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Four Horsemen and a Rotten Apple
On the Technological Rationality of Nuclear Security

Abstracts

The technological rationality of nuclear security is not one of means and ends. Instead, it satisfies the technical demand of the international system of nuclear security that it be tended to, taken care of, calibrated, fine-tuned and maintained. Care for the working order of things – even where it appears obsolete or corrupt – is explored as a form of prudence (*Klugheit*) that extends to the so-called klu(d)ge. It requires a kind of attentiveness and feeling for the mechanism which is subject of Alexander Kluge's political philosophy. Thus, what may appear to be a mere play on a word might provide analytic insight into the shift from political security concerns towards technical safety cultures.

Die technische Rationalität der nuklearen Rüstungskontrolle fügt sich nicht in das Schema von Mittel und Zweck. Stattdessen genügt sie den technischen Anforderungen eines fragilen Sicherheitssystems, das gepflegt, gewartet und erhalten sein will. Diese Sorge um die Anordnung der Dinge – auch wo sie überholt, beschädigt oder korrupt erscheint – wird hier als eine Art von Klugheit interpretiert, die den einfallsreichen Notbehelf der »klu(d)ge« umfasst. Sie beruht auf einer Form der Aufmerksamkeit und einem Gefühl für Mechanismen, die Gegenstand von Alexander Kluges politischer Philosophie sind. Und so mag ein bloßes Wortspiel analytische Einsicht verschaffen in den Übergang von politischen Sicherheitskonzepten (*security*) zu technischen Sicherheitskulturen (*safety*).

Can a play on words do philosophical work? The seductive question demands a sobering answer: Even if the resemblance of words were to mirror sympathetic relations among concepts and things, it would not be helpful to appeal to such obscure connections.

If the following pages nevertheless follow the trail of a German word or rather its sound, this takes license from the fact that this paper had been invited into a sphere of paradox and unreason, namely the further development of game-theoretic conceptions of nuclear deterrence. For this theory and its MAD variants like »mutually assured destruction« it has already been shown that it marks an era »when reason almost lost its mind«.[1] For deterrence to be credible it always had to impress rational actors that they are mad enough to actually launch a first or second strike.[2]

1 Paul Erickson, et al.: *How Reason Almost Lost Its Mind: The Strange Career of Cold War Rationality*, Chicago, Ill.: Chicago UP 2013.

2 Indeed, the problem of the retaliatory second strike is particularly puzzling and paradoxical: The second strike is necessary in order to deter a first strike, but once a first strike has taken place, deterrence has evidently failed. Why then retaliate at all since it can only escalate the path toward henceforth undeterrable mutual destruction? This predicament is known, of course, to all

To be sure, contemporary political theory with its conceptions of non-proliferation and deterrence does not play game theory quite so crudely anymore. Instead it speaks of »predictable deviations from rationality« that arise, for example, in arms control negotiations such as efforts to extend the NPT (Non-Proliferation Treaty). The deviation from rationality could be a feeling of not being respected properly or of being treated unfairly. To be sure, in a system that is essentially unfair, one might expect such feelings to arise – the NPT treats states that possess nuclear weapons differently from those that do not and is invoked to deny the aspirations of countries like Iran. So, perhaps, economic self-interest is not sufficient to model the reasoning of strategic actors but needs to be amended by »justice«, »fairness«, or »respect« not as normative conceptions, but as supposedly irrational psychological factors that influence the behavior of economic trading partners.

When thus invited into deliberations of »predictable deviations from rationality« it is not clear on what grounds a philosophical argument can stand.[3] On the one hand, it needs to expose the limits of rationality and show that actual deviations from rationality – if that is what they are – cannot be recovered in a rational calculus. On the other hand, it might point to another kind of thinking that does not involve the contrast of economic self-interest and moral sentiment. Perhaps, it can uncover a kind of prudence (in German, *Klugheit*) which is based in a technological feeling for a mechanism, for an organism, for an algorithm, or for the working order of a system quite generally. To thus explore the shifting ground on which as yet we cannot find our bearing, a play on words might be permissible and even do some work towards disorientation at first and orientation again.

Predictable Deviations from Rationality

The story begins with an anecdote about prudence and care, one that shall serve as a paradigm for rationality – of sorts. The anecdote is familiar, and as it happens, there is some historical truth even to embellished versions like this one. It takes place in Vienna before World War I. This is the Vienna that was a capital of modernism and urbanization, of advanced science and philosophy, it is Wittgenstein's and Freud's

who contemplate a first strike. They must therefore be assured that the second strike will really happen, no matter how irrational it would be after a first strike has already taken place.

