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Beware of Art: ARTificial Intelligence Challenging Organizations and Society

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Christian Stary, Claudia Schnugg

Algorithmic Overdependence: Fostering Awareness through Digital Facilitation and (Re-)Construction

Abstract

This contribution intends to raise awareness of connectedness in the continuous digitalization of society and organizations. It suggests points of reflection when being tracked by Internet-of-Things systems, which in turn encourage or discourage behavior. The question arises: How much digital facilitation is necessary and when does algorithmic overdependence dominate? Concerns related to the invasive expansion of digital technologies and their 'smartness' (through algorithms and artificial decision-making) to direct behaviors of all kinds can be represented and experienced by art installations. We suggest promoting constructive awareness by offering a scenario in such an installation. It allows subjects to experience algorithmic influence and subsequently encourages regaining control through individual capacity building for individually coherent (and transparent) design. The proposed installation enables new forms of governance based on experiential learning and digital artefacts for personal mastery of collective intelligence.

Keywords: Internet of Behavior, predictive analytics, artificial decision-making, behavior control, governance, opacity, digital literacy, design-integrated engineering, citizen participation, accountability

1. Caught in the Web of Behavior Due to Digital Intelligence?

According to the renowned research and advisory company Gartner, by 2023, individual activities will be tracked digitally by an "Internet of Behavior" to influence benefit and service eligibility for 40% of people worldwide. This Internet of Behavior will link a person digitally to their actions.[1] For example, linking an image as documented by facial recognition with an activity such as purchasing a drink from a vending machine can be tracked digitally. The resulting understanding of an individual's or group's behavior can profit various actors. For example, not only vending machine providers and drink producers will track individuals' behavior for arranging their offerings model; insurance companies will also track individuals' behavior for determining a corresponding pricing model.

Tracking and applying knowledge about behavior will not only link individuals to their preferred actions and always provide their preferred drinks in the vending machine, nor only help companies to create the best pricing models. The Internet of Behavior can also be used to encourage or discourage behavior. Algorithmic processing of data enables navigation and synthetization of large amounts of data. Based on identifying patterns from all the data, it allows conclusions to be drawn in a time-efficient way: The tailored efficiency of algorithms can shift attention to a limited choice. For instance, an observing individual's behavior in a certain situation might provide the best inference results for similar situations but lack other opportunities when algorithms do not capture alternative viewpoints on activities. Results may differ among those individuals an algorithm deems to have certain properties, e.g., walking on the right side of a street. Contextual information, such as the street environment or the country of origin, can shed light on the meaning of artificial conclusions. 'The danger of such reliance on algorithms is that, despite the benefits and assumption that algorithms are efficient, logical, and data-driven and therefore unbiased, algorithms are not infallible and oftentimes carry biases of their own or of their creators' (Wei et al., 2017, p. 3).

1 https://www.gartner.com/smarterwithgartner/gartner-top-strategic-predictions-for-2020-and-beyond/

Once providers or users depend too much on algorithm-generated information they become algorithmically overdependent (Banker et al., 2019). Then, information generation and exchange are increasingly handled autonomously by digital systems, leading humans to give up control unwittingly and losing track of process-steps they are held accountable for.

The technological drivers of such developments are the Internet-based communication system and the increasing set of objects that can be connected, mutually and with people, by utilizing the Internet protocol stack. Internet technology operated as part of so-called Internet-of-Things (IoT) applications allows the connection not only of people but also of physical objects of various kinds. It enables the integration of various sensors, actuators, and objects so they can communicate directly with one another without human intervention (cf. Lin et al., 2017). Such digitalized objects can track the state of humans and their level of awareness (to their environment), and guide them to achieve their objectives, such as finding a location. Others can intervene in certain situations, e.g., stopping a car to prevent an accident. Information is collected by sensors and combined to trigger either actuator or human behavior. Originally passive or observing elements such as sensors can become active ones (Shaev, 2014).

