



Lufthansa: A model airline

Europe's largest airline uses statistical modeling in JMP® to match services with passenger preferences

Deutsche Lufthansa AG is one of the world's leading civil aerospace groups. It is Europe's biggest airline, in terms of both passenger numbers and turnover. In 2012 a total of 103 million people flew with Lufthansa or one of its subsidiaries. The airline is currently offering passengers flights to 250 destinations in more than 100 countries.

In recent years the air travel market has changed considerably. For instance, established airlines have to increasingly compete against Persian Gulf state airlines, which benefit from lower operating costs. In addition, the low-cost airlines have triggered a significant shift in prices, which is reducing the margins of all companies.

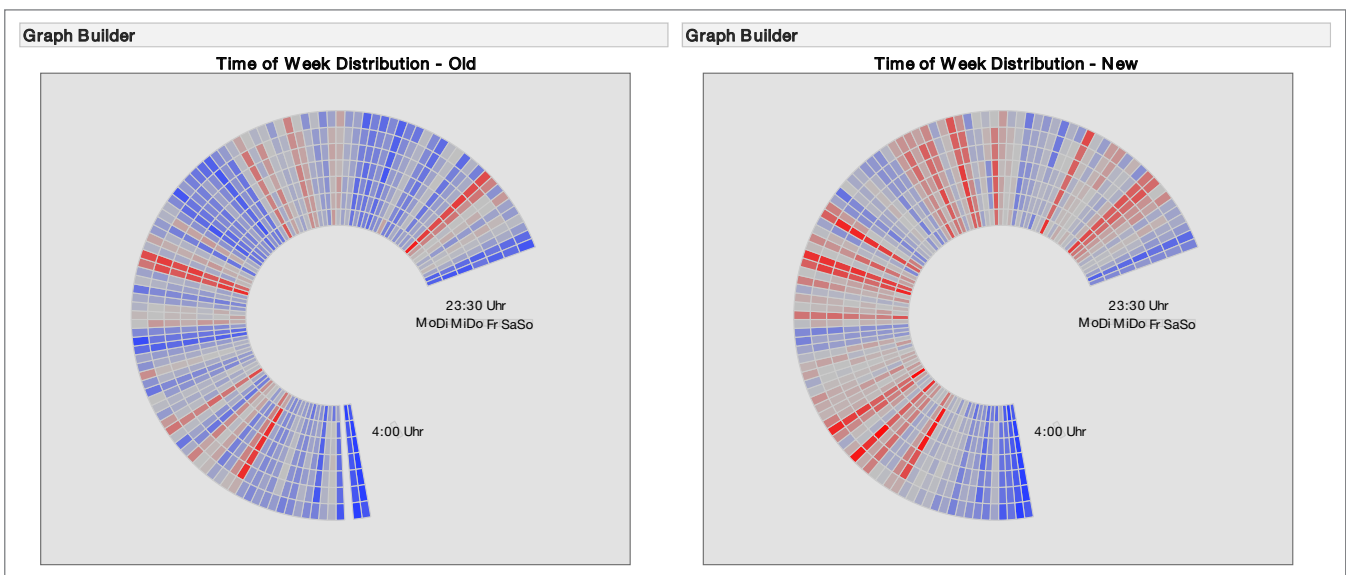
Nonstop dedication to customer satisfaction

Lufthansa, known as a network carrier, offers its customers a dense, global network of direct connections and transfers, precisely tailored to passengers' travel requirements. For many years the group has relied on SAS® data management and analysis solutions to help the group structure flight schedules so that passengers reach their destinations as quickly and comfortably as possible. Lufthansa also uses SAS as part of its Miles & More frequent flier program, for targeted approaches to customer groups.

As part of their work, Lufthansa network schedulers rely on data provided by

their colleagues in the Information Management Department for flight network scheduling systems. Anja Simon, PhD, a project manager in the department, explains, "We model which flight connections passengers prefer in order to get from one part of the world to another." This is no simple task, as customer preferences depend on countless factors.