3 The workshop in question took place in October 2014 in Washington, DC. Organized by Anne Harrington, Jeff Knopf, and Miles Pomper for the Monterey Institute of International Studies, it was entitled »Real World Nuclear Decision Making: Using Behavioral Economics Insights to Adjust Nonproliferation and Deterrence Policies to Predictable Deviations from Rationality«. For a workshop report see www.nonproliferation.org/wp-content/uploads/2016/01/160112_behavioral-economics-and-nuclear-weapons.pdf (visited: August 16, 2017). I would like to thank Anne as a driving force behind the IANUS network on changing Nuclear Condition(s) at the intersection of technology, politics, and philosophy.

Vienna.[4] This was also the Vienna of the last decades of the Austria-Hungarian empire. And the emperor of that empire refused the amenities of modern life, such as running water, electric lights, flushing toilets. He refused these not because he lacked the means to have his castles and palaces upgraded as were the streets and houses all over Vienna. He refused these not because he was an eccentric old man, set in his ways and affectionately bound to tradition. He did this because he likened his empire to a rotten apple or feeble structure such that introducing even the slightest change could make it come apart entirely and might bring it to collapse. Evidently, he was deeply aware of how precarious his situation was. The modern world of electrical devices would require a different system of rule than that of an emperor, it would be maintained by an elaborate system of wires and grids.

Perhaps, the emperor's refusal to entertain technical improvements is at once a paradigm of rationality and a paradigm for a deviation from rationality, though a deviation that is predictable and thus a rational kind of irrationality, one that can be accounted for and understood, made sense of within the horizon of people caring for the world they inhabit. But then, how should we characterize the emperor's deviation from canonical, formalizable, calculable, perhaps scientific conceptions of rationality towards an understandable, even predictable kind of irrationality? I suggested that this would be an anecdote of prudence and care, but we are not seeing here the kind of prudence that weighs options, that deliberates potential consequences, or that determines the appropriate means for a desirable end – all of which play into the prudential algebra, moral arithmetic, or calculus of pleasures that was first envisioned by Benjamin Franklin and then taken up by Jeremy Bentham.[5] Though it is possible to squeeze the emperor's reasoning into the straightjacket of this form of rationality, doing so would require the introduction of further premises or hidden assumptions. As it stands, the emperor is not seeking the means to prolong his rule, he is not weighing gains of luxury against loss of crown, he is not even saying that the final collapse of the rotting apple is a dreadful thing that needs to be avoided at all cost. He is simply tending to that rotten apple, doing what it takes to maintain it. By the same token, the emperor's attitide also does not correspond to an ethics of care, because there is no consideration here of the moral value of what he is tending to, there is no concern for human suffering, not even his own, that is to be prevented or ameliorated, and there is no concern for the creation of conditions for peaceful living and human flourishing.

4 This anecdote is adapted from Alan Janik, et al.: *Wittgenstein's Vienna*, New York: Simon and Schuster 1973, pp. 37, 41–42. Literally, the emperor did not speak of a rotten apple but a »worm-eaten house«. Janik and Toulmin quote him: »My realm resembles a worm-eaten house. If one part is removed, one cannot tell how much will fall« (ibid., p. 38).

5 See Benjamin Franklin's letter to Joseph Priestley (September 19, 1772) in which he suggests a decision procedure or »what might be called Moral or Prudential Algebra«. From there it was but a small step to Bentham's »moral arithmetic« or »felicific [hedonistic] calculus«.

So, if there is prudence or *Klugheit* in play, it is a special kind of prudence, and what the emperor cares for and tends to is not a moral community or body politic but a way in which things are configured, in which they function, mutually support each other or work together. What the emperor tends to is an order of things, not necessarily a good order, but a working order. And apparently it is no trivial matter to maintain this order, since apparently it does not maintain itself, and we are in respect to it far from a condition of total information. We are thus in the sphere not of structuralism or constructivism but rather that of actor-network-theories. To maintain this order one needs a feeling for its mechanism, that is, a sensorium – to use Bruno Latour's terms – for the length and strength of connections and the distributions of nodes in our network, for the quality of attachments, for obligatory passage points. But in a rather more technical idiom and more mundane than actor-network theory, one might draw on notions of people and things composed and maintained in a working order.[6]

It is from the standpoint of prudence or *Klugheit*, then, that one might make sense of the emperor's irrationality, of his turning a blind eye to the unstoppable march of progress, perhaps even of his ostrich-like behavior of burying his head in the sand. Accordingly, I want to explore in the following how a calculating rationality deviates predictably towards working orders which are technological systems, broadly speaking, that need to be managed or maintained.[7]

Since game theorists and strategic thinkers of deterrence love to tell and investigate hypothetical scenarios, I will draw on fiction and the imagination – following the trail of the German word for prudence, namely *Klugheit* which makes a noun of the adverb *klug* that can been translated variously as wise, prudent, and sensible, not merely clever but clever in a mature and circumspect fashion.

