https://riskinstitute.uk/events/vice/ https://sites.google.com/site/riskthinkover/home/epistemic

#### **BRANDING**

ViCE: Virtual Conference on Epistemic Uncertainty in Engineering

#### **PURPOSE**

This event hopes to encourage discussion, and foster opportunities for emergent collaborations on fundamental issues of modeling and decision making in the face of uncertainty in practical engineering contexts. Building on the recent REC meeting in Liverpool and the RUC meetings in Cambridge and Amsterdam, we hope that this event will feature even more discussion and debate, serving as a workshop to address and perhaps come to concrete shared conclusions about handling uncertainty in engineering, and these questions:

- Uncertainty arithmetic: do epistemic and aleatory need different calculi?
- Uncertainty in engineering: how can we build a model with what we don't know?
- Computing with uncertainty: what would a *unified uncertainty calculator* look like?
- Admitting you don't know: how should epistemic uncertainty be communicated?
- Manifesto on epistemic uncertainty: can we agree on anything?

#### **ORGANIZATION**

Planning ideas are set out at <a href="https://tinyurl.com/epistemic2020">https://docs.google.com/document/d/1slC0UJ4Ov48oBKEkUjmCtzKNL3COlC6bLNav4l cTYE/edit</a>). Feel free to make additions to this document. Indicate your desired deletions by recolouring the text as grey rather than actually deleting the material.

### **DATES AND TIMES**

Multiple two- or three-hour sessions over two or three weeks in January and February 2021. Rather than squeezing everything into one or two exhausting days, a series of smaller events distributed over an *uncertainty month* will be less exhausting, less susceptible to the distractions of emails or other pressing business, and much easier for speakers to find a slot that fits their schedules. Talks will be accessible live worldwide, but only at hours comfortable for Europe, Africa, eastern North America, and western Asia. Recordings of talks should be accessible within one or days.

DAY	TIME(GMT)	SPEAKER 1	SPEAKER 2	DISCUSSION	THEME
2 February	14:00	O'Hagan	Oberkampf	Must decisions / designs distinguish uncertainties?	Decision making
3 February	16:00	Xie	Kreinovich	What would a unified uncertainty calculator look like?	Computing with uncertainty
15 February	10:00	Denoeux	Goldstein	Can we agree on anything about epistemic uncertainty?	VICE manifesto
17 February	16:00	Ben-Haim	Hemez	Are there other kinds of uncertainty?	Kinds of uncertainty
x	x	Chatzi and Ntertimanis	< <moens?>&gt;</moens?>	Management, compliance and monitoring	Management/compliance
3 March	15:00	Straub	Crespo	How can we build a model given what we don't know?	Uncertainty engineering

12 March	14:00	Ferson and Worden	Aven	Can we agree on anything about epistemic uncertainty?	VICE Manifesto
17 March	15:00	Dubois	Swiler	Do epistemic and aleatory need different calculi?	Uncertainty arithmetic
x	14:00	< <bostrum?< td=""><td>Gigerenzer</td><td>How should we explain and talk about uncertainty?</td><td>Communication</td></bostrum?<>	Gigerenzer	How should we explain and talk about uncertainty?	Communication

#### CALENDAR

7-10 December 2020 Sheffield Workshop on Structural Dynamics

8-10 December 2020 SIPTA School

12-13 January 2021 DigiTwin Programme Grant meeting

?? January 2021 DAWS UQ Scoping meeting (2 x 2 hr sessions)

February & March ViCE

## **SPEAKERS**

Bill Oberkampf, WLO Consulting, "Simulation-Informed Decision Making"

Open weeks: Nov. 30 - Dec. 4,Dec 7 - Dec. 11, Dec. 15 - Dec. 18, Jan. 4 - Jan. 8, Jan.