The enrichment of communication and interaction between humans and artefacts of all kinds linked with IoT-based networking developments converge physical, digital and the virtual elements 'to create smart environments that make energy, transport, cities and many other areas more intelligent' (Vermesan et al., 2013, p. 8). This intelligence is based on algorithmic decision-making tools, which are increasingly used by government and private bodies. Artificial decision-making is applied to various forms of data, often relying on the algorithmic analysis of personal information. As a result, a new wave of policy concerns has emerged (Zarksy, 2015) questioning the legitimacy of algorithmic decision-making and asking for accountability (cf. Binns, 2018, Hutchens et al., 2017, Bovens et al., 2014). So far, they have not been satisfactorily resolved, although individual notice and consent has become commonplace – cf. the video camera sign when entering public places like train stations. Rather, troubling implications for democracy and human flourishing are expected, when self-interests of companies or public bodies determine the use of collected data and oversee their future use (Yeung, 2017).

Overdependence has nurtured the discussion of a *scored* society (cf. Citron et al., 2014) and *algocracy* (cf. Danaher, 2016). It underlines the need to understand overdependence on an analytical level while on the basic level, vast reactions and actions with respect to the detriment of individuals occur. On an analytical level, the nature of these concerns is linked to the way the decision-making relies on biased and inaccurate datasets, the opacity of applied algorithms, the lack of thorough review, and/or opportunities to intervene from a design perspective.

An awareness of this analytical understanding of overdependence of all actor groups needs to be raised. We elaborate on algorithmic data processing and on (re)gaining control through active design intervention and introduce the concept of an experiential learning support installation. By creating experiences, especially artistic installations can help different audience groups to understand complex theoretical ideas and explore technological concepts through sensemaking construction (Schnugg, 2019). Entering the proposed installation provides a feeling of getting 'caught' in the Internet of Behavior by providing a feeling of opacity and lack of transparency. Based on data measured with IoT components interlinked with decision-making algorithms, the scenario also physically limits the person passing through. At the end, the results of the algorithmic interpretation of behavior and prescriptions will be generated and handed out to each person. These results are expected to trigger demand for (re)gaining control of IoT system behavior. Hence, a second part of the installation includes a novel governance scheme with digital design facilities that allow for learning and exploration. In this way, the feeling of oppression is modulated towards actively engineering IoT-spaces.

2. Algorithmic Overdependence – Opening Space for Intervention and Facilitation

Algorithms form the core of machine intelligence since their processing leads to computer-interpreted data and decisions. Those can be used to influence human behavior and to direct human coexistence. A recent example concerns social relations that undergo significant changes in everyday life and sociality due to pervasive and perpetual mediated presence of friends by social media (cf. Thulin et al, 2020): Not only the emergence of novel constraints of coupling with other interactors (e.g., becoming 'friends') and the recoupling of social interaction can be observed, but also modified rhythms of interaction in terms of increasing frequency and insistency. Both finally affect human foreground activities due to the continuous stream of online contacts, including their structuring. Such 'domestication' processes of digital media are based on role shifts. Individuals shift from being passive receivers and consumers of technology to highly active interactors. Novel forms of (social) networking driven by interactors' behavior shape technology's meanings, functions, and representations. The material artefact and its algorithmic capabilities shape the individuals' sensemaking of digital systems, as well as how their actions affect individual sensemaking (Mesgari et al., 2019).

But do algorithms incorporate these factors and categories of information? Wayingwe (2019, p. 6.) explains:

> 'Conclusively, algorithms intend to present an avid manner in which artificial intelligence skills could be applied in organizational decision-making sections. However, its actual use to guarantee improvements in consideration to those who are both directly and indirectly affected by the resultant decisions is inevitably jeopardized by the variations in considerable factors so as to ensure a positive change (The New York Times, 2018, p. 19). It is evident that algorithmic approaches are entirely dependent on the users' mastery of computer skills such as coding, instructional discernment, and the capacity to execute the encoded guidelines (Danaher 2016, p. 256). Furthermore, overdependence on the algorithmic requirements deters user

> organizations and individuals to consider mental capacities, situational changes and the relevant needs of data contributors and decision-making beneficiaries. Therefore, algorithms can be improved by frequent changes and improvements in relation to the systemic requirements to give a sensible meaning to decision-making organizations and individuals.'