6 Evelyn Fox Keller famously spoke of Barbara McClintock's »feeling for the organism« as a particular capacity of sensing and reasoning in science, see her *A Feeling for the Organism: The Life and Work of Barbara McClintock,* San Francisco: Freeman and Company, 1983. For reasons that should become clear, I prefer to speak here of a feeling for the mechanism, that is, for a system or working order more generally, see Alfred Nordmann: »Das Gefühl der Welt als begrenztes Ganzes. Sachlichkeit«, *Zeitschrift für Kulturphilosophie* 8/1 (2014), pp. 89–99 and Alfred Nordmann: »Werkwissen oder How to express things in works«, in: Gerhard Gamm, et al., eds.: *Jahrbuch Technikphilosophie. Ding und System*, Zurich: diaphanes 2015, pp. 81–89.

7 If I speak of working orders and managed technical systems interchangeably, I do so without reference to systems theory or the non-linear dynamics of complexity. Though it might be worthwhile to explore points of contact. I am not requiring that the systems in question are »complex« in the technical sense of that word – they are more or less complicated, comprehending within themselves a greater or smaller number of processes or parts.

The first of my scenarios of *Klugheit* comes straight from a fairy-tale by the Brothers Grimm and features a very sensible woman.[8] It poses in a personal and personable way the question regarding a predictable deviation from rationality. In my retelling of the story, the protagonist is a king who marries a woman because he is impressed by her *Klugheit.* As one might expect in a feudal system of power, this backfires very soon. In front of his wife, he rules unjustly in a case that is brought before him. So blatant is his injustice that his wife goes behind his back to advise the losing party, suggesting that a kind of *reductio ad absurdum* be staged to expose it. When the king sees it, she assumes, he must mend his ways and reverse his judgment. Far from it, however, he immediately senses the hand of his wife in the ruse, her going behind his back and subverting the ruling. Obviously she needs to be punished and he kicks her out of his castle allowing her to take with her only the one thing that she loves most dearly. And so she sedates the king with a potion of hers and takes him with her away from the castle. When he awakens in a trunk he is utterly delighted – not because of her declaration of love but because of her *Klugheit*, for that is what she truly is, *eine Kluge.*

Now, when the King kicks out his wife, does he know what she will do? From the beginning of their relationship, he has surrendered to her *Klugheit*, and now again he saves face by daringly entrusting his happiness to her. His own *Klugheit* or prudence lies in this surrender. The administrator of justice steps down, so to speak, and gives up his position of calculation and judgement. He maintains the order of things by deferring to its workings. It is not just *her* prudence, then, that is at play here, but *theirs*. The conflicting forms of rationality that are required for the administration of justice and for the maintenance of a commonwealth become attuned to each other as they engage in what Andy Pickering has called – but never fully analyzed – a dance of agency.[9] The king exerts his legal authority by punishing her and she accepts the punishment. And by doing so she tends to the working order of which he knows her to be an indispensable part.[10]

8 In Margaret Hunt's translation, »Die kluge Bauerntochter« was rendered »The Peasant's Clever Daughter«, see Jacob and Wilhelm Grimm, *Household Tales*, London: George Bell 1884 and 1892, 2 volumes. The peasant's daughter then became *Die Kluge* in an opera by Carl Orff.

9 The notion of a »Dance of Agency« was developed in Andrew Pickering: *The Mangle of Practice*, Chicago, Ill.: Chicago UP 1995.

10 It is worth considering in those terms the technical, procedural, bureaucratic administration of justice more generally.

The second scenario of *Klugheit* is firmly based in reality and only needs to be reported from the ground floor of technoscience and engineering, climate modelling and computer simulations, also from synthetic biology and lo-tech tinkering. It concerns an abandonment of what is called rational design engineering and simultaneously the rise of a rational strategy to compensate this failure of rationality. Rational engineering is based on knowledge and principles. In its most ideal form, it consists in the construction and mere implementation of a blueprint. Just by thinking about a problem and bringing the relevant knowledge to bear, rational engineering can devise an intellectually tractable solution, one that can be understood or derived by technicians from plans and drawings just like musicians can read a musical score. When the problems and required solutions become intractably complex, however, other approaches must be sought. Software engineers and modelers might first construct a knowledge-based prototype and then begin a process of systematically tuning it to achieve the desired performance. In order to do so, modules and routines are added, the augmented system tested against expectations, further modules added, parameters changed, correction routines incorporated. Soon the engineered system becomes intractably complex, a maze of modules and routines and no one knows quite what each component does, yet unwilling to pull it out since it might just support the overall working order. The situation soon becomes not at all unlike the rotten apple. Indeed, to this day the Federal Aviation Agency is reluctant to abandon a flight control system that works with outdated computer hardware, unsupported operating systems, archaic software – at least it has been debugged, is in working order, and relies in specific ways on human intelligence.[11] To replace the rotten apple with a new system that utilizes the much-enhanced processing power of modern computers may carry too many risks, as fatal bugs would inevitably be discovered and human intelligence cannot keep up.