18 - Jan 22, Jan. 25 - Jan. 29

Bill offers a high-level discussion of how many factors enter into decision making in industry, regulatory bodies, and government policy. Uncertainty is an element in each factor. Some are dominated by epistemic uncertainty, some aleatory uncertainty, and some are (known and unknown) biases held by the decision maker and the information providers to the decision maker.

Didier Dubois, Toulouse, "<<tentative title TBD>>"

first half of December and (all?) of January are best

Luis Crespo, NASA, "Responses to the (NASA) UQ Challenge Problems"

January is best

Thierry Denoeux, UTC, "Random fuzzy sets: a general model of epistemic uncertainty" Between mid-November and mid-January

Daniel Straub, TUM, "Epistemic uncertainty in engineering decision making"

Not Mo or Th afternoons (teaching)

Vladik Kreinovich, UTEP, "Epistemic vs aleatory: granular computing and Ideas beyond that" Fall teaching Monday and Wednesday, Spring teaching on Tuesday and Thursdays

Min-ge Xie, Rutgers, "Bayesian/Fiducial/Frequentist uncertainty quantification by artificial samples"

December and January are best

Tony O'Hagan, Sheffield, <<TBD: We already have a grand unified uncertainty calculator>> December is impossible, January best

Michael Goldstein, Durham, <<TBD>>

December is impossible, January and February much better

Yakov Ben-Haim, Technion, Foundational aspects and decision making in the face of deep uncertainty

Not free on Tuesdays 13:00 to 14:30, or Wednesdays 13:00 to 17:00 GMT Tuesday 15:00-16:30, Thursday 12:30-13:30 israel time.

6pm goes first

Terje Aven, Stravinger, "Conceptualising, representing and describing epistemic uncertainties in a risk analysis context"

After 5 February (book project overwhelming before that)

Eleni Chatzi, ETH

Francois Hemez, Lawrence Livermore - 8am california, 6pm in Israel.

Laura Swiler, Sandia, lpswile@sandia.gov

### **VENUE**

We've been using Zoom very successfully with all manner of devices for several months now. Videos will be archived at <a href="http://riskinstitute.uk/">http://riskinstitute.uk/</a>. Consult with Grace at University of Sheffield for extra advice about Zoom meetings.

To participate in the conference live, you will need to download a small, free app from Zoom. You join the meeting by clicking on the link that will be supplied by email from Grace, or by entering a multidigit code. You can connect over the web if your device has a speaker, or connect audio by telephone if it doesn't. You'll need a camera (if you want to be seen) and a microphone (if you want to be heard). You can mute and unmute your microphone any time by moving your cursor to the lower left corner of the screen and clicking on the microphone icon. Turn on or off your camera similarly. There is also a chat facility by which you can pose questions and make silent interjections during discussions or presentations.



To present a talk with slides, you would join the conference live (as explained above), prepare your slides for display on your device, and then click on the green Share Screen button at the bottom of the Zoom screen to show them. Select the window you want to display from among a list of open windows. You may need to click on the slide presentation to enable automatic or manual slide advancing. If you flip between windows, you may need to stop sharing one and then share the new screen. The only thing Zoom is not convenient for is handwritten material. If you have that, let us know and we can arrange to get you a "visualiser" which is basically a camera on a mount that you can point down.

You can leave a Zoom meeting anytime by clicking on the red button in the lower, right corner of the Zoom screen. You can rejoin the meeting later if it is still going on.

You can access the conference via your smartphone using Zoom downloaded from the app store, although detailed presentation slides might be rather small on your phone display. This would be workable wherever your phone has internet access, but you will have to grant Zoom permission to access your phone's camera and microphone (if you want to be seen and heard).

### **FORMAT**

Multiple short programs (2-3 hours) across 1-2 weeks All programmed meetings will be recorded, but break out sessions may not be recorded

## **SPONSORSHIP**

The event is being organised by a collaboration between the University of Sheffield and the Institute for Risk and Uncertainty at the University of Liverpool, under the aegis of the DigiTwin programme grant funded by EPSRC (UKRI).

