School of
Engineering

IPP Institute of Product Development
and Production Technologies

Wissenschaftliches Arbeiten

Fachartikel

Prof. Jörg Agarico, IPP

- Sie kennen die Textsorte Fachartikel (evtl. Repetition).

- Sie kennen den Aufbau eines Fachartikels und können eine Disposition für Ihren Artikel erstellen.

- Sie repetieren bestimmte formale und inhaltliche Elemente eines Fachartikels.

Was heisst 'wissenschaftlich'?
Transparenz

- Public Good:
  Erzeugung von öffentlichem Wissen (Erkenntnisgewinn)

- Tradition und Deklaration:
  Ausgehen von bestehendem Wissen

- Nachprüfbarkeit/Transparenz:
  Beschränkung auf nachprüfbare (beobachtbare),
  nachvollziehbare Tatsachen und Thesen

Was heisst 'wissenschaftlich'?
Methodik

- Relevanz und Originalität:
  Die Arbeit soll Wissen vermehren, also relevant sein und auch Neues vermitteln.

- Methodik und Systematik:
  Planmässiges, geordnetes Vorgehen unter Einhaltung bestimmter Regeln (methodisch und systematisch)
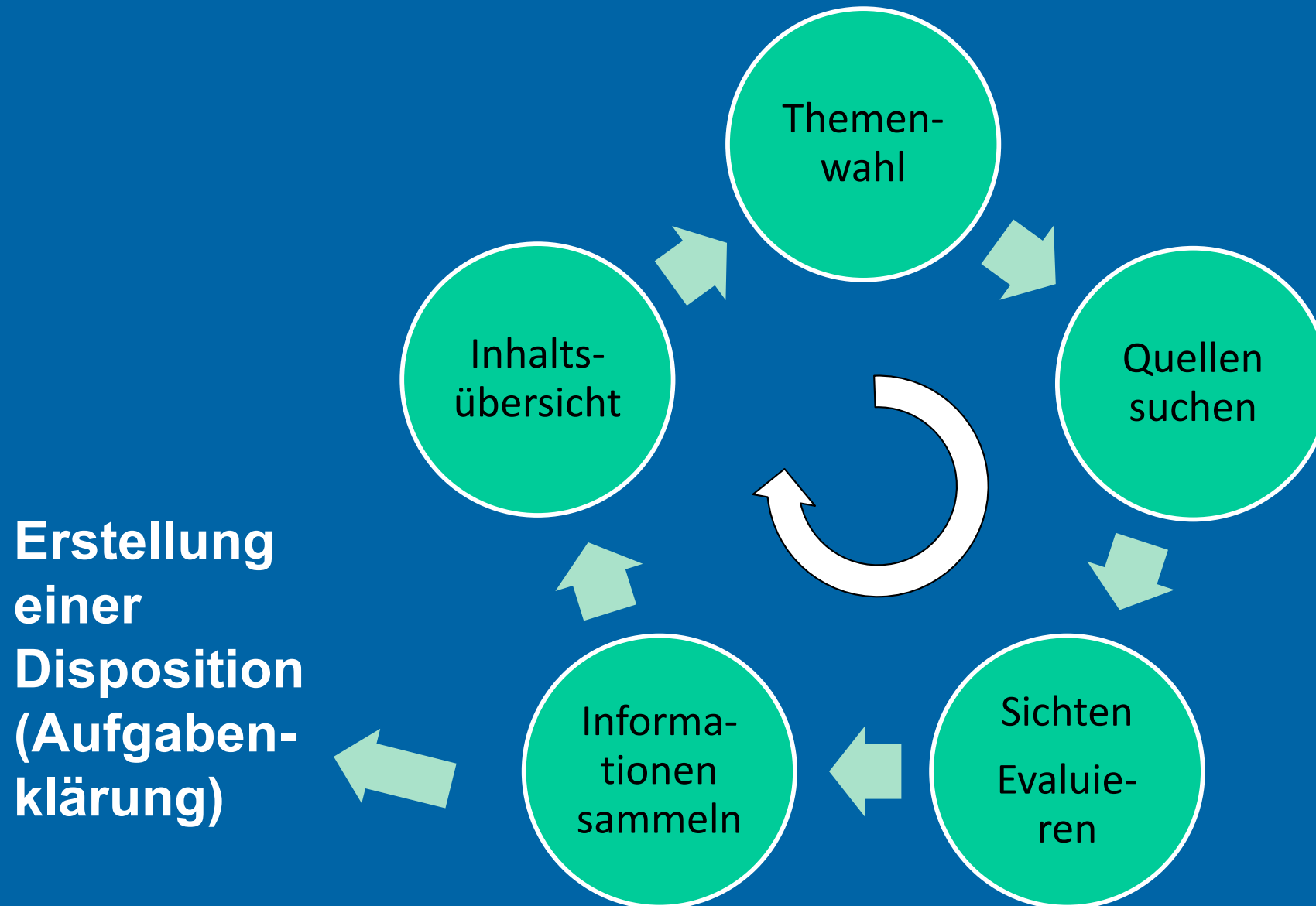
„Massification of scientific enterprise"