When they are in the business not of implementing rational plans but of achieving and maintaining a working order, engineers adapt their standards of rationality accordingly. This is where the *kluge* or *kludge* comes in. It offers a standard for judging engineering solutions: »Klumsy Lame Ugly but Good Enough« (KLUGE) – with »Dumb« sometimes added to make it a KLUDGE. As in all the predictable deviations from rationality discussed here, we here find something dumb that is good enough, we find something which satisfies the requirements of the working order without satisfying intellectual requirements of rationality. As such, it fits into an opposition proposed by Herbert Simon – it provides an example of »satisficing« as op-

11 The *Wall Street Journal* reported on August 16, 2015, that 476 flights had to be cancelled due to a software update in the flight control system which was then retracted immediately.

posed to »optimizing«.[12] While kluges are most prominent in software engineering, a piece of photographic evidence from a mundane bookstore beautifully exemplifies how the kluge is an insult to human intelligence and at the same time a tribute to human ingenuity. Along with many other kluges, it appeared on the website »there I fixed it« and features a stack of books lying sideways in a bookseller's shelf. Bold letters run across twelve of the volumes in the stack and spell the message: »These books are here for an essential structural purpose. They are not for sale.« In other words, the shelf might collapse if a book lover were foolish enough to take a volume from a stack that is evidently used to support the shelf – presumably, the other books in the store are for reading.[13]

Alexander Kluge

With the klu(d)ge, we decisively shifted from the management of a social order to the management of a technical working order. The commonality between these modes of management is a major theme in the work of Alexander Kluge who is, along with Jürgen Habermas, perhaps the most prominent and interesting among the last members of the Frankfurt School of critical theory. The philosopher, political theorist, lawyer, filmmaker, television producer, and prolific author of non-fictional literary fictions is a story-teller who explores the forms of rationality that tend to the working order of humans, that is, to the working order of a federation of cells and their sensory modalities in a world that needs to be judged primarily as hot or cold, accommodating or resisting, rigid or malleable, trustworthy or treacherous.

Kluge's stories read like reports, they are sober renditions of the course that a life can take, of a scientific experiment, of a one-time encounter, of the battle at Stalingrad, of the bombardement of Halberstadt, of a transaction during the financial crisis. They are narrated with such matter-of-factness and so deeply entrenched in familiar historical contexts that one can never be quite sure whether they concern a real or an imagined event. Accordingly, Kluge's imagined or invented stories meet a high standard of realism – it is the reader's knowledge and experience of the world,

12 See Herbert Simon: »Rational Choice and the Structure of the Environment«, *Psychological Review* 63 (1956), pp. 129–138. To be sure, kluges also serve to optimize some given system by adapting it to achieve a desired performance or behavior. The system will fail to be optimal only in respect to notions of rational design and attendant notions of maximal efficiency.

13 I encountered this image in an inspiring presentation by Maureen O'Malley on kluges in synthetic biology. While it appeals especially to philosophers and other book-lovers, the thereifixedit.com website offers many amusing examples. One offshoot of all this is Gary Marcus's popular science book *Kluge. The Haphazard Construction of the Human Mind*, New York: Houghton Mifflin 2008, which conceives of the mind as a clumsy and inelegant solution to the problems posed by its environment. It thereby suggests a theory of unintelligent design for the emergence of mind.

after all, that render these fictions as something that may as well have happened. This is true also when Kluge writes about strategic decision-making in military contexts.

