

# Working and Walking with Joachim Kunert

R. A. Bailey

University of St Andrews



QMUL (emerita)



18th Workshop on Quality Improvement Methods,  
Dortmund, 17 July 2021

## Initial meeting

I was invited to organize the *Design and Analysis of Experiments* session of the 1984 *European Meeting of Statisticians*, held in September at Universität Marburg. I invited two speakers (in addition to me):

Joachim Kunert      Universität Trier

André Kobilinsky    Institut National de la Recherche Agronomique,  
Paris

## Initial meeting

I was invited to organize the *Design and Analysis of Experiments* session of the 1984 *European Meeting of Statisticians*, held in September at Universität Marburg. I invited two speakers (in addition to me):

Joachim Kunert      Universität Trier

André Kobilinsky    Institut National de la Recherche Agronomique,  
Paris

I had had no previous contact with either of them, but I had read their work.

## Initial meeting

I was invited to organize the *Design and Analysis of Experiments* session of the 1984 *European Meeting of Statisticians*, held in September at Universität Marburg. I invited two speakers (in addition to me):

Joachim Kunert      Universität Trier

André Kobilinsky    Institut National de la Recherche Agronomique,  
Paris

I had had no previous contact with either of them, but I had read their work. They both accepted, and we met in person at the conference.

## Initial meeting

I was invited to organize the *Design and Analysis of Experiments* session of the 1984 *European Meeting of Statisticians*, held in September at Universität Marburg. I invited two speakers (in addition to me):

Joachim Kunert      Universität Trier

André Kobilinsky    Institut National de la Recherche Agronomique,  
Paris

I had had no previous contact with either of them, but I had read their work. They both accepted, and we met in person at the conference. This resulted in me having long-standing collaborations with both of them.

## Initial meeting

I was invited to organize the *Design and Analysis of Experiments* session of the 1984 *European Meeting of Statisticians*, held in September at Universität Marburg. I invited two speakers (in addition to me):

Joachim Kunert      Universität Trier

André Kobilinsky    Institut National de la Recherche Agronomique,  
Paris

I had had no previous contact with either of them, but I had read their work. They both accepted, and we met in person at the conference. This resulted in me having long-standing collaborations with both of them.

In 1997 I organized a similar session, on *Planning Experiments*, with these speakers and one more, at the meeting in Rostock on *Mathematical Statistics and its Applications to the Biosciences* run by the Bernoulli Society and the Institute of Mathematical Statistics.

## Gerechte designs: I

The solution to a sudoku puzzle is a  $9 \times 9$  Latin square with the extra property that it is a  $3 \times 3$  array of subsquares, each of which contains each symbol exactly once.

## Gerechte designs: I

The solution to a sudoku puzzle is a  $9 \times 9$  Latin square with the extra property that it is a  $3 \times 3$  array of subsquares, each of which contains each symbol exactly once. When these became popular, JK noticed that, in a 1956 paper, W. U. Behrens had introduced *gerechte* designs. Such a design is a Latin square of order  $n$  with the extra property that it is divided into  $n$  compact areas of size  $n$ , each of which contains each symbol exactly once. If  $n$  is not a square then the small areas cannot be squares.

A	B	C	D	E
D	E	A	B	C
B	C	D	E	A
E	A	B	C	D
C	D	E	A	B



## Gerechte designs: I

The solution to a sudoku puzzle is a  $9 \times 9$  Latin square with the extra property that it is a  $3 \times 3$  array of subsquares, each of which contains each symbol exactly once. When these became popular, JK noticed that, in a 1956 paper, W. U. Behrens had introduced *gerechte* designs. Such a design is a Latin square of order  $n$  with the extra property that it is divided into  $n$  compact areas of size  $n$ , each of which contains each symbol exactly once. If  $n$  is not a square then the small areas cannot be squares.

A	B	C	D	E
D	E	A	B	C
B	C	D	E	A
E	A	B	C	D
C	D	E	A	B

JK, RAB and Richard Martin discussed this, and noticed that the proper statistical analysis of an experiment conducted using such a design is more complicated than Behrens had realised.

## Gerechte designs: II

The three of us worked together, and wrote a paper explaining this. JK translated this into German as *Bemerkungen zu gerechte Versuchsanordnungen und andere Methoden, die Abhängigkeiten zwischen den Parzellen berücksichtigen*, and submitted it to *Zeitschrift für Acker- und Pflanzenbau*.

The three of us worked together, and wrote a paper explaining this. JK translated this into German as *Bemerkungen zu gerechte Versuchsanordnungen und andere Methoden, die Abhängigkeiten zwischen den Parzellen berücksichtigen*, and submitted it to *Zeitschrift für Acker- und Pflanzenbau*.