- **8 Mio**. researchers worldwide

  - 1 : 1000 of world population

  - 1 Mio. new researchers in the developing countries in the last decade

- **2Mio**. papers/ yr. 1.346 million articles were published in 23.750 journals within 2006.(B.-C. Björk, R. Annikki, and M. Lauri.) 1.8 mio in 2014 (Smithonian)

  - 3 Mio papers rejected, min. 3 reviews each; >50% never cited, never read.

  - >50 Mio papers in total since 1665

- **28.000** peer reviewed journals (increasing)

- **23.000** universities in *webometrics* (increasing)

Wissenschaftsbetrieb
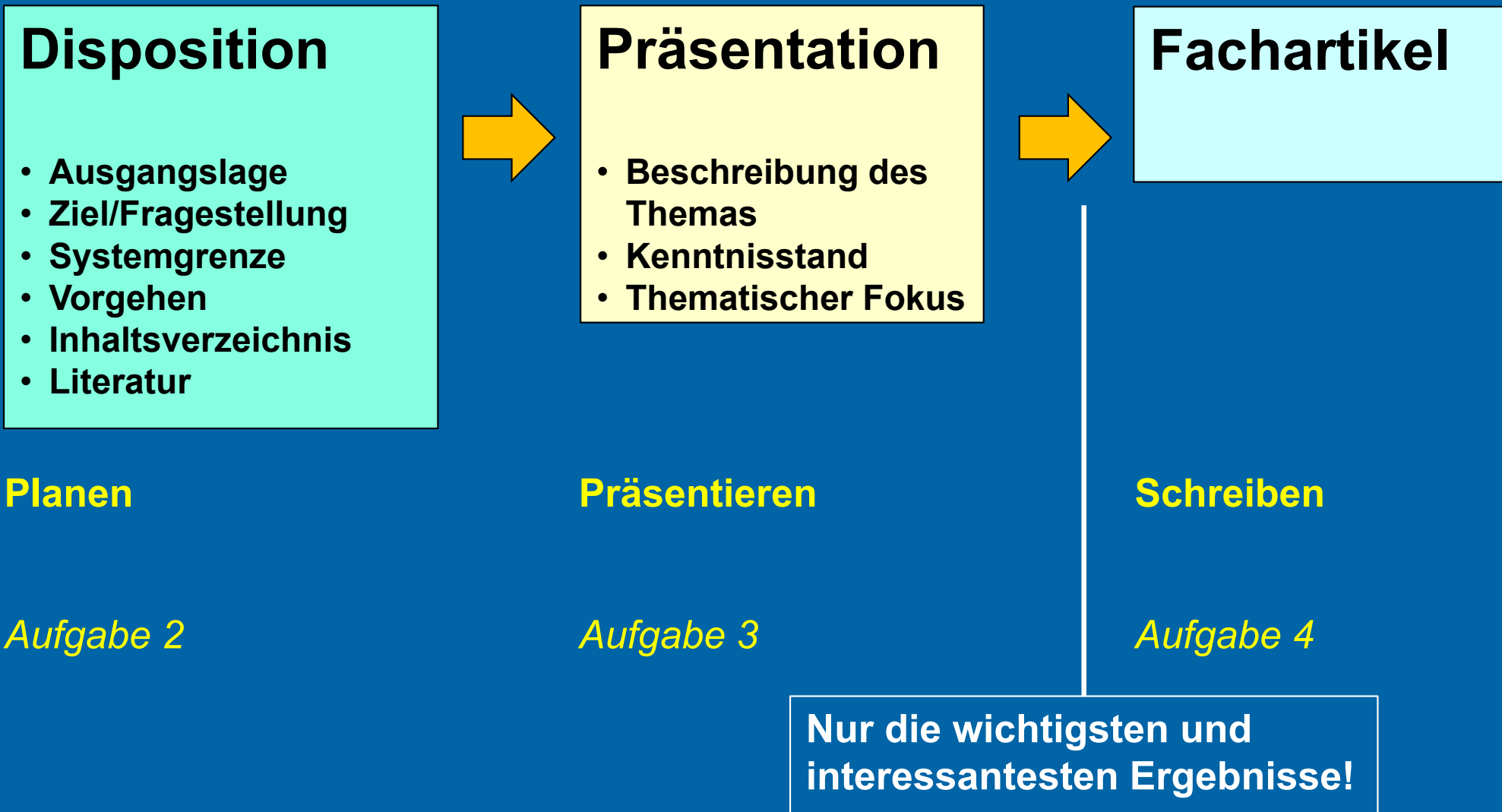## «Informationsexplosion» (wikipedia)