In the collection *Die Lücke, die der Teufel lässt,* Kluge groups a number of his semi-fictional anecdotes around the 2003 Munich security conference and thus around the ways of making sense of the 9/11 terrorist attacks and their aftermath. He »reports« a conversation between two experts and thereby introduces the suggestion that the response to the act of terrorism did not follow a logic of warfare (*Kriegslogik*) but a logic of seeking out realities (*Logik der Wirklichkeitsfindung)* – an enemy had to be found who could answer to the weapons in the arsenal.[14] Two pages later he features another conversation, supposedly cut short by the need to get a cup of coffee before the end of the break. It concerns the accidental shooting down of a British plane by US forces, and whether the same could have happened to a US plane. One of the experts denies this, citing the technical superiority of the US weapons systems. The following exchange ensues:

> » - But it is crucial for the coalition that us partners are seen as military equals.
> - That's where the problem comes in of unsoundness in war (*Unwahrheit im Krieg*). War takes everything apart that isn't sound. In that way, it is the harshest critic.
> - You ascribe intelligence to war?
> - Not intelligence but analytic power.«[15]

In both episodes, the working order of a military system with its technological capabilities demonstrates its power to render salient certain features of reality and thereby to constitute a reality in which some are answerable and some are not, in which conceits are exposed as illusory. This identification of salient features and probing of conceits illustrates the analytic power of the machinery of war itself and not of the strategic thinking of anyone who deploys this machinery. This, at any rate, is how the experts, the machinists of war, would talk. It is decidedly not the language of politics, of reason or rationalization.

The logic of finding a fit is featured also in one of Kluge's early books, one of the few of his literary works that were translated into English. Lieutenant Boulanger took on a gruesome task, supposedly in the service of science, and definitely in the context of German atrocities during the Nazi period. The perversely precise execution of his task required a kind of stringency, however, that proved hard to attain in practice:

> »The strong possibility of error made it seem advisable to discontinue the mission altogether. By the same token it followed that, if the mission were continued, the errors must be tolerated and allowed for in the calculations. So Boulanger was beset by endless

14 See Alexander Kluge: Die *Lücke*, *die der Teufel läßt*, Frankfurt am Main: Suhrkamp 2003, p. 618.
15 Ibid., p. 620.

> doubts, but he felt that these doubts must not be permitted to hamper the careful and conscientious execution of his mission. It was therefore important to him to convey his ideas and good intentions to an area where they could not harm the performance of his duties: during the period he read philosophical works […]«.[16]

Here, then, the apparently unavoidable deviation from rationality forced Boulanger towards the sphere of pure reason – one in which such deviations need not be countenanced. The weapons in his arsenal and his good intention to fastidiously execute a plan demanded a reality that is answerable to the plan. However, the arena of politics and war did not provide this reality, but required instead other ways of engaging with real world problems. The mission could only be continued, therefore, if an outlet could be found for the scientific spirit, that is, another reality in which good intentions (*ein guter Wille*) can be realized. In the philosophy of Kant – most likely the one that Boulanger turned to – it is the *Reich der Zwecke* (sphere of ends) as opposed to the sphere of nature or the fog of war that provides the playground for the good will and its rational means to evaluate maxims of action. In the case of Boulanger, therefore, the desire to compensate the deviation from rationality and to return to the realm of reason is itself a predictable deviation from rationality. Reading the philosophical works of Kant is Boulanger's klu(d)ge, that is, it is his way of acknowledging the analytic power of war as well as the prudence and care required for tending to the maintenance even of a rotten apple.

Attunement

For Lieutenant Boulanger to function properly and continue his mission, he needed to be tuned or calibrated properly. If practical conditions were too error-prone, preventing him to continue in good conscience, he needed to find relief in another sphere. This requirement of his inner machinery or working order was more important than the theoretical question of whether his philosophical readings were consistent with the atrocities he had to commit in pursuit of his mission.

In one of Kluge's films – *The Power of Feelings (Die Macht der Gefühle)* – there is a brief scene where a stodgy mechanic explains the art of fastening a screw. The upshot of the explanation is that, no matter how fat one's fingers, one has to do this with feeling. Force needs to be exerted, of course, but neither too little nor too much – it has to be a force that does not force the screw. In the act of fastening the screw the mechanic acknowledges the resistance coming from the material since he experiences the response of the screw to the force exerted by him. He is also engaged in a

16 See Alexander Kluge: *Attendance List for a Funeral*, New York: McGraw Hill 1966, pp. 119–120, see p.115.

dance of agency which Kluge likens to love-making – when lovers want to be touched just right, firmly but not clumsily, responsively and without violation.

In another scene of that same film, Kluge introduces by way of his characteristically wry voice-over a prostitute who will be the heroine of the episode to come.

