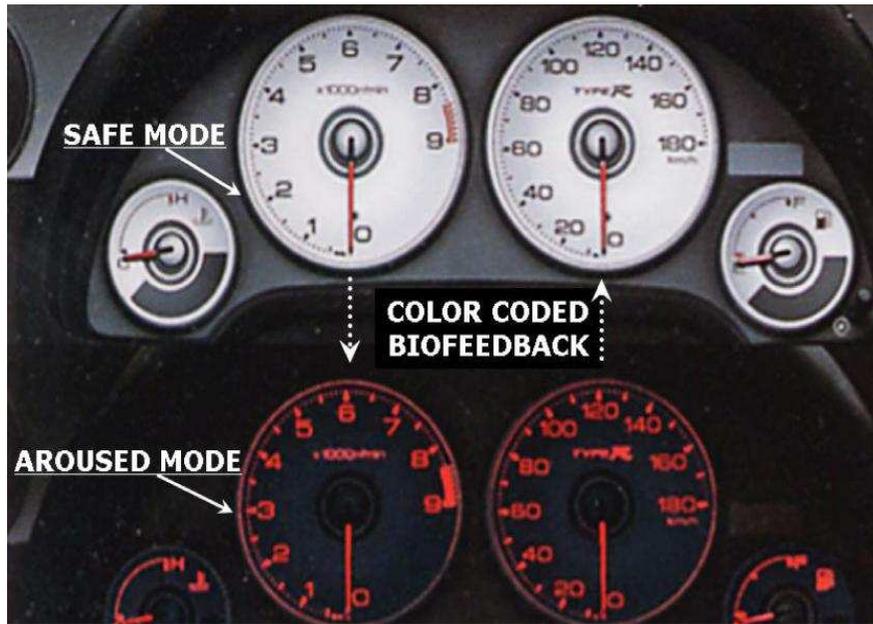
Bluetooth transmission design is optional.



## Driver Feet

With Exmovere sensors, driving shoes will be able to detect and prevent slippage, monitor muscle fatigue and nervous sweat, signal danger, change temperature and inflate in case of emergency. Sensitive Feet can also be paired by Bluetooth to a sensorized helmet and sensorized gloves.

## **Part 3: Scenes of the Emotional Car**



## Virtual Persona

The immediate benefit to car makers of using emotion algorithms and biosensors is the creation of an artificially intelligent and sensitive vehicle interface or "persona."

The voice of the system may be selectable and/or randomly alternating between half a dozen characters, accents, male/female, etc. The voice announcements may be made with simulated emotional and idiosyncratic behavior, selected by the computer based on the actual reading of - and in reaction to - the psychological makeup of the driver and occupants at any given time.

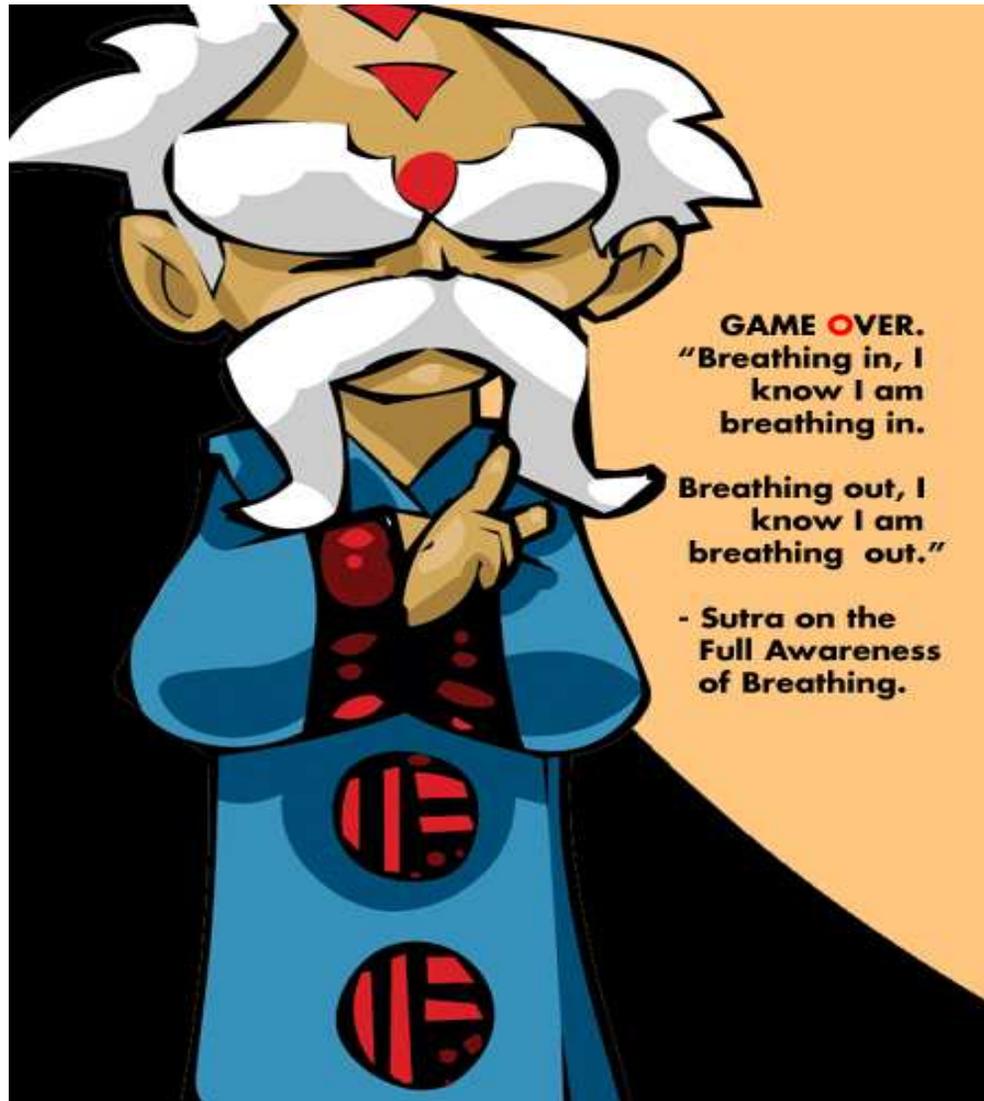
This very element makes the driver pay more attention to the announcements, which are more entertaining to them, since they are in direct response to their own state of mind at the time (wondering why the car spoke to you that way, and what that means in terms of how you feel at that moment, etc.)



## The Backseat Spa

Thanks to Exmovere sensors, cars will be able to ensure backseat passengers greater comfort through targeted seat massage, light, music and video displays, fragrances and aromas and even relaxation exercises.

When passengers try to sleep, the vehicle's Exmovere sensors will help maintain their ideal air circulation, humidity, temperature, sound and light levels to ensure comfortable rest.



**GAME OVER.**  
"Breathing in, I  
know I am  
breathing in.

Breathing out, I  
know I am  
breathing out."

- Sutra on the  
Full Awareness  
of Breathing.

## The Babysitting Car

Today's kids demand entertainment in any and every environment they encounter. Exmovere's backseat biofeedback-oriented video games will reward them for staying quiet and calm with cool graphics and action sequences.

**For More: Visit [www.exmovere.com](http://www.exmovere.com)**