- 64 (oder 100?) Mio. ForscherInnen weltweit

- Online-Studien: Verdoppelung alle 9 Jahre (ETHZ)

- 2018 gab es mehr als 33.000 englischsprachige Zeitschriften mit Peer-Review, in denen mehr als drei Millionen Artikel pro Jahr erscheinen.

- Oligopol: drei Verlagshäuser (Elsevier, Springer Nature und Wiley)

- Über 28'000 Universitäten weltweit (webometrics, 2019)

Streit um teure Fachjournale
Unis und Elsevier brechen Verhandlungen ab
Von Tilmann Warnecke

Quelle: Tagesspiegel

Die Arbeit vor der Arbeit: Schritte vor dem Schreiben

Erstellung einer Disposition (Aufgaben-klärung)

- Themen-wahl
- Quellen suchen
- Sichten Evaluie-ren
- Informa-tionen sammeln
- Inhalts-übersicht

Arbeitsablauf in dieser Woche

Disposition

- **Ausgangslage**
- **Ziel/Fragestellung**
- **Systemgrenze**
- **Vorgehen**
- **Inhaltsverzeichnis**
- **Literatur**

Präsentation

- **Beschreibung des Themas**
- **Kenntnisstand**
- **Thematischer Fokus**

Fachartikel

Planen

Aufgabe 2

Präsentieren

Aufgabe 3

Schreiben

Aufgabe 4

Nur die wichtigsten und interessantesten Ergebnisse!

a) Arbeitstitel, eventuell informativer Untertitel

b) Ausgangslage und Problemstellung: Worum geht es überhaupt? Was ist der Kontext?

c) Fragestellung, Leitfrage, ev. Thesen und Zielsetzung der Arbeit, in eigenen Worten!

d) Wichtige Grundbegriffe, Eingrenzung des Themas

e) Thematische Gliederung (prov. Inhaltsverzeichnis)

f) Projektmanagement: Vorgehen, Methodik, Arbeitsablauf

Erscheint in (Fach-)Zeitschriften → nicht der Inhalt, sondern das Medium ist definierend

Im Gegensatz zur Facharbeit aktuell, da Fachzeitschriften öfter und rascher als Bücher publiziert werden.

Fokussiert auf eine oder wenige Fragestellungen.