> »Betty's secret of her trade:
> 1. precision
> 2. gentleness
> 3. no particular feeling
> But it takes a great deal of feeling to maintain these three things all at once.«[17]

Betty has to be no less circumspect than the mechanic, in fact she is a »machinist of love«.[18] And when fastening his screw, the mechanic has to be no less sensitive and responsive and precise than Betty. Kluge refers to their feelings for the mechanism as *Sachlichkeit* which is an attitude analogous to but very different from that of objectivity in science:[19] Objectivity is an intellectual attitude of neutrality or detachment for the purpose of facilitating intersubjective agreement among people. *Sachlichkeit* is the requisite attitude for becoming attuned to the requirements of a working order for the purpose of establishing what one might call an interobjective agreement among devices. *Sachlichkeit* seeks attunement to a socio-technical system for the purpose of maintaining, managing, reconstructing, modulating, steering or developing it such that its component parts – people and things and their relations – mutually support or agree with each other. As an epistemic attitude or way of beholding and relating to things, *Sachlichkeit* enculturates a feeling for the mechanism of a working order, a way of knowing one's way about the composition of things, their relative standing to each other, their sensitivity to displacements. It aims for a theoretically informed practical knowledge of all that it takes to keep a rotten apple from coming apart.

»Attunement« is the achievement of *Sachlichkeit*, it is knowledge of a working order and as such corresponds to prudence and care as we first encountered it in the story of the Viennese emperor. Attunement is deeply implicated in a *status quo* but cannot simply be identified with political conservatism – it is neither committed to preserving the present nor is it afraid of change. Instead, it takes its knowledge of a present working order as the only material for building or making a world, including a new and different world: The present working order has to be acknowledged as the primary resource for any future working order. In this sense, as Kluge writes, one has to be conservative in order to be progressive. Historical catastrophes (totalitarian

17 Alexander Kluge: *Die Macht der Gefühle*, Frankfurt am Main: Zweitausendeins 1984, p. 145.
18 Kluge first conceived this scenario in »Das sabotierte Verbrechen. Entwurf für einen Spielfilm« in Alexander Kluge: *Gelegenheitsarbeit einer Sklavin. Zur realistischen Methode*, Frankfurt am Main: Suhrkamp 1975, pp. 23–51. Here, he refers to the prositute as a »machinist of love« (p. 29).
19 For the following, see the paper on »Sachlichkeit« cited in note 6 above.

systems, genocides, wars) arise when something new is introduced prematurely and when the old is defended beyond its time – they result from a lack of attunement to the right moment when change is necessary, when its time has come.[20]

To be attuned consists in being implicated with a working order but does not therefore attach moral or political value to its preservation. All the while it tends to the working of things in a way that acknowledges and thereby values them: Attunement exemplifies sensitivity and attentiveness, selfless engagement, humility toward the powerful reality of facts. These are managerial virtues that allow for the modulation of complex systems. They come to the fore when strategic rationality loses its bearing or is not brought to bear in the first place.[21]

In Good Hands

To the non-expert reader of the daily paper, strategic thinking no longer governs the discourse of nuclear (non-)proliferation or disarmament. The dangerous presence of the bomb is to be contained not by way of deterrence, mutually assured destruction, and related concepts – that is, in reference to the bomb as a weapon or to an arsenal of weapons with a certain destructive power, mode of delivery, and battlefield impact. Instead, the dangerous presence of the bomb is to be contained by way of tracking, monitoring and regulating the flow of fissile material, by tending to the physical integrity of arsenals, by implementing technical safeguards – that is, in respect to the bomb as a generalized destabilizing hazard not unlike climate change or environmental pollution, raising questions of the whereabouts, quantity, and quality of plutonium, questions regarding the effects of age on nuclear arsenals, or the deployability of more and less disassembled weapons. This shift of focus comes along with a shift from a political to a managerial discourse, from strategic questions of power to technical questions of maintenance.[22] The overriding question appears to

20 See Alexander Kluge »Das Politische als Intensität alltäglicher Gefühle. Theodor Fontane«, in: Alexander Kluge: *Theodor Fontane, Heinrich von Kleist, Anna Wilde*, Berlin: Wagenbach, 1987, pp. 7–18, esp. p. 16–17. Accordingly, perhaps, Kluge's production company is called *Kairos*. – Authors as diverse as Nelson Goodman and Karl Marx also made what is only an apparently trivial point: The material for making a new world must be available already in the given world.

21 Another episode from Kluge: *Die Macht der Gefühle* illustrates this in his characteristically laconic style: Its protagonist is a match-maker who seeks to bring the required precision to her task and recognizes the need for ultrafine-tuning. Match-making would be easy, she notes, if everyone had only one feeling or sensory modality, but the problem is that all people have all sensory modalities. Match-making is thus not a matter of fulfilling a wish or executing a plan, but one of finding or forging a fit beween two material systems. See Kluge: *Die Macht der Gefühle*, p. 126.