Departure and arrival times are just two of many parameters. There is also a considerable difference between the travel habits of business fliers and tourists. "The fastest connection is not always the best if transfers are involved," says Simon. "Short stopovers cause some passengers stress, so this plays a role too."



Rapid pattern identification opens up completely new quality assurance opportunities.

“Sall almost effortlessly showed a solution to the problem that had driven us crazy for months.”

Anja Simon
Deutsche Lufthansa AG

Simon and her colleagues use booking details from reservation systems such as Amadeus to generate the models. The booking details also contain the travel information of passengers using competitive airlines – anonymously, of course. The problem is that the data doesn't depict the whole market, as more and more people purchase their flights directly from the airlines. In the case of connections between Germany and Spain, for example, the data only covers one-sixth of all bookings.

The database is not only shrinking, but also becoming less representative. This makes it difficult to find models that are actually meaningful. “If I calculate models based on this data, I can only trust them to a certain extent because

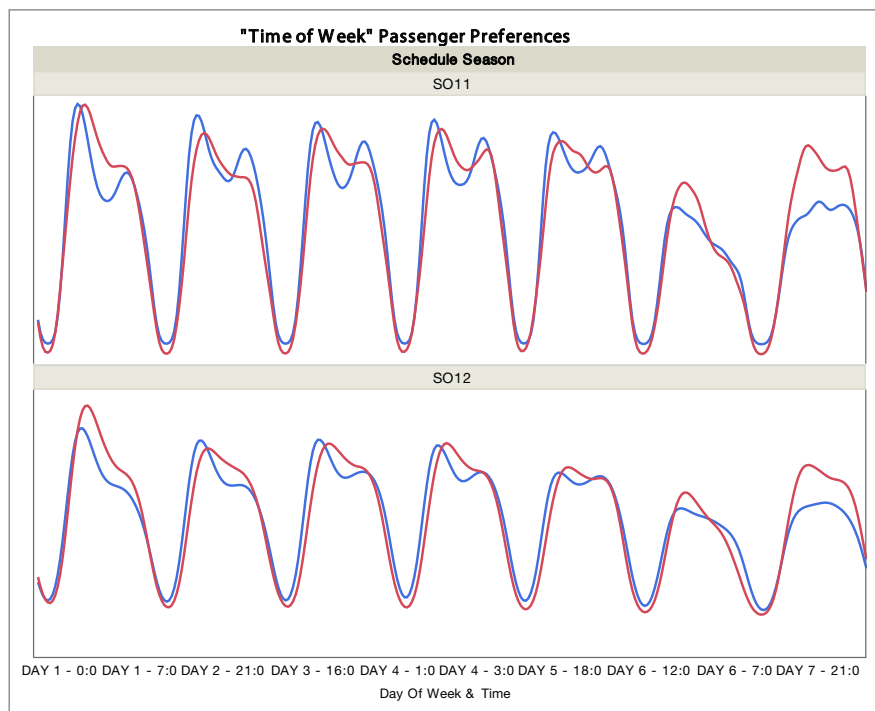
there are such big gaps in the database,” says Simon. “On the other hand I have to live with the data I have.”

Highest expectations for model quality

How is it possible to tell whether a model actually depicts reality or is unusable because of a poor database? This is a very important question for Lufthansa. “We always place great importance on the quality of connection, because we want to offer our passengers a superb service that meets their requirements, every time,” says Simon. Defective models can lead to flight schedules that don't meet customers' requirements. This is especially important since part of schedule optimization is automated. “Our

expectations of model quality are extremely high,” she explains.

Knowing it was time to update established processes and tools, Simon and her colleagues invested a lot of time in finding a solution that helps them to select the right model. The breakthrough came during a visit to a SAS R&D users conference (KSFE) in 2012, where they attended the opening keynote speech by John Sall, Co-Founder and Executive Vice President of SAS, and the inventor of JMP® software. “Sall almost effortlessly showed a solution to the problem that had driven us crazy for months,” Simon recalls. After the conference Simon's team immediately downloaded the free 30-day test version of JMP.