Durchläuft ein Qualitätssicherungsverfahren (z.B. Peer Review)

Kann auch in Publikumszeitschriften erscheinen («populärwissenschaftliche» Artikel)

Je nach Zielgruppe ist eine didaktische Aufbereitung für Lesbarkeit und Verständlichkeit erforderlich

Kategorien von Zeitschriften

1. Publikumszeitschriften (graue Literatur)

   • keine strikten Formatvorgaben

2. Fachzeitschriften mit Gutachterverfahren

   • Detaillierte Anweisungen zum formalen Aufbau und zu Layout, vorgegebene Seitenzahl, meistens Doppelblindgutachten, Bewertung und Überarbeitungshinweise

   • Ansprechende, auch kreative Titel

   • Tabellen, Grafiken, Bilder

3. Internationale Fachzeitschriften auf hohem Niveau (A-Journals)

   • Wie Fachzeitschrift, aber strengeres Review-Verfahren; weniger als 10 % werden veröffentlicht.

   • Meist streng formalisiert

   • (…und ein Bombengeschäft.)

- nach Kriterien des „Wissenschaftlichen Arbeitens" erarbeitet (Nachvollziehbarkeit, eigenständige Recherchen, Quellenangaben)

- gute Leserführung (gedanklich klar strukturiert; roter Faden; optisch klar gegliedert)

- Sprache korrekt und dem Zielpublikum angepasst

- angemessen gestaltet

nicht zu technisch, muss gut lesbar sein
"Beobachterperson" => unpersönlich

- Titel /Untertitel und formale Angaben

- Lead / Abstract

- Einleitung (Einführung, Ziele)

- Theorie, Methode, Vorgehen

- Resultate

- Diskussion

- Schlussfolgerungen

- Literatur   4-5 quellen reichen

Neue Marsmission der Nasa

«Insight» soll einen Blick in die Tiefe werfen

Kaum hat der «Curiosity»-Rover die ersten Daten vom Mars zur Erde gefunkt, kündigt die Nasa für 2016 bereits die nächste Marsmission an. Im Fokus soll das Innere des Mars stehen.

Spe. · Der Mars wird sich auch in den kommenden Jahren amerikanischer Präsenz erfreuen dürfen. Wie die Nasa am Montag bekanntgegeben hat, soll die Erkundung unseres Nachbarplaneten im Jahr 2016 mit der «Insight»-Mission fortgesetzt werden. Während der Mars-Rover «Curiosity» in den nächsten Monaten Aufschluss über die mine-

für enttäuschte Forscher mag Spohn nicht glauben. Bei «Insight» handele es sich um eine geophysikalische Mission, hinter der ganz andere Forscher stünden als hinter der Exo-Mars-Mission.

Beispiel 2

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Arguments on the Imminence of Global Collapse Are Premature when Based on Simulation Models

Reaction to G. M. Turner. 2012. On the Cusp of Global Collapse? Updated Comparison of The Limits to Growth with Historical Data. GAIA 21/2: 116–124

Rodrigo Castro

On the occasion of the 40th anniversary of the publication of the famous book *The Limits to Growth (LtG)* (Meadows et al. 1972), Graham M. Turner (2012) published an article in this journal. He claimed that the data review of said book "continues to confirm that the standard run scenario represents real-world outcomes considerably well. This scenario results in a collapse of the global economy and population in the near future" (Turner 2012, p. 123).

I will argue on mathematical grounds that several of Turner's key arguments are premature. The mathematical gap in his arguments stems from an incomplete sensitivity analysis of the *standard run* scenario *(Std Run)* of Meadows' *World3* model. This fact imposes methodological limits on the interpretation of comparisons between recently updated historical data and simulation results.

Model Sensitivity

World3 is a non-linear model in the form of differential equations. The sensitivity of such models is understood as the tendency to undergo qualitatively noticeable changes in response to shifts in the parameters used to fix the model setup (Khalil 2002) (e.g., changes in global population from an exponential growth mode to oscillations around an average value, or from equilibrium to an *Overshoot and Collapse [OaC]* mode, etc.).

Authors of *World3* have stressed inexhaustibly that their goal was not to provide precise forecasts, but explorations of plausible modes (Meadows et al. 1972, 1974, 1992, 2004). As parametric uncertainty is prominent in *World3*, sensitivity becomes a crucial property.