We sought and received (non-monetary) co-sponsorship from the Society for Risk Analysis.

REQUEST FOR SRA SPONSORSHIP OF AN EVENT ORGANIZED BY ANOTHER ORGANIZATION

If a workshop or conference is sponsored by SRA, the event will be listed on the member portion of SRA's website for all members to see. Additionally, an email broadcast may be made to a subset of SRA membership (for example, the relevant specialty group) to promote the event, if that is requested. The event organizer should identify any relevant sub-groups that the email should be sent to. If deemed generally relevant to all SRA members by the committee, the announcement may go out to all SRA members. SRA sponsorship does not connote any financial relationship with SRA.

The information requested on this form will help us determine whether your event is eligible for this sponsorship. Generally, we want to be able to verify that (1) the event would be of interest to SRA members, (2) the objectives for the event are consistent with SRA objectives, and (3) the meeting is open to anyone who is interested to attend.

Please answers to the following questions to apply for SRA sponsorship.

NOTE: Do not use this questionnaire if you want to propose a workshop for the Sunday before the annual meeting – there are different forms for that. See www.sra.org for that information.

1) What is the name of the proposed event? When and where will it be held?

Virtual Conference on Epistemic Uncertainty in Engineering (ViCE)

February-March 2021, University of Liverpool, United Kingdom (via Zoom)

2) What organization(s) is/are putting on this event?

Institute for Risk and Uncertainty, University of Liverpool

The University of Sheffield

DigiTwin Programme Grant (funded by EPSRC/UKRI)

3) What is the name, telephone, fax and email address of the contact person for the event?

Francis Baumont de Oliveira Scott Ferson

Mobile +44 (0) 7807046533 Mobile +44 (0) 74 8855 6139

Email sgfbaumo@student.liverpool.ac.uk Email ferson@liverpool.ac.uk

Email sandp8@gmail.com [preferred]

4) What is the scholarly purpose of the event?

This open and free conference provides a forum to encourage discussion and collaborations on modelling and decision making in the face of epistemic and aleatory uncertainty in practical engineering contexts. Building on the recent REC meeting in Liverpool and the RUC meetings in Cambridge and Amsterdam, we hope that this event will feature even more discussion and debate, serving as a workshop to address and perhaps come to concrete shared conclusions about handling uncertainty in engineering.

5) Who should attend the event? What audience is it intended to address:

Engineers, risk analysts, modellers, designers, and data scientists who may encounter epistemic uncertainty in their analyses, models, and designs

Please list any SRA specialty groups you would like receive information about this event

The event is of interest to any member of the Society, but especially to those in the Engineering and Infrastructure and Foundational Issues specialty groups

6) Is participation in the event open to the public? If not, explain.

Participation is open to all. 7) How will the event be funded? The event will be funded by Liverpool Institute for Risk and Uncertainty. 8) Is the event intended to make a profit? If there are profits, where will they go? The event is not intended to make a profit. Participation is free. 9) If the event is recognized by SRA, will you be able to share attendee names and email addresses and offer exhibit space to SRA? Attendee names and email addresses can be shared with SRA. The Society is welcome to use gratis exhibition space provided on the conference webpage 10) Please provide a URL for this event. https://sites.google.com/site/riskthinkover/home/epistemic https://www.riskinstitute.uk/events/vice/ (these sites are still in flux) In addition, please provide any additional information about this event, including an abstract, a description, information about registration procedures, an agenda, list of speakers, or any other information that is See the event workshop announcement below, with inline links to abstracts and speaker profiles for each talk. **Virtual Conference on Epistemic Uncertainty in Engineering (ViCE)** 9 days over two months, 18+ speakers, 2.5-hour thematic sessions Talks and open discussions presented over Zoom in February and March 2021 https://sites.google.com/site/riskthinkover/home/epistemic (click on the names/titles to see abstracts and biographical profiles of speakers) Decision making, 2 February 2021, 14:00-16:30 GMT Anthony O'Hagan, We Already Have a Unified Uncertainty Theory William Oberkampf, Simulation-Informed Decision Making Discussion: Must decisions and designs distinguish kinds of uncertainties? Computing with uncertainty, 3 February, 16:00-18:30 GMT Min-ge Xie, Bayesian/Fiducial/Frequentist Uncertainty Quantification by Artificial Samples Vladik Kreinovich, Epistemic vs Aleatory: Granular Computing and Ideas Beyond That