22 To be sure, this brings to the fore that power may have less to do with the ability to enforce political objectives and more to do with the general technical and managerial competence of a knowledge society.

be: Is the bomb in good hands, to whom can it be entrusted, what engineering capabilities, which public institutions or systems of governance are required to ensure the (relative) safety of the global arsenal?[23]

The apple is rotting. During the times of the Cold War, the precarious equilibrium of strategic threats had its own working order. It could be trusted and, in fact, had to be trusted in many ways. The weapons were carefully monitored, subject to permanent surveillance from many points of view. They were closely watched through the eyes of one's own strategists, technicians and engineers, military personnel, local opposition forces, but also through the eyes of friends and foes, international agencies and monitoring groups. Everyone was attending to the weapons for different, perhaps conflicting reasons, and yet the many observations were maintained in a relation of mutual support. The weapons themselves became fixated and paralyzed at their center of attention.

When the so-called »four horsemen« (Henry Kissinger, George Shultz, William Perry, Sam Nunn) and political leaders like Barack Obama have called for a world without nuclear arms, it is because they are worried about the break-down of this working order.[24] In their view, the current modes of monitoring, proliferation, negotiation, and sanctioning represent a deviation from the Cold War rationality of deterrence with its system of mutual checks and balances. Accordingly, they call for adequate ways of controlling material flows, of regulating access, of instituting transparency and accountability. Their question is a technical question: Given the half-life of plutonium and given the volatility of systems of government in many parts of the world, how does one institute a robust international system of arms-control? Thus, they worry only secondarily whether the weapons might get into the wrong hands, politically speaking and in the short term. They pose primarily a question from within a technologically advanced, economically and politically robust knowledge society – aside from the United States, who can be counted upon to reliably provide the necessary know-how in the long term? Who can take responsibility for the management of what was once and is no longer a denumerable, firmly circumscribed set of nuclear things?

This point can be further developed by briefly considering three other aspects of the current state of debate: First, as Christopher Daase has pointed out, the extension into the future of the nuclear privilege of weapon states in the NPT becomes ques-

23 We are here reminded that the notion of governance derives from the steam engine's governor – it implies regulation through feedback.

24 This, to be sure, is the impression of the aforementioned non-expert reader of the daily newspaper – who fully expects that the experts would offer a far more complex, and also more political reading of the political agenda of these elder statesmen. For the texts that might be encountered by this untutored reader see, for example, Eben Harrell: »The Four Horsemen of the Nuclear Apocalypse«, *Time* magazine, March 10, 2011, online at http://science.time.com/2011/03/10/the-four-horsemen-of-the-nuclear-apocolypse/ (visited: August 16, 2017).

tionable when this privilege no longer serves to maintain a taboo in times of strategic conflict but when it somewhat arrogantly declares whose hands are the good hands such that they can be entrusted to carry out a managerial process. Inclusion and exclusion can be justified more easily on the criterion of the possession of nuclear weapons, it becomes contestable if the criterion is the cultural competence of handling with due diligence and care a dangerous and globally endangering commodity.[25] Second, this may prove to be the reason why some of the non-nuclear states like Norway, Austria, Mexico are seizing the moment to claim that, if anyone, they are best suited to frame the question or redefine the terms of the debate. They wish to bring the humanitarian consequences to the fore and thus the mishandling of the bomb, irrespective of a balance of power or terror.[26] Finally, when the question is one of maintaining or recreating a safe working order for a dangerous technology and when the arms race is taking place between knowledge societies and their claims that the technology is with them in good hands, the general technical capabilities of these societies become increasingly important. The responsibility of diplomats and negotiators in the political and military sphere to create conditions for global security is shifting to the maintenance, broadly speaking, of a safety culture in civil society.

If this diagnosis is correct, the rules of the game have changed as has the rationale for inclusion and exclusion in the club of nuclear-weapon states, and the definition of the community of responsible actors. The global challenge is defined not as preserving peace or security in an age of ideological conflict and competing national interests. Instead, the challenge is one of tending to a working order of nuclear safety and safeguards. Issues of proliferation and disarmament, transparency and control now appear in the collective consciousness as analogous to the global threat of climate change. Both put national and stakeholder interests into a managerial mode. The Earth and the Bomb need to be handled with care – grounded in the perhaps illusory hope that in good hands, with a technical mindset, and attunement to the complexity of affairs, the challenge can be met and the danger contained.

25 See Christoper Daase: »Die Konstruktion normativer Singularität – zu Entstehung und Wandel des nuklearen Tabu«, in: Constanze Eisenbart, ed.: *Die singuläre Waffe? Was bleibt vom Atomzeitalter*, Wiesbaden: Springer 2012, pp. 185–206. Hugh Gustersson has spoken in this context of an indefensible »nuclear orientalism«, see his »Nuclear Weapons and the Other in Western Imagination«, *Cultural Anthropology* 14/1 (1999), pp. 111–143.