The ever-increasing application of algorithms to decision-making in a range of social contexts has prompted demands for algorithmic accountability: Accountable decision-makers must provide their decision subjects with justifications for their automated system's outputs (Binns, 2019). So far, it is still open what kinds of principles such justifications can be expected to appeal to. Moreover, accountability needs to be based on a common concept understanding. Bovens et al. (2014) explains accountability of a party A to another party B in case A has an obligation to provide B with some justification regarding a certain conduct. If B finds A's justification to be inadequate, A may face some form of sanction. This has important implications for algorithmic decision-making and the actors involved.

Imagine a community deploying an IoT surveillance system is held accountable by a citizen who is denied access to a public service by the system. Accountability in this scenario might consist of a demand by the citizen that the community provides justification for the decision; a response from the community council with an account of how the surveillance system works, and why it is appropriate for the context; and a final step in which the citizen either accepts the justification or rejects it, in which case the community council might have to revise or reprocess the decision with a human agent, or face some form of sanction. Such a situation serves well as input for experiencing algorithmic overdependence, particularly the impact of opaqueness with respect to directly affected stakeholders.

In our example, one way for the community council is to provide evidence of prior effective algorithmic decision-making, e.g., meeting public demands for security. It could also provide proof of methodological and/or scientific rigor in the development of algorithms for decision-making. Finally, (possibly) affected stakeholders could be invited to participate in explanatory features, or more proactively to the redesign of the IoT application and co-create transparent algorithms for automated decision-making with the development team. Such a move not only avoids *a posteriori* resolving of misunderstandings and resulting conflicts, but also addresses a major challenge to accountability (cf. Zarsky, 2015). Allowing affected stakeholders to scrutinize and hold to account the exercise of algorithmic design of decision-making strengthens the commitment to share responsibility for dependence on algorithmic decision-making.

Tackling transparency as a problem for socially consequential mechanisms can concern several forms of opacity (cf. Burell, 2106): '(1) opacity as intentional corporate or state secrecy, (2) opacity as technical illiteracy, and (3) an opacity that arises from the characteristics of machine learning algorithms and the scale required to apply them usefully'. We recognize that increasing technological literacy could help to uncover algorithmic decision-making and reflect on its purpose. Moreover, audit trails to the algorithmic process or interactive modeling allow individuals to gain a better understanding of how their actions impact upon the algorithmic response (Citron et al., 2014). Recognizing the distinct forms of opacity that may come into play in given applications is key to determining which technical and non-technical solutions can help to prevent harm.

Transparency can help restore accountability. Even when sophisticated algorithms are inherently opaque, algorithmic decisions preferably become more understandable, either to be interpreted ex post or to be interpretable ex ante by responsible and affected stakeholders (cf. Le Laat, 2017).

3. Immerse Experience and Facilitation Design for Re-Weaving the Web of Behavior

We term the suggested installation *Digitized* as it starts with experiencing the algorithmic overdependence based on IoT components and triggers the use of digital facilities for (re)designing IoT settings to regain control over digitized systems. Capacity building is driven by personal experience of algorithmic decision-making and by creating an understanding of IoT system components and their interplay. The desired outcome is an individual's (re)gained confidence in dealing with complex systems in an analytical and constructive way. Such experiential design is understood as artful in the context of business innovations (Cain, 1998) and can be connected to artistic elaboration of the installation. Through experience it reduces the semantic gap between non-familiar systems or objects and affected stakeholders.

Fig. 1. Momentum-based experiential design

Figure 1 gives an overview of a possible instance of the *Digitized* installation to be located on a usually crowded part of a university campus or a similar public place. The interactive experience is based on 4 momentums. Starting with conveying the feeling of oppression (Momentum 1) and that of overdependence of algorithmic decision-making for behavior en- or discouragement (Momentum 2), the momentums cumulate in design-centered engineering of an IoT application when developing component understanding (Momentum 3) and behavior control (Momentum 4).

