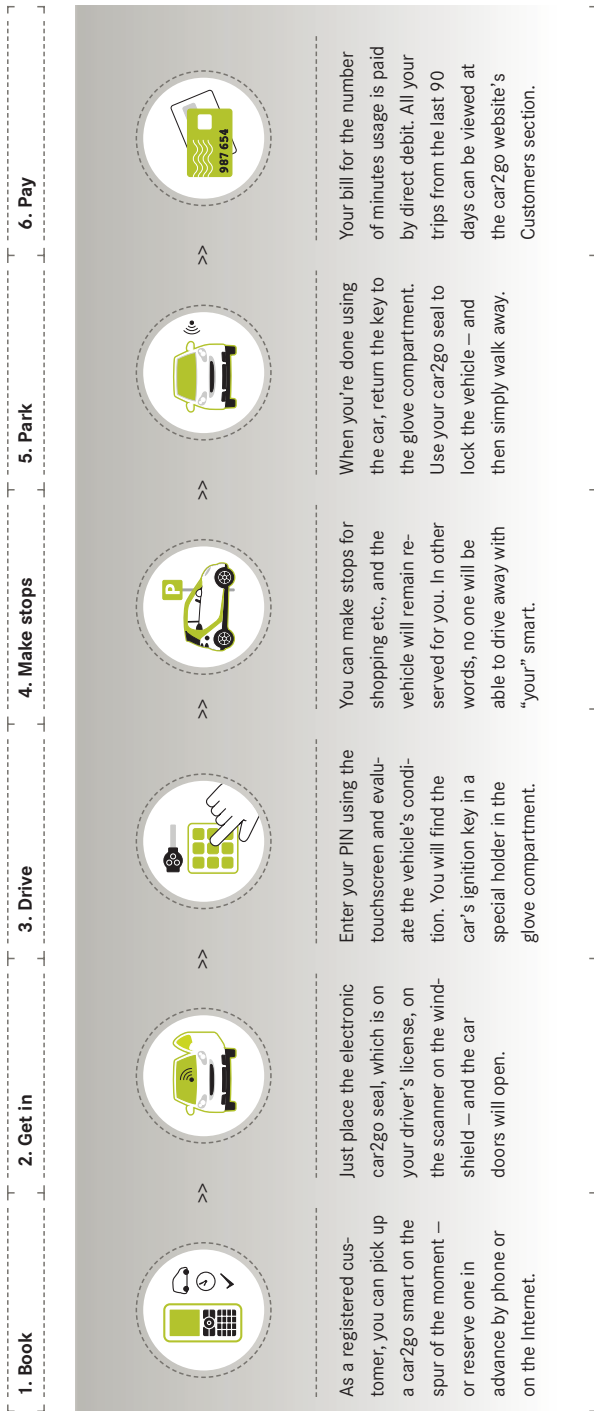


MOBILITY CONCEPTS



Daimler is presenting a new mobility concept. Here's how it works:



Text Roland Bischoff Illustrations Gernot Walter



uruma Banare," says Thomas Weber, the Daimler Board of Management member responsible for Research and Development, "is the Japanese term for a trend in major Japanese cities, which can more or less be translated as 'de-motorization.' Many people in such areas are opting not to buy their own vehicle and turning to car-sharing solutions." And Japan isn't the only place where more and more people are driving; the trend is evident in all the world's large metropolitan areas, whose populations continue to grow. There are 450 cities in the world today with populations of more than one million.

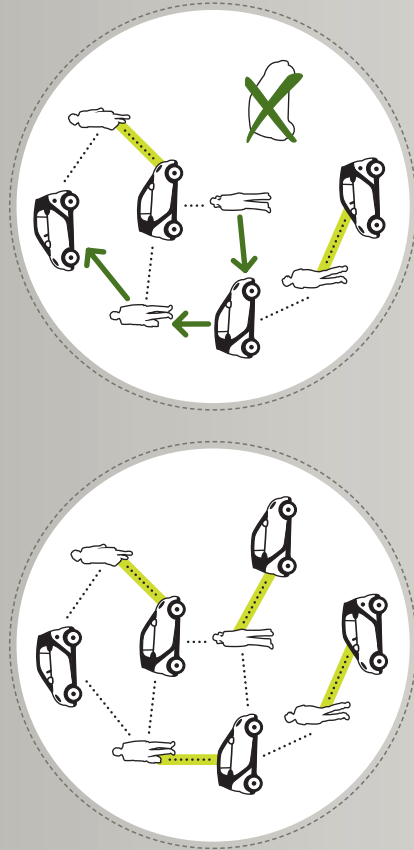
completely new solution in this field: the "car2go" program. Unlike conventional rental or sharing concepts, car2go vehicles are available to customers anywhere and at any time. Cars can even be picked up and driven off on the spur of the moment.