Their response:

- ▶ We like this in principle.

The three of us worked together, and wrote a paper explaining this. JK translated this into German as *Bemerkungen zu gerechte Versuchsanordnungen und andere Methoden, die Abhängigkeiten zwischen den Parzellen berücksichtigen*, and submitted it to *Zeitschrift für Acker- und Pflanzenbau*.

Their response:

- ▶ We like this in principle.
- ▶ It is too long; split it into two papers.

The three of us worked together, and wrote a paper explaining this. JK translated this into German as *Bemerkungen zu gerechte Versuchsanordnungen und andere Methoden, die Abhängigkeiten zwischen den Parzellen berücksichtigen*, and submitted it to *Zeitschrift für Acker- und Pflanzenbau*.

Their response:

- ▶ We like this in principle.
- ▶ It is too long; split it into two papers.
- ▶ We are now an international journal, so any paper with at least one native English speaker should be written in English.

The three of us worked together, and wrote a paper explaining this. JK translated this into German as *Bemerkungen zu gerechte Versuchsanordnungen und andere Methoden, die Abhängigkeiten zwischen den Parzellen berücksichtigen*, and submitted it to *Zeitschrift für Acker- und Pflanzenbau*.

Their response:

- ▶ We like this in principle.
- ▶ It is too long; split it into two papers.
- ▶ We are now an international journal, so any paper with at least one native English speaker should be written in English.

The three of us worked together, and wrote a paper explaining this. JK translated this into German as *Bemerkungen zu gerechte Versuchsanordnungen und andere Methoden, die Abhängigkeiten zwischen den Parzellen berücksichtigen*, and submitted it to *Zeitschrift für Acker- und Pflanzenbau*.

Their response:

- ▶ We like this in principle.
- ▶ It is too long; split it into two papers.
- ▶ We are now an international journal, so any paper with at least one native English speaker should be written in English.

We did what we were told, and this resulted in papers in *Journal of Agronomy and Crop Science* in 1990 and 1991.

## Neighbour designs: I

The main topic that JK and RAB have in common is design of experiments where there may be neighbour effects.



## Neighbour designs: I

The main topic that JK and RAB have in common is design of experiments where there may be neighbour effects.

For example,

- (a) Tasting different wines in sequence;
- (b) Growing different varieties of tomato plants in a long line in a polytunnel.

## Neighbour designs: I

The main topic that JK and RAB have in common is design of experiments where there may be neighbour effects.

For example,

- (a) Tasting different wines in sequence;
- (b) Growing different varieties of tomato plants in a long line in a polytunnel.

Is there a neighbour effect from both sides?

## Neighbour designs: I

The main topic that JK and RAB have in common is design of experiments where there may be neighbour effects.

For example,

- (a) Tasting different wines in sequence;
- (b) Growing different varieties of tomato plants in a long line in a polytunnel.

Is there a neighbour effect from both sides? ((a) no, (b) yes)

## Neighbour designs: I

The main topic that JK and RAB have in common is design of experiments where there may be neighbour effects.

For example,

- (a) Tasting different wines in sequence;
- (b) Growing different varieties of tomato plants in a long line in a polytunnel.

Is there a neighbour effect from both sides? ((a) no, (b) yes)

Are the neighbour effects from both sides the same?

## Neighbour designs: I

The main topic that JK and RAB have in common is design of experiments where there may be neighbour effects.

For example,

- (a) Tasting different wines in sequence;
- (b) Growing different varieties of tomato plants in a long line in a polytunnel.

Is there a neighbour effect from both sides? ((a) no, (b) yes)

Are the neighbour effects from both sides the same?

Do we allow any treatment to come next to itself?

## Neighbour designs: I

The main topic that JK and RAB have in common is design of experiments where there may be neighbour effects.

For example,

- (a) Tasting different wines in sequence;
- (b) Growing different varieties of tomato plants in a long line in a polytunnel.

Is there a neighbour effect from both sides? ((a) no, (b) yes)

Are the neighbour effects from both sides the same?

Do we allow any treatment to come next to itself?

Is there a neighbour effect of “no treatment” at the end of the line?

## Neighbour designs: I

The main topic that JK and RAB have in common is design of experiments where there may be neighbour effects.

For example,

- (a) Tasting different wines in sequence;
- (b) Growing different varieties of tomato plants in a long line in a polytunnel.

Is there a neighbour effect from both sides? ((a) no, (b) yes)

Are the neighbour effects from both sides the same?

Do we allow any treatment to come next to itself?

Is there a neighbour effect of “no treatment” at the end of the line?

Are neighbour effects proportional to direct effects?