Computing with uncertainty, 3 February, 16:00-18:30 GMT

Min-ge Xie, Bayesian/Fiducial/Frequentist Uncertainty Quantification by Artificial Samples

Vladik Kreinovich, Epistemic vs Aleatory: Granular Computing and Ideas Beyond That

Discussion: What would a unified uncertainty calculator look like?

Manifesto on uncertainty, 15 February, 10:00-12:30 GMT

Thierry Denoeux, Random Fuzzy Sets: A General Model of Epistemic Uncertainty

Michael Goldstein, The Basic Principles of Reasoning About Uncertainty: A Subjectivist Approach

Discussion: Can we agree on anything about handling epistemic uncertainty in engineering?

Kinds of uncertainty, 17 February, 16:00-18:30 GMT

Yakov Ben-Haim, Innovation Dilemmas: An Info-gap Perspective

François Hemez, Uncertainty in Numerical Simulations: Does It Matter? What To Do About It? Discussion: Are there other kinds of uncertainty? Uncertainty engineering, 3 March, 15:00-17:30 GMT Daniel Straub, Epistemic Uncertainty in Engineering Decision Making Luis Crespo, Responses to the NASA UQ Challenge Problems **Uncertainty arithmetic** Didier Dubois, A Unified View of Uncertainty Theories Laura Swiler, <<title>> Discussion: Do epistemic and aleatory need different calculi? Management of uncertainty Eleni Chatzi, Vasilis Dertimanis, Counting on Uncertain Models for Structural Health Monitoring <<Speaker 2>> Discussion: How are management, compliance and monitoring affected by uncertainties? Manifesto on uncertainty (revisited), 12 March, 14:00-16:30 GMT Terje Aven, Conceptualising, Representing and Describing Epistemic Uncertainties in Risk Analysis Keith Worden & Scott Ferson, Say what? Discussion: Can we agree on anything about handling epistemic uncertainty in engineering? <<speaker 1>>, <<title>> Gerd Gigerenzer. <<title>>

#### **DEDICATION**

Discussion: How should we explain and talk about uncertainty?

ViCE is dedicated to B. John Garrick, who passed away unexpectedly in 2020 after a long career devoted to bringing the tools of probabilistic analysis to technological problems across engineering. The following is a panegyric commenting on B.J. Garrick's 2010 paper "Commentary Interval Analysis Versus Probabilistic Analysis" (which appeared in *Risk Analysis* 30: 369-370. DOI: 10.1111/j.1539-6924.2010.01360.x), which was a critique of Terje Aven's 2010 perspective paper "On the Need for Restricting the Probabilistic Analysis in Risk Assessments to Variability" (in *Risk Analysis* 30:354-360. DOI: 10.1111/j.1539-6924.2009.01314.x).

<u>B. John Garrick</u> was one of the founders of modern risk science, the primary goal of which, he thought, is to improve decision making. He held that probability as a thought process should be used to foster honesty in the analysis, "to better tell the truth about threats, events, and their

outcome". Garrick shined a light on the ways in which stochasticity impacts technological advancement. Deterministic analysis is insufficient for an increasing number of complex applications, and a practical consideration of risk analysis can make strides in safety, economy and performance in many disciplines.

Some researchers, like Terje Aven, have argued that a more expressive representation beyond traditional Laplacian probability is needed for problems combining epistemic and aleatory uncertainties. Garrick saw this argument as losing sight of the primary goal, and of improperly omitting valuable details. He noted that the additional benefits of a new theory of imprecise probabilities pale in comparison to those of a straightforward informative probabilistic approach.