Turner (2012, p. 119) comments: "It is noteworthy that despite the non-linearity of the *World3* model, the general outcomes of the scenarios are not sensitive to reasonable uncertainties in key parameters (Meadows et al. 1974)." He thus conveys the overall impression that the issue of sensitivity in *World3* is a matter already studied, a case closed with no further implications.

The text of the source book, however, communicates a largely different picture. The authors state their position in Meadows et al. (1974, p. 22): "Sensitive points may exist within the system structure, where a certain combination of parameters becomes equivalent to a major structural change. These points are rare, and they generally occur at the intersection of several positive and negative feedback loops, where a small shift in numbers may change the relative dominance of loops and thus the tendency of the entire system to grow or decline. An important purpose in making a dynamic model is to locate these points because they indicate relationships on which more research may be necessary to understand the system fully."

Accordingly, their heuristic procedure may be summarized as follows: 1. intuitively inspect the model looking for sensitive locations and identify the related parameters; 2. locate other parameters bearing most uncertainty (based on the least reliable information); 3. intuitively propose discrete, usually drastic pessimistic/optimistic parameter shifts; and 4. run new simulations and contrast results.

As a consequence, the efforts made by Meadows et al. (1974) cannot be regarded as a methodologically comprehensive sensitivity analysis. I would rather refer to them as "intuitive parametric explorations". Among over 70 parameters (including constants and table functions) at most three were perturbed simultaneously, while most of the tests performed altered only one parameter at a time. This approach offers only qualitative insight into the model's dependence on dubious assumptions embedded into parameters. By no means can it be taken as a comprehensive study, >

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because it blinds out the general problem of sensitivity: When parameter shifts are applied, both the "original" and the "shifted" models can still be sensitive or insensitive relative to small deviations (either in the originally shifted parameters or in other ones). Therefore, *World3* can neither be regarded as sensitive nor insensitive based on the work cited by Turner (2012). In Meadows et al. (1982, p. 131), one of the *LtG*'s authors makes a retrospective comment highlighting the heuristic nature of their approach: "(…) we were not trying to establish that the model was either sensitive or insensitive, but that it was sensitive where we would expect the real system to be and not sensitive where we would not expect the real system to be".

Updating global data, Turner (2012) finds the simulated *standard run* scenario of the 1972 book *The Limits to Growth* approximately confirmed up to year 2010. It projects a global collapse of the economy and population in the near future, caused mainly by the exhaustion of non-renewable natural resources. Even though resource depletion will strongly shape the course of global economy, several of Turner's arguments on the imminence of a collapse appear premature when regarded on mathematical grounds.
The picture shows part of an Argentina-Bolivia gas pipeline, recently boosted to accompany the social development of the region.

Empirical Validation?

The *Std Run* suffers from sensitivity issues allowing for unforeseeable changes of modes relative to changes in parameters, making its most salient characteristic – the *OaC* trajectory – a non-robust mode. Under these circumstances any empirical validation over a time interval allows for conclusions restricted to that given interval. It has never been ruled out that combinations of plausible parameters exist that can produce, e.g., a stabilized population for 2010 to 2100 while still accommodating the validated 1970 to 2010 trajectory. Thus, the validated period can only talk about a transitory success of the *Std Run* (parameterized as of 1972) exclusively for that time lapse. Hence, when it comes to the subject of the possible development of a future *OaC* mode, we have no elements to deduce from the *Std Run* whether it will take place or not.

Critiques to Arguments

Listing those key arguments made by Turner (2012, p. 123) that deserve a different view in light of the comments above, the following critiques are given:

"The data review continues to confirm that the *standard run* scenario represents real-world outcomes considerably well. This scenario results in collapse of the global economy and population in the near future."
The *Std Run* simulation has so far represented considerably well a 40-year period of a business-as-usual world, but we lack sufficient information to know whether this fact increases or decreases the probabilities of a future *OaC* mode or a modification in the timing of such event.