## Neighbour designs: I

The main topic that JK and RAB have in common is design of experiments where there may be neighbour effects.

For example,

- (a) Tasting different wines in sequence;
- (b) Growing different varieties of tomato plants in a long line in a polytunnel.

Is there a neighbour effect from both sides? ((a) no, (b) yes)

Are the neighbour effects from both sides the same?

Do we allow any treatment to come next to itself?

Is there a neighbour effect of “no treatment” at the end of the line?

Are neighbour effects proportional to direct effects?

We published a joint paper addressing the last question in *Biometrika* in 2006.



## Neighbour designs: II

In May 2013, Katarzyna Filipiak hosted a one-week “research in small groups” meeting at the Mathematics Research and Conference Centre of the Polish Academy of Sciences at Będlewo, concentrating on research on cross-over designs and neighbour designs. JK and RAB were part of this.



## Neighbour designs: III

This led to five-author paper in *Statistica Sinica* in 2017.



## Conferences: Quality Improvement

Sometimes JK and RAB visited each other to continue our research (I went to Universität Trier in October 1988), but most of our interaction was at conferences and workshops.

## Conferences: Quality Improvement

Sometimes JK and RAB visited each other to continue our research (I went to Universität Trier in October 1988), but most of our interaction was at conferences and workshops.

Workshop on Quality Improvement Methods, organized by statisticians at TU Dortmund, was held most years, sometimes in Haus Bommerholz, sometimes in Dortmund.

## Conferences: Quality Improvement

Sometimes JK and RAB visited each other to continue our research (I went to Universität Trier in October 1988), but most of our interaction was at conferences and workshops.

Workshop on Quality Improvement Methods, organized by statisticians at TU Dortmund, was held most years, sometimes in Haus Bommerholz, sometimes in Dortmund.



June 2015

Working and walking with Joachim Kunert

# Model-Oriented Design and Analysis of Experiments

The MODA conferences are held every three years, at various locations in Europe.

# Model-Oriented Design and Analysis of Experiments

The MODA conferences are held every three years, at various locations in Europe. My first was at Luminy, in the South of France, in June 1998.

# Model-Oriented Design and Analysis of Experiments

The MODA conferences are held every three years, at various locations in Europe. My first was at Luminy, in the South of France, in June 1998.





# Model-Oriented Design and Analysis of Experiments

The MODA conferences are held every three years, at various locations in Europe. My first was at Luminy, in the South of France, in June 1998.



On the free afternoon, JK, RAB and Richard Martin walked down to the beach. The paths are steep and narrow, and I have no sense of balance, so this was not easy for me, but the other two helped me.

# MODA 2001

The 2001 MODA was in Puchberg, in Austria, in June.



A steam-train excursion took us to Schneeberg. Then JK, RAB and Richard Martin walked down the 500 metre Fadenwände. Richard (in sandals, with no socks) strode down confidently and soon left me behind.

The path was stony and steep. JK was kind enough to go at my slow pace and help me at difficult points. We did not get back to Puchberg until 2040, rather late for dinner!

JK and Christine Müller organized the 2016 MODA, which was held at Hamminkeln-Dingen in June.



Here is JK relaxing at MODA 2019, held in June in Smolenice in Slovakia.



# Isaac Newton Institute, Cambridge

I was co-organizer of research workshops on Design of Experiments at the INI in 2008 (4 weeks, July–August), 2011 (5 months, July–December) and 2015 (one week, July). JK attended all three.



## Isaac Newton Institute, Cambridge

I was co-organizer of research workshops on Design of Experiments at the INI in 2008 (4 weeks, July–August), 2011 (5 months, July–December) and 2015 (one week, July). JK attended all three.



On the day after the last one, JK and RAB walked on a flat path beside the river from Cambridge to the cathedral city of Ely.

In August 2017, JK and RAB attended the one-week meeting on *Design and Analysis of Experiments* at BIRS.



# Banff International Research Station

In August 2017, JK and RAB attended the one-week meeting on *Design and Analysis of Experiments* at BIRS.

On the free afternoon, I was a bit nervous about walking on such high ground, but JK kindly accompanied me, and all went well.



## Back to Luminy

In May 2018, we both returned to the Centre International de Rencontres Mathématiques in Luminy for a meeting on *Design of Experiments: New Challenges*.



# Back to Luminy

In May 2018, we both returned to the Centre International de Rencontres Mathématiques in Luminy for a meeting on *Design of Experiments: New Challenges*.



On the walk, I had the sense to wimp out. The others all walked on, but later Jo came back to accompany me on the return walk.



# Thank you

Thank you to Joachim Kunert for many years of friendship, collaboration and walking together.