The system works well: Since March of this year, 200 smart fortwo cdi vehicles have been available in the city of Ulm, Germany, for use as special rental cars. The program launch in Ulm was preceded by a six-month pilot phase. In the fall of 2009, another 200 smarts will be made available as car2go vehicles that can be picked up and driven in Austin, Texas, making it possible to test new forms of urban mobility in the U.S. as well.

Intelligent mobility concepts will soon be required if we intend to cope responsibly with the growing volume of traffic. Daimler has presented a "Our mobility concept allows individuals to drive an environmentally sound vehicle at a reasonable price, around the clock," says car2go Proj-

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- Possible assignment
- Preliminary assignment with algorithm
- ✗ Canceled assignment
- ➔ Expansion path generates new assignments



Smart Dispatching

Simply grab a car2go. Drive around for a while in and/or around Ulm. Then park the car in the city – and there’s nothing left for you to do. This simple process for customers actually posed a great challenge for the engineers at Daimler Research who developed the algorithms for managing the car2go system.

“On the one hand, we had to ensure that the smarts could be parked almost anywhere in the city after use, while on the other, we had to take into account the fact that the number of available vehicles would repeatedly fluctuate because customers would be picking up vehicles on the spur of the moment,” explains Johann-Friedrich Luy from the Quality Analysis unit at Group Research. “We also needed to guarantee that confirmed vehicle reservations would always be honored. Finally, the service had to be organized in a way that would ensure the cars are always clean and sufficiently fueled.”

To meet the demands related to automated allocation of the car2go fleet, Luy and his team made use of graph theory, a branch of mathematics that is used, among other things, to optimize routes taken by traveling sales representatives. A graph consists of a collection of vertices (nodes) linked together by lines (edges). The nodes in the graphs

developed by the Ulm researchers represent the vehicles and customers, while the edges are the reservations and spur-of-the-moment bookings, whereby these can also be depicted as lists. “Mathematically speaking, we use the graphs to search for the maximum bipartite matching of vehicles and bookings,” says Luy’s colleague Axel Blumenstock. “We also determine the minimum number of ‘critical’ vehicles – the only ones that may not be used on the spur of the moment, to make sure we can meet our reservation obligations. There’s also a routing server, of course. Much like a navigation system, it ensures that customers are issued the closest available smart.”

Until now the researchers have been focusing on development and optimization of the booking engine in order to achieve vehicle distribution in line with actual demand. Another key issue involves the fully automated dispatching of the service teams. The researchers are already working on forecasting technology that will allow the greatest possible amount of spur-of-the-moment use of already reserved vehicles. “The next step,” says Luy, “will be to transfer the knowledge and experience gained in Ulm and Austin to big cities with several million inhabitants, where thousands of car2go vehicles will then be put into operation.”



Baden-Württemberg, Germany

“Using car2go is as easy as making calls with your cell phone”

Robert Henrich, Project Manager

Project Manager Robert Henrich. “Using car2go is as easy as making calls with your cell phone.” The principle is in fact extremely simple: Daimler is providing 200 smarts in Ulm and 200 in Austin. Registered customers can use the speedy little cars as they wish, and then simply park them anywhere within the city limits when they’re done. Billing is based on total time of use, whereby the 19 euro cents charged per minute in Ulm include tax, insurance, unlimited kilometers, and even fuel. There are also flat rates of €9.90 and £49 for hourly or daily use, respectively.

Fully booked during peak hours The pilot phase for the Ulm program was launched in October 2008, when 50 vehicles were made available to 500 employees at Daimler’s Ulm Research Center and 200 of their family members. The goal here was to test the concept’s hardware and software. In addition, the project team wanted to see how customers would use car2go, and determine how much it would cost to provide the service. “The success of the pilot phase was surprising even to us, and it showed just how important forward-looking mobility concepts already are,” says Henrich, whose team is part of the Business Innovation de-

partment. “The vehicle fleet was fully booked during peak times, and we could easily have significantly expanded it in view of the great demand. During the six-month pilot phase, we recorded more than 8,000 rental transactions, and every day as many as eight people used the same car.”

Customer feedback was uniformly positive, and many were surprised by how smoothly car2go functioned in practice. In addition, users found the minute-based billing system to be very customer-friendly. The project also attracted a great deal of national and international interest from the beginning. “We’ve received numerous queries from cities around the world that would also like to offer a car2go system,” says Henrich. That’s not surprising, given that a survey conducted before the project was even launched showed that such a mobility concept would be received positively by a broad segment of the population.