Of course accepting the idea that there could be non-Laplacian uncertainty doesn't mean one throws away probability theory, any more than accepting non-Euclidean geometry removes the need for Euclidean geometry. The traditional approach remains as practically important and useful as before, with just as many applications. Indeed, the probabilistic approach Garrick championed will surely remain the primary tool in risk analysis, fully appropriate for a host of problems. The new imprecise approach relaxes one of the assumptions of the traditional theory, and it is a generalisation of probability. But Garrick's point, that it seems unnecessary for the main use of risk analysis, is a serious one. Do the nuances or possibly wider applications pay for the complications inherent in generalising probability theory?

The issues at the very heart of the debate exemplified by these papers by Garrick and Aven are the focus of an upcoming virtual conference on epistemic uncertainty in engineering (<a href="http://riskinstitute.uk/vice">http://riskinstitute.uk/vice</a>), which has been dedicated to Garrick in appreciation of his contributions to the subject.

Scott Ferson and Alexander Wimbush, Institute for Risk and Uncertainty, University of Liverpool

## ADDITIONAL POSSIBLE SUBTHEMES

## **Emerging Agreement**

Do we agree on the simple problems?

Too many hammers, and oddly shaped nails: comparing results for <u>exemplar problems</u> Manifesto on epistemic uncertainty: can we agree on anything?

# Computing with Epistemic Uncertainty

What does a computer language for calculating under uncertainty look like? Towards a *grand unified uncertainty calculator* 

### **Unsolved Problems**

What should we do about model form uncertainty?

\*Models of dependency

## Calculations we cannot yet make

## **Epistemic Arithmetic**

Different calculi of epistemic uncertainty (pbox, fuzzy, DDS)
Can epistemic uncertainty be encoded in probabilities?
Are intervals and constraints always needed to wrangle epistemic uncertainty?

# Uncertainty in Engineering Problems

What is needed in engineering design?
Risk analysis versus engineering design
Optimisation under varying and hazy conditions
Validation of uncertain models with imprecise data
Differential equations under uncertainty
Decision making under both epistemic and aleatory uncertainty
Uncertainty logic

### <u>Miscellaneous</u>

Admitting you don't know: communicating epistemic uncertainty Uncertainty in machine learning and artificial intelligence Larger uncertainty should never make safety increase: false confidence

ViCE Conference on epistemic uncertainty in engineering

### SPEAKER INVITATIONS

Subject: invitation to speak at the first virtual conference of epistemic uncertainty in engineering

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Dear Thierry,

We are organising a **virtual conference on epistemic uncertainty in engineering** for this winter. We are thinking of you as a critical speaker, so we wanted to check in with you about it even before we've set the dates.

We are thinking of a bit of a reprise of the REC meeting in Liverpool, only more discursive. More of a workshop to perhaps come to real conclusions about some of these matters.

Provisionally we are aiming to have multiple sessions perhaps based around these themes:

- Manifesto on epistemic uncertainty: can we agree on anything?
- Uncertainty arithmetic: do epistemic and aleatory need different calculi?
- Uncertainty in engineering: how can we build a model with what we don't know?
- Admitting you don't know: how should epistemic uncertainty be communicated?
- Computing with uncertainty: what would a *unified uncertainty calculator* look like?

These themes are flexible and your talk might not fall within these categories.

We hope to encourage a lot of discussion, and foster opportunities for emergent collaborations, so we are thinking of 40-minute presentations, followed by 15 minutes of questions and discussion.

We have been entertaining the idea of having a series of short (two- or three-hour) sessions distributed over one or two weeks in December 2020 or January 2021. The idea behind this is that, rather than squeezing everything into one or two exhausting days, a series of smaller events distributed over an *uncertainty week* or two will be less exhausting, less susceptible to the distractions of emails or other pressing business, and much easier for speakers to find a slot that fits their schedules.