Other investigators have dealt thoroughly with *World3* sensitivity applying advanced techniques (e.g., Scolnik 1979, Vermeulen and De Jongh 1976, De Jongh 1978). They found examples where the *Std Run* exhibits drastic qualitative changes when parameters are slightly perturbed well within their ranges of uncertainty, e.g., a shift from the *OaC* mode to a stabilized mode in the global population up to year 2300 by altering in less than five percent a set of five parameters (Scolnik 1979). These exercises were meant to raise warnings about the precautions that should be taken when building arguments based on *World3* simulation runs.

For quite some time already, techniques are available (Scolnik and Talavera 1974, McKay et al. 1979, Hearne 1985) that lead to non-intuitive discoveries of sensitivity problems and avoid the overwhelming option of having to explore all possible parameter combinations. Hearne (1987) and Kleijnen (1995) aimed at applying such techniques for System Dynamics (Forrester 1968), which was the modeling methodology adopted to formulate *World3*.

To wrap up, the *Std Run* has to be interpreted with extreme care. Let's consider next how this fact relates to empirical validation.

"The confirmation of the key model mechanism underlying the dynamics of the *standard run* strengthens the veracity of the standard run scenario."
Mechanisms in the *Std Run* have been only partially confirmed, those being in fact the less rich and most expectable ones: continued growth and resource depletion, in accordance with the sustained industrial-based growth-addict patterns dominating modern society. Yet this says nothing about the veracity of the *Std Run* as a whole in terms of its *OaC* mode.

"The corroboration here of the *LtG standard run* implies that the scientific and public attention given to climate change, whilst important, is out of proportion with, and even deleteriously distracting from the issue of resource constraints, (…)."
The *LtG Std Run* has not been corroborated as a whole. Its *OaC* mode remains a simulated trajectory subject to weakly studied sensitivity issues, which leaves us with insufficient information to make assertions about its degree of plausibility among other possible modes.

"Another implication is the imminence of possible collapse. This contrasts with the general commentary on the *LtG* that describes collapse occurring sometime mid-century; and the *LtG* authors stressed not interpreting the time scale too precisely. However, the alignment of data trends with the model's dynamics indicates that the early stages of collapse could occur within a decade, or might even be underway."
The partial validation of the *Std Run* for 1970 to 2010 may or may not imply a modified timing of a potential *OaC* mode. It can only imply that other conceived modes – labeled *stabilized world* and *comprehensive technology* in Turner (2012) – have been transiently ruled out, and that the *Std Run's* first phase of projections (that exhibiting exponential growth) has not been falsified.

Conclusion

All concerns raised by Turner deserve proper attention and debate. Nevertheless, several arguments can hardly be regarded as causal implications of the validation of the *Std Run* during 1970 to 2010. A rephrasing of Turner's key message that would retain its original spirit while avoiding entering a conflict with methodological aspects of mathematical modeling and computer simulation would possibly read:

In the same way the concerns raised in *LtG* have not been widely taken into account, and history having shown facts that so far validate the *Std Run*, it may well be the case that the projections for 2010 to 2100 also turn out to be accurate, which would imply an undesired *OaC* mode. The simulations of the *World3* model and their comparison against reality offer insufficient information for either increasing or decreasing our confidence in

the development of an *OaC* mode. We simply don't know. But its mere possibility, along with risk-based reasoning, ideas about precautionary governance, and good alignments with other sources of knowledge, indicate that a potential *OaC* mode deserves serious attention akin to that applied to climate change.

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Beispiel 3

ENVIRONMENTAL MICROBIOLOGY

Association between the Presence of Class 1 Integrons, Virulence Genes, and Phylogenetic Groups of *Escherichia coli* Isolates from River Water

Ryszard Koczura · Joanna Mokracka · Agata Barczak ·
Natalia Krysiak · Adam Kaznowski

Abstract Ninety-six class 1 integron-positive and 96 integron-negative *Escherichia coli* isolates cultured from the water of the Warta River, Poland, were characterized for their phylogenetic group affiliation and for the presence of genes associated with virulence. Most strains belonged to phylogenetic group A, but phylogenetic group affiliation was not related with the presence of integrons. The occurrence of heat-stable toxin gene of enterotoxigenic *E. coli*, S fimbriae subunit gene *sfaS*, and siderophore receptor genes, *fyuA* and *iutA,* was associated with the presence of class 1 integrons. Moreover, virulence factor score (the total number of virulence-associated genes) was associated with the presence of integrons in groups. The results bring new insight into relations between the presence of integrons in *E. coli*, virulence traits, as well as phylogenetic group affiliation.