The car2go team made service a top priority right from the beginning, whereby the associated concept relied heavily on the cooperation of customers, who need to not only enter a PIN on a touchscreen before they can drive off, but also complete a checklist on the condition of the smart vehicle they are about to rent. If, for example, customers report finding dirt inside or outside, the vehicle will be blocked for subsequent use until a service team can clean it. Such unscheduled cleanings haven’t been an issue to date: “There’s been very little dirt or damage — our experience here has been extremely positive,” Henrich reports.

Easy to find in the vicinity Service personnel also go into action when a vehicle is about to run out of fuel. To ensure that this rarely happens, a prepaid fuel card is kept in the glove compartment, enabling customers to

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Ulm, Baden-Württemberg, Germany



120,000 people live in Ulm. The city's trademark is the Ulm Cathedral, which boasts the world's highest steeple. Two autobahns, five national highways, and seven rail lines make Ulm a major German transport hub.

119 square kilometers is the total area of Albert Einstein's home town. The surrounding countryside on both sides of the Danube is very geographically segmented and lies between 459 and 646 meters above sea level.

1,023 people occupy one square kilometer in Ulm on average. Research is a key industry in the city. The Eselsberg science hub in Ulm is home to several public colleges and many research institutes operated by companies from the automotive and IT sectors. Among the more well-known institutions are Ulm University Hospital and the German Armed Forces Hospital.

Austin, Texas, USA



750,000 people live in the Texas capital, whose trademark is the State Capitol building. The major transport arteries are Interstate 35, seven highways, and the Chicago-San Antonio rail line. Austin is also served by an international airport.

767 square kilometers is the total area of the city on the Colorado River, whose surrounding pleasant hillsides lie between 150 and 238 meters above sea level. Austin is also surrounded by several lakes that are used for swimming and water sports.

1,152 people occupy one square kilometer on average in Austin, thus making this city densely populated as well. With 50,000 students, the University of Texas, which is located in Austin, is one of the largest universities in the U.S. The capital's many well-known computer and electronics companies have led to it being called "Silicon Hills."

AUSTIN



Texas, USA

to fill up themselves. Those who carry out this minor task are rewarded with a discount on the rental fee, provided the tank was less than 25 percent full when they did so. Moving the blue and white smarts around town hasn't been as big an issue as was originally expected, since the high demand for the 200 smarts in Ulm means the cars are used often, and thus continually "redistributed" around the city. As a result, customers can generally find a car2go within a radius of a few hundred meters.

A growing number of users Following the program's successful start, the car2go team picked up speed in February 2009 by expanding access to the service to staff from the Ulm/Neu-Ulm Mercedes-Benz dealership and Daimler's EvoBus subsidiary. "That's why we also upped the number of car2go vehicles to 100," says Henrich's colleague Andreas Leo. "After that, the number of users rose to more than 1,000." With the launch of the public test phase at the end of March, 200 car2go vehicles are now available to all 120,000 Ulm residents, and to visitors to the city. The number of registered users has also been growing steadily since then, with more than 7,000 people registering in a period of less than two months. On some days 200 new customer registrations were received.

The car2go program in Austin will follow along the lines of the one in Ulm – in other words, the vehicles will initially be available only to a limited group of users, such as city employees. Then, in the fall, a fleet that will likely consist of 200 smart fortwos will go into operation. In a second stage, car2go will be made available to the general public in Austin. With a population of around 750,000, the capital of Texas is much larger than Ulm, and its residents have a reputation for being very environmentally conscious. Austin's advanced economy also made the city the clear

choice for the first car2go project outside Germany. In addition, Austin is home to the fourth-largest university in the United States. Finally, the car-sharing market in the U.S. is growing faster than any other car-sharing market in the world.

While the main objectives in Ulm are to assess the general level of acceptance for the concept and put the technology on a solid footing, the project in Austin is intended to generate greater expertise for international applications. "The requirements here," says Jérôme Guillen, director of the Business Innovation department, "include concept transferability to other cities, language needs, and mobility trends, as well as the adaptability of business processes to legal requirements at locations around the world."

WEB TIP



HTR online currently features a videocast about the new, forward-looking mobility concept. Reports from car2go customers can be found at the car2go blog at:

<http://blog.car2go.com>

Complete information is online at www.car2go.com, which also shows the locations of currently available vehicles.

www.daimler.com/innovation