To accommodate as many people as possible internationally, most sessions will be during the afternoon in Europe. However, we will try to accommodate speakers for whom this time period is inconvenient. All talks will be recorded and shared on-line shortly after the event.

I really hope you can provisionally accept this invitation to speak. If so, you might like to let me know a tentative title for planning purposes. If you can anticipate your schedule during December-February, please feel free to indicate times and dates you'd prefer (or cannot do) so that we can build the schedule around you. Perhaps you already have a title in mind?

Other preliminary organisational ideas are set out at <a href="https://tinyurl.com/epistemic2020">https://tinyurl.com/epistemic2020</a>. You are welcome to make contributions there directly if you like.

# Kind regards,

Scott

Prof Scott Ferson, PhD Institute for Risk and Uncertainty University of Liverpool +44(0)7488556139

### **INVITEES**

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Michael Balch

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Keith Beven

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Mark Burgman, Imperial philosophy

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Mark Colyvan, philosophy

Frank Coolen, Durham

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Isaac Eliashikov, FAU

Roger Flage, Stravinger

Louisa Flander, Melbourne

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Wolfgang Graf

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Yakov Ben Haim, yakov@technion.ac.il

Michael Hanss, Universität Stuttgart fuzzy

Andy Hart

Keith Hayes, CSIRO

George Hazelrigg fireworks



Jon Helton, ASU

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Dominik Hose, Universität Stuttgart fuzzy

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Daniel Krpelik, Durham

Henry Kyburg

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Kyoko Makino ODE

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Ignacio (Nacho) Montes

Rafi Muhanna, Georgia Tech

Robert Mullen, South Carolina

Bob Nau, Duke

Rich Neapolitan

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Arnold Neumeier (sp?) philosophy

Michael Oberguggenberger, Innsbruck

Bill Oberkampf, formerly Sandia National Labs, wloconsulting@gmail.com

Tony O'Hagan fireworks, a.ohagan@sheffield.ac.uk

Jose Palma-Oliveira communication

Edo Patelli

Judea Pearl

Francesco Pugliese

Erik Quaeghebeur

Helen Regan, San Diego

Willem Roloefs

Siegfried Rump

Ullrika Sahlin, Lund

Andrea Saltelli

David P. Sanders (Julia interval guy), National University of Mexico

Teddy Seidenfeld philosophy

Kari Sentz, Los Alamos National Lab

Michael Siegrist communication

Nozer Singpurwalla

Jim Smith, Duke

Pol Spanos, Rice

David Spiegelhalter

Mark Stadherr ODE

Daniel Straub, Munich, straub@tum.de fireworks

Bruno Sudret, sudret@ethz.ch

Laura P. Swiler, Dakota person at LANL

Matthias Troffaes, Durham

Peter Walley philosophy

Yan Wang, Georgia Tech

Bob Williamson, Australia

Robert L. (Bob) Winkler, Duke

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Enrico Zio, Politecnico di Milano

Jean-Paul <<Ullrika knows him>>, Leeds

<<fiducial guys>>, UNC

https://tu-dresden.de/bu/bauingenieurwesen/sdt/forschung/spp1886/teilprojekte

**Herman Matthies** 

Fabian Duddeck, Muenchen

<>>> Kaliske, TU Dresden

Herman G. Matthies

Lars Grasedyck

Sigrid Leyendecker

Etkatrina Auer, Wismar

<<Cuenen et al. RSS paper>>

DigiTwin people

Liverpool people

**REC** invitees

RUC people, https://www.researchgate.net/project/The-Cambridge-Risk-and-Uncertainty-Conference-RUC

China grey systems people

ETH people

Dakota, Cossan, UQLab, JAGS, BUGS, Stan

<<12 women>>

### OTHER INVITATIONS TO SEND

AGYakovlev@sovintel.ru

## GDPR issues?

# RI addresses from REC, SIPTA, DigiTwin, Liverpool

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