Preferred departure times – the image facilitates an immediate comparison of model and experiential values.

CHALLENGE

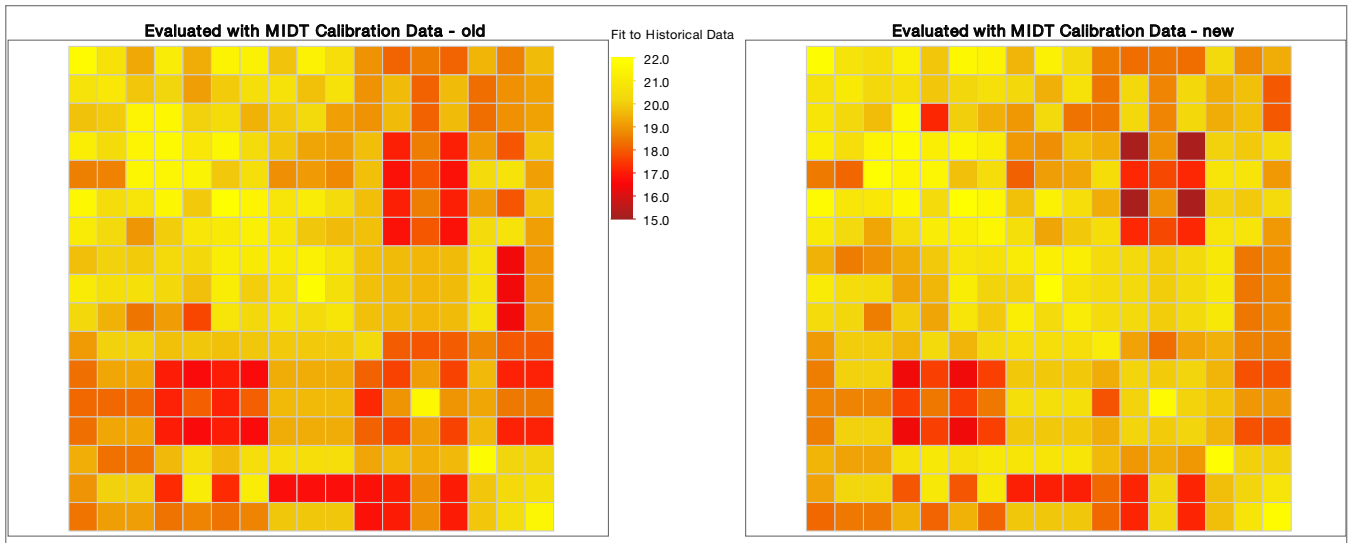
Lufthansa's incomplete database meant that mathematical models yielded scheduling suggestions that were unrealistic.

SOLUTION

Complex data cluster visualization for statistical model evaluation with JMP.

RESULTS

Lufthansa improved the quality of its flight scheduling, and now has the ability to arrange for precise connections for all customer groups.



Graph Builder immediately highlights outliers.

In December 2012 Lufthansa decided to purchase JMP licenses. Simon calls the introduction of the software a “milestone,” explaining that her team is “benefiting tremendously from the data visualization which JMP provides. We can now represent complex data clusters as colored maps, for example. We simply place various maps next to each other in order to interpret distinctions and outliers. This way we are immediately in a position to identify whether a mathematically correct model is actually plausible.”

The solution simultaneously helps to calibrate the models. Using JMP, Simon and her colleagues can see at a glance what happens if individual parameters such as departure or arrival times change. “No one can work out such effects in their head; it’s much too complicated,” says Simon. “The nonlinear function evaluation platform makes it possible to define arbitrary parameterized formulas; we are now able to develop a specific model and analyze it using JMP.”