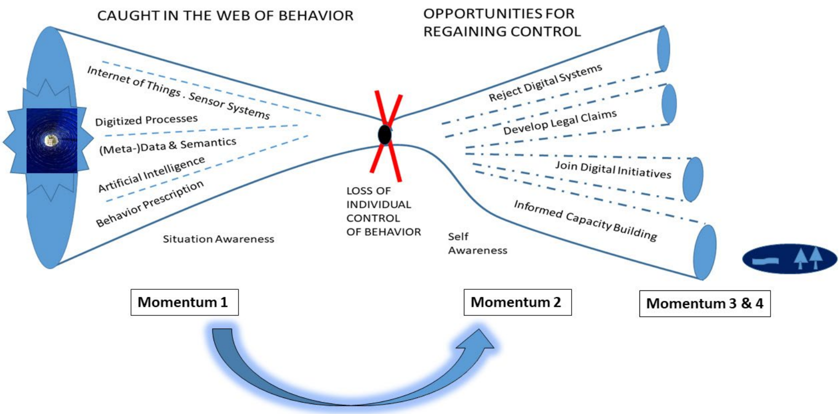

Fig. 2. Options-generating Momentum 1

Figure 2 overviews the prepared topics in the *Digitized* tunnel approaching some point of decision-making after experiencing the loss of individual control of behavior. Walking through the small entry several options (right-hand side of Figure 2) become available. When aiming for encouragement (Momentum 2), Momentum 3 introduces design-centered engineering of an IoT application for regaining behavior control in Momentum 4. Each momentum is described in the following.

Momentum 1: Feeling of Oppression

Making the increasing invisible restriction of behavior explicit: The interactive experience starts by passing through a tunnel that is getting smaller so that participants begin to feel uncomfortable, until at the end of the tunnel a small outlet is available. This needs to be passed to continue the interactive experience. The participants walk towards the end of this narrowing tunnel, leaving digital finger- and footprints until they leave the tunnel through a small outlet with an algorithmic decision displayed on their future behavior regulations, making the invisible parts of the IoT system visible in terms of conclusive behavior prescriptions. Navigation and deep links to content and background information on the domestication and development of IoT systems are provided along the tunnel wall by IoT components, interactive stations, and QR codes. The visual, acoustic and spatial experience becomes more intense the more data is collected and the lower the range of opportunities by algorithmic decisions-making becomes. Hence, the feeling of oppression is triggered through multiple channels, regardless of whether the behavior conforms to expected patterns or leads to regulating a participant's behavior.

Figure 3 shows the concept of the tunnel design. The tunnel is equipped with information and interactive stations on the IoT (i.e. the system context), showing some of the sensor systems physically. The tunnel system collects sensor data and processes them using decision-making algorithms on the behavior of each participant. Movements, time, navigations paths followed on the screens on the walls of the tunnel, etc. are recorded and reflected to the participant as part of that process.

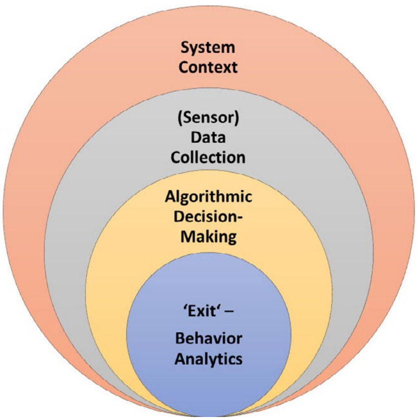

Fig. 3. Structuring the tunnel experience (Momentum 1)

Momentum 2: Experiencing Algorithmic Overdependence

Confrontation with the system that incrementally restricts behavior based on artificial decision-making: Passing through the small exit, each participant receives information how their behavior in the installation shapes and constrains future behavior, e.g., by restricting access to information, resources, services, social contacts and settings. It is a manifestation of algorithmic overdependence in an IoT environment for an individual who is part of a community. For instance, a student is denied access to certain services, while being nudged to adapt to certain ways of behavior, such as booking courses earlier to individualize course designs. Figure 2 captures typical behavior patterns that can result from experiencing algorithmic decision-making. It shows that besides informed capacity building based on the intention to (re) gain control of IoT technologies, other strands of action can result from the tunneled experience.