26 This initiative came to fruition when the UN on July 6, 2017 adopted a treaty to prohibit nuclear weapons, www.un.org/disarmament/ptnw/index.html (visited: August 16, 2017).

At this point it may appear as if I wanted to recommend or valorize an engineering approach that abstains from moral and political judgement but brings to the table the requisite understanding for maintaining, modulating, recreating a working order or technological system. This is not the case. I am arguing merely that one need to take seriously the different modes of conceiving the problems that are in need of solution – not only because the definition of a problem entails a conception of its solution and the reasoning processes adequate to it. If only for heuristic purposes we should attend to the implications of a shift from the logic of warfare and deterrence to a logic of attunement and trust – attunement to a working order and trust in the good hands of technical expertise. In conclusion, here are some of these implications, briefly stated.

First of all, the acquisition of working knowledge and the ability to maintain and modulate a working order does nothing to justify technocratic approaches or to enthrone the expertise of managers and engineers. As the case of the klu(d)ge served to remind us, deviations from strategic rationality coincide with deviations from top-down engineering or rational design. The situations in which working knowledge comes to the fore are highly ambivalent, whether it is the challenge of maintaining a rotten apple or of managing material flows in an ageing nuclear arsenal. In these situations, rational decision making is of the kind where a security update is scheduled to the operating system of a computer and users wonder a bit nervously whether it is really such a good idea to install the update. Not only the readers of Charles Perrow's *Normal Accidents* will wonder whether the security updates might increase the complexity, perhaps instability, perhaps insecurity of the operating system.[27] And of course, with the end of the Cold War, the operating system of nuclear security has been changed, prompting us to ask anew what are the conditions for stability and security.

Secondly, as Günther Anders has pointed out, with nuclear weapons came a profound reversal. Up until the 20th century and even now in terms of the implicit normativity of any conception of politics, the development of technology took place within the horizon of history. Notions of progress, of meaning, of human welfare provided orientation to the diffusion, assessment, appropriation, and regulation of technology in and by society. Owing to the brute facticity of the bomb and its irrevocable dangerous presence, history has been taking place within the horizon of technology, anxiously concerned to address the requirements of peace, to answer and mitigate more or less imminent but undeniable technological threats to human sur-

27 See Charles Perrow: *Normal Accidents. Living with High-Risk Technologies*, Princeton, NJ: Princeton UP 1984.

vival.[28] This grand instauration of the bomb as the center of attention and concentration of power has gone unquestioned by strategic efforts to institute a system of effective mutual deterrence. It goes equally unquestioned by the technological or managerial mode of tending to the working order of the nuclear machinery. In this sense, there is still no alternative that might break the spell of the Bomb and that might reestablish politics, morality, history as the horizon within which problems can be addressed like climate change or the hazardous waste of a post-Cold War nuclear arsenal.[29]

Finally, the analysis provided here serves to confound the notions of nuclear safety and nuclear security and in this sense blurs the boundary between concerns with nuclear energy and nuclear arms. Nuclear engineering and its working knowledge provides a common denominator for the otherwise distinct challenges of on the one hand hazardous waste and the safety concerns associated with nuclear power, and on the other hand the hazardous »waste« that appears as the material shadow of the weapon – which is all that is left behind when strategic thinking whithers away and the question arises of creating a regime that can reliably manage the radiant remains of a former nuclear working order.[30]

The technological rationality of nuclear security is not one of means and ends: The ballistic missiles that are aiming at each other are not the means for the achievement of deterrence, nor is the whole machinery of deterrence a means for the maintenance of peace (or for a deferral of ineluctable catastrophe). The insane logic of deterrence, its required deviations from rationality cannot be fitted into the sober schemes of means and ends. Instead, the technological rationality of the international system of nuclear security lies in the technical demand that it be tended to, taken care of, calibrated, fine-tuned, maintained. No matter how precarious it is – a rotten apple, indeed.

28 Here it becomes apparent again that climate change currently inhabits this space.

29 This point, in particular, is indebted to Anne Harrington and Matthias Englert – and their interest in »nuclear philosophy« which they defined as bringing »tools of critical analysis to bear on problems of nuclear policy. The goal is to recover space for human agency within the debate about nuclear security by transforming nuclear weapons from the subject into the object of the discourse« (quoted from their blog http://blog.nuclearphilosophy.org/?p=7, visited: August 16, 2017).

30 As Matthias Englert has pointed out (in conversation), the Ukraine provides a case in point. Once firmly entrenched in the regime of civilian nuclear power and Soviet nuclear weapons, Chernobly and the Crimea speak of radiant remains and the difficulty of containing them, that is, of keeping sites and arsenals safe.