Introduction

Escherichia coli is a part of intestinal flora of human and homoiothermal animals; however, pathogenic strains can cause gastrointestinal and extraintestinal infections. Strains that are responsible for gastrointestinal infections have been classified into several pathotypes, such as enteropathogenic *E.*

(EHEC). Major extraintestinal infections include mostly urinary tract infection, pyelonephritis, neonatal meningitis, cystitis, and bacteremia [1].

Pathogenic *E. coli* strains differ in their virulence factor (VFs) which confer pathogenic potential. Some recognized VFs of pathogenic *E. coli* include diverse adhesins (e.g., P fimbriae, S and F1C fimbriae), toxins (e.g., hemolysin and cytotoxic necrotizing factor), siderophores (e.g., aerobactin and yersiniabactin), polysaccharide coatings (e.g., group II and group III capsules and lipopolysaccharide), and invasins. These VFs alleviate colonization and invasion of the host, avoidance or disruption of host defense mechanism, and stimulation of inflammatory response [1].

Phylogenetically, strains of *E. coli* are divided into four groups: A, B1, B2, and D. They can be distinguished upon the presence of *chuA* and *yjaA* genes, and TSPE4.C2 non-coding region [2]. Some studies have reported an association of VF genes with phylogenetic group affiliation [1, 3, 4]. Commensal *E. coli* strains belong mostly to groups A and B1 9130. EHEC, ETEC, and EIEC strains are linked with groups A and B1 [5]. Strains isolated from extraintestinal infections, on the other hand, belong mostly to group B2 and, to a lesser extent, D [1, 5]. EPEC, EAEC, and DAEC are not associated with phylogenetic group affiliation [5]. The predominance of different phylogroups may also

Beurteilungskriterien Inhalt

Einbettung in einen Kontext/Problemstellung; eigenständige, kreative Überlegungen; logische, nachvollziehbare Erklärungen und Begründungen; differenzierte und kritische Verarbeitung von Quellen; Bezug zur aktuellen Fachdiskussion; Fazit, Vernetzungen der Inhalte; persönliche Bewertung; Trennung von Fakten und Meinung; Konzentration auf das Thema, sinnvolle Gewichtung der einzelnen Aspekte

Beurteilungskriterien Form

Übersichtlich gegliederte Darstellung, nicht überladen (Graphik und Text); klarer, nachvollziehbarer Aufbau; zielgruppengerechter Stil; verständliche Sprache; Rechtschreibung; wissenschaftlich korrekte Zitierweise und ~~Quellenverzeichnis;~~ Graphiken/Bilder mit Legenden/Quellen; Titel, Namen (Autoren), Datum vorhanden.

Strukturverzeichnis

Bilder => Abbildung 1 : bla bla
nur mit bezug

Sämtliche Gedanken, die nicht von Ihnen selber stammen, müssen in der Arbeit so gekennzeichnet werden, dass die Quelle für eine Leserin bzw. einen Leser ohne weiteres auffindbar ist.

Plagiate sind verboten.

Literaturreferenzen

Vgl. Zitierleitfaden für

wissenschaftliche Arbeiten

an der SoE (Harvard/IEEE)

Spezialfälle technischer Texte

Vgl. Leitfaden der SoE

Leitfaden (LCC/SoE)

**Abkürzungen, Kurzwörter und Begriffszeichen
Zahlen, Ziffern und Masse**

Thomas Baumberger

Fachgruppe Kommunikation/Deutsch des LCC Language Competence Centre

https://intra.zhaw.ch/departemente/school-of-engineering/
bachelorstudium/projekt-und-bachelorarbeiten.html