Momentum 3: Regaining Control

Zooming out & zooming in, actively exploring the system: After having received the interpretation of individual behavior data, the participants are guided to a learner-friendly location nearby to start actively (re-)designing an IoT application. This set of activities aims to explore a variety of design opportunities. They have a digital baseline, i.e. the 'digital twin' of themselves in the installation. The digital twin is prepared on a tabletop system (Oppl et al., 2014) (see Figure 4). It represents all IoT elements the participants were able to experience through algorithmic decision-making in the *Digitized* tunnel in the form of abstract block elements and their relationships. In this way, participants can physically generate of model of IoT components, including sensor systems and software components processing collected data (see Figure 5 and Figure 6). In addition, algorithms (encoded in hard- or software) can be decomposed to explain step-by-step computational intelligence.

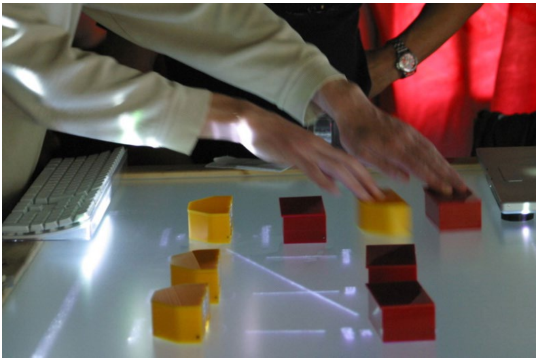

Fig. 4. Modeling the digital twin on a table-top system

Momentum 4: Self-efficient Digital Capacity Building

In-depth understanding leading to action: The model created in Momentum 3 needs to be instantiated by IoT elements and synchronized by a specific operation logic (algorithmic decision-making procedure). For capacity building, so-called Nerd Trees (see Figure 5) have been designed (Stary et al., 2020). They contain simple and combined IoT components. Participants can grab one or more IoT components, namely IoT-(i.e. M5Stack©) elements in each of the boards (layers) and compose applications according to their model. Since these components have inherent behavior, their coupling makes the IoT system operate according to participants' individual needs as represented in their model. The implementation allows monitoring of the generated data and the flow of information for decision-making. Figure 5 shows the top-down and bottom-up drivers to explore IoT systems and their components. The layered approach of the Nerd Tree supports middle-out capacity building, in particular for visitors who are familiar with combined sensor systems including temperature and movement measurement and who want deeper knowledge, either in technologies or application development. The M5Stack control element contains various ways to plug in sensors and combine them to create intelligent application system behavior. It also provides basic functions for display, navigation, and control. For complex interaction, M5Stack-applications can be operated from mobile phones. They reside on top of the Nerd Tree.

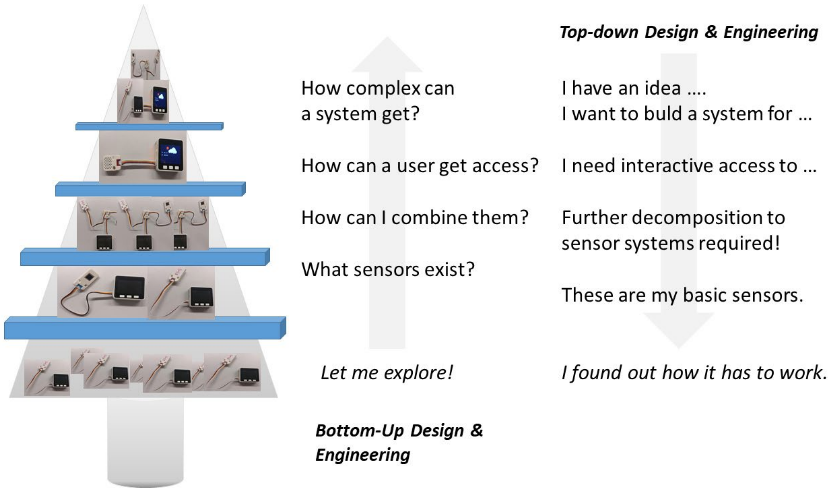

Fig. 5. Variety of IoT system components – A NerdTree

Figure 6 zooms into programming the behavior of M5Stack© applications (cf. M5Stack.com) using Blockly. On the left, the M5Stack control component with several sensors for securing the access to rooms (including a keyboard to typing in keys) is illustrated. On the right, a screen shot of UIFlow (when programming in Blockly) is shown, processing an event and (re)acting based on recognized sensor data. The creation of IoT application behavior through Blockly is based on the language JavaScript supporting block-based visual programming. According to its concept, Blockly features structured (de) composition of IoT components (represented as units) and handling of events in an IoT environment. In this way, not only can each block of the digital twin be mapped to one or more operational entities, but also the successive passing of information along algorithmic computations can be experienced and operated in real time.