Bernd Heinen, a JMP Systems Engineer with SAS who helped implement the solution, adds, “Because it’s possible to set optimization specifications for the individual parameters in JMP, the same

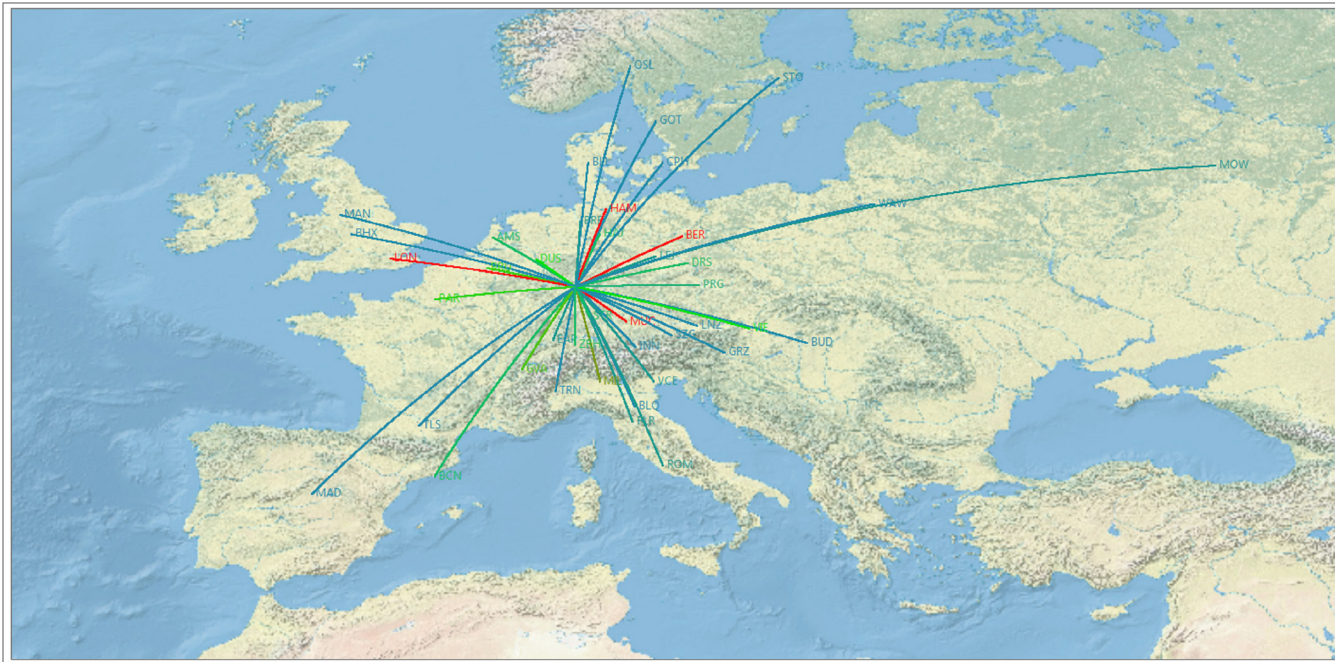
model can even be adapted to different situations.”

Success = valid figures + (intuition + experience)

Visualization of the data allows Simon and her team to combine mathematics with their own intuition and experience when making decisions. “With JMP we are moving away from the blind trust in numbers. There are always situations where model generation results in mathematically perfect but unrealistic solutions. The visualization means that we can now identify these immediately,” says Simon. For many tasks it’s advisable to use one’s common sense, instead of solely relying on figures. “Visualizations are a very valuable instrument for making the right decisions,” explains Simon. During the calibration of the model, JMP and SAS make an “ideal tandem.” The prototype created with JMP now runs smoothly as a production model in the new process on SAS.

Thirteen of the airline’s experts now use JMP. The solution has been very well-received by users from the outset, as the documentation is clear and easy to use. Simon says, “The solution is intuitive to use, and if something does require clarification, then the online help

Defective models can lead to flight schedules that don’t meet customers’ requirements.



Rapid capture of passenger changes thanks to the geographic visualization options.

and blogs on the JMP website are very useful.”

Simon and her colleagues have played a large part in ensuring so many Lufthansa customers are able to enjoy precise connections today. It’s hardly surprising that she is enthusiastic about the visualization solution. “With JMP software’s help we can now develop models that approach optimal quality, which is simply great!”



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SAS Institute Inc. World Headquarters

+1 919 677 8000

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