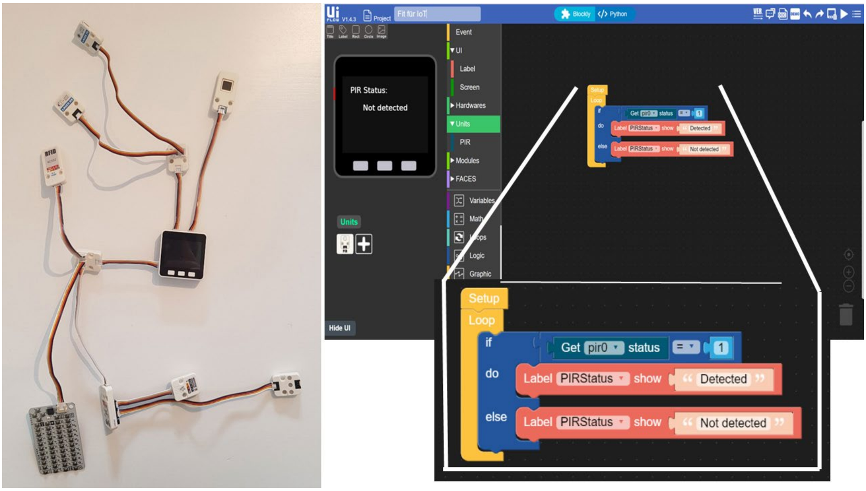

Fig. 6. Design-oriented engineering utilizing M5Stack© elements, and Blockly programming in UIFlow©

4. Conclusion

More and more data are captured through IoT sensor components, and often users as well as other adopters tend to depend too much on algorithmically generated information, so much so that they may even select inferior products and services to their own detriment or restrict their own free moving space. We refer to this as algorithm overdependence. Rather than 'surrendering to technology' in modern digital environments we suggested experiential design for stakeholders to develop an understanding of the complex systems to create agency.

The proposed installation *Digitized* aims to trigger reflective practice for (concerned) stakeholders in continuously digitized environments. It promotes awareness by offering scenarios of concern and triggers to allow transparency and design for mutual use for users and providers of digitized systems. For the physical parts of the installation a digital support system is available so participants can regain intelligent control.

Digitized is an individual, however, socially grounded and co-created artistic protocol of space perception and (re)design. Based on the interactive experience of artificial decision-making, constructive interventions can be set through physical experience even for intangible elements including algorithmic processing.

Due to its partly interactive character and educational elements the installation enables active reflection on and testing of IoT and develops methods of behavior capturing and regulating. Artistic mediation showcases anchors of digitization in different fields ranging from explicit access control to indirect control of behavior. It uses audio, visual arts (drawing, video, visualization) and edutainment (crafting intervention, workshops). These elements will be explored in situ and insights might vary from individual to individual.

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Integrating somatic intelligence in high performance teams
(4d)

Awaken somatic intelligence for generative change

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Writers space *
Photography & Film *
Freestyle *

* choose one – or more (optional)

Craft your ideas and developments and bring them into the world. Act!

Whole System:
Co-Creating new structures for collaboration
(2,5d)

Futuring, working with large groups and networks for transformational change

The COS-Certified Curriculum "Creating Organisations & Society"

New Creations in Organisations & Society originate in the undivided source of sensing, feeling, thinking. Acting from there we make a difference. In this curriculum you will touch the source, develop your inner world and come out with new resources for action in the outer world. It's challenging for you and others!

We designed the curriculum for **mindful people** who:

- Wish to live and work closer to their calling and aspiration.
- Desire to go on a journey of transformation and tangible action.
- Want to intentionally achieve better, more creative results in the organisations they own or work for.
- Change their surroundings collaboratively, mindfully and powerfully.
- Direct intention and generative power towards shared development.
- Enter uncharted territory.

Here and now modules address individual, group and organisational learning spaces and offer learning on the spot in the here and now. You practice presencing and learn how to intervene in the moment – here and now. This is where immediate change happens.

Flow and grow together through action learning. You come closer to yourself, develop ways to generatively hold your many facets, connect with others in this way and manifest your actions from a fresh, supportive social network. A learning through experiencing and acting, experiencing and acting …

Craft and manifest: During your learning journey you are continuously crafting your own masters' piece. This artistic, scientific or freestyle „piece of work“ is your gift and your challenge to yourself and to Organisations & Society: The one you work or live in or the one you are intending to create. A project development, a new business idea, a book, a new way of working and living.

Your calling triggers and shapes your learning journey throughout all modules. We support you in making a pearl-chain, your intentional learning process is the pearl string. – Beautiful!

COS Certified Curriculum: Creators for Organisation & Society

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Costs approx.: € 5.600,– + VAT

Become a Friend & Member of COS!

Join the COS movement and become a Friend & Member of COS! COS is a home for reflective hybrids and a growing platform for co-creation of meaningful, innovative forms of working & living in and for organizations and society, between and beyond theory and practice. We invite you to become an active member of COS.

Being a part of COS you have access to our products and happenings. As a Friend & Member, you carry forward the COS intention of co-creating generative systems through mindful, fresh mind-body action. Let's connect in and for novel ways around the globe!

Access points for your participation & future contribution are:

- Mutual inspiration & support at the COS-Conference
- Development & transformation at COS-Creations Seminars
- Creative scientific publishing & reading between and beyond theory and practice
- COS LinkedIn Virtual Community
- And more …

The Friend & Membership fee is € 200,00 + 20 % VAT for 2 years.

Your 2 years COS Friend & Membership includes:

Free access to all Volumes and all Issues of COS online-Journal:
www.cos-collective.com

- Conference fee discount of 25 %
- COS-Creations: Special discount of 20 % for one seminar of your choice during the membership period.

Please send your application for membership to office@cos-collective.com

Join COS, a Home for Reflective Hybrids

The future is an unknown garment that invites us to weave our lives into it. How these garments will fit, cover, colour, connect and suit us lies in our (collective) hands. Many garments from the past have become too tight, too grey, too something…and the call for new shapes and textures is acknowledged by many. Yet changing clothes leaves one naked, half dressed in between. Let's connect in this creative, vulnerable space and cut, weave and stitch together.

Our target group is reflective hybrids – leaders, scientists, consultants, and researchers from all over the world who dare to be and act complex. Multilayered topics require multidimensional approaches that are, on the one hand, interdisciplinary and, on the other hand, linked to theory and practice, making the various truths and perspectives mutually useful.

If you feel you are a reflective hybrid you are very welcome to join our COS movement, for instance by:

- Visiting our website: www.cos-collective.com
- Getting in touch with COS-Creations. A space for personal & collective development, transformation and learning. Visit our website: www.cos-collective.com
- Following our COS-Conference online: www.cos-collective.com
- Subscribing to our newsletter: see www.cos-collective.com
- Subscribing to the COS Journal: see www.cos-collective.com
- Ordering single articles from the COS Journal: www.cos-collective.com
- Becoming a member of our LinkedIn group: go to www.linkedin.com and type in "Challenging Organisations and Society.reflective hybrids" or contact Tonnie van der Zouwen: office@cos-collective.com

The Journal with Impact

The Journal "Challenging Organisations and Society . reflective hybrids® (COS)" is the first journal to be dedicated to the rapidly growing requirements of reflective hybrids in our complex 21st-century organisations and society. Its international and multidisciplinary approaches balance theory and practice and show a wide range of perspectives in and between organisations and society.
Being global and diverse in thinking and acting outside the box are the targets for its authors and readers in management, consulting and science.

www.cos-collective.com
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