The Planning Daemon: Future Desire and Communal Production

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Abstract

Within the planning discourse two poles have materialised over the last decades: a participatory ideal guided by substantive rationality, opposed to an algorithmic governmentality subordinated to instrumental reason. This rift within socialist thought is also observable when it comes to the discovery of needs. The paper understands this discovery procedure primarily as a forecasting problem and demonstrates how many authors dedicated to a participatory planning process call for consumers to write down their desires in the form of wish lists. As a response to this epistemically questionable discovery procedure, the state of the art in capitalist demand-forecasting at enterprises like Amazon is presented, where machine-learning algorithms excel at modelling interrelated time series on a global level by extrapolating demand patterns in real-time. The paper closes with a proposal to reconfigure this predictive apparatus for socialist ends and raises questions concerned with the political implications of centralising decision-making in black-box algorithms.

Keywords

economic planning – algorithmic governmentality – demand forecasting – predictive analytics – economic rationality

If a universal mind existed, that projected itself into the scientific fancy of Laplace, a mind that would register simultaneously all the processes of nature and society, that could measure the dynamics of their motion, that could forecast the results of their inter-reactions, such a mind, of
course, could a priori draw up a faultless and exhaustive economic plan, beginning with the number of acres of wheat down to the last button for a vest. In truth, the bureaucracy often conceives that just such a mind is at its disposal; that is why it so easily frees itself from the control of the market and of Soviet democracy. But, in reality, the bureaucracy errs frightfully in its appraisal of its spiritual resources. In its creativeness, it is obliged perforce, in actual performance, to depend upon the proportions (and with equal justice one may say, the disproportions) it has inherited from capitalist Russia, upon the data of the economic structure of contemporary capitalist nations, and finally upon the experience of successes and mistakes of the Soviet economy itself. But even the most correct combination of all these elements will allow only of constructing a most imperfect wire skeleton of a plan, and not more.¹

After the horrors of Stalinist despotism and the alienating top-down approach of Soviet command economies, large parts of the contemporary Left today have capitulated to market-socialist positions that retain the anarchy of the market or seek refuge in the local gift economies of the Commons as a form of anarchy without markets. But in recent years the daunting undertaking to rationally plan entire economies through the conscious control of communal production has experienced a discursive resurgence. Technological developments, heightening inequality, a looming ecological catastrophe, and the shortcomings of market mechanisms in dealing with the global Covid pandemic have widened the discursive space for economic planning further. Within this debate that is torn between proving the economic feasibility of a socialist mode of production on its right flank while simultaneously preserving the tenets of a democratic planning process on its left, two poles have materialised over the last decades that fundamentally differ in their assessment of the primary cause for the economic downfall of the Soviet Union. At one end of the spectrum we encounter a participatory approach to planning, which spans from radical anarchist proposals, to those rooted more in a council communist tradition, to those still relying to a certain extent on market mechanisms.² What they share is the radical conviction to subjugate economic coordination to horizontal

¹ Trotsky 1933, pp. 29–30.
² See Albert and Hahnel 1991; Bernes 2020; Devine 1988; Saros 2014.
decision-making processes by incorporating everyone who is affected by their outcomes. With an emphasis on human negotiations, the goal is that no qualities or stakeholders should be left out in this deliberative planning process. The other end of the spectrum is represented by a mathematical approach to planning that is characterised by an algorithmic governmentality, which acknowledges a scaling problem inherent to the socialist mode of production and builds the vision of communal production on the premise that in the absence of markets for intermediate and capital goods the complexity of national economies can only be tamed with the assistance of algorithms and is therefore, in the view of radical critics upholding participatory values, always at risk of falling victim to its inherent technocratic tendencies and the fallible logic of calculation. The purpose of this paper is to present this factional dispute under the overarching question of needs registration for material consumer goods, touching on the dynamic aspect of planning. It is written in the naive hope of, if not building bridges then at least establishing a better understanding between the two approaches, which are in fact nothing but echoes of the blighted rupture that has divided socialists and anarchists ever since.

When approaching the task of economic planning, at a rather abstract level it can be subdivided into two smaller problems. At the beginning stands the problem of needs registration that is framed in this paper as a forecasting problem and can be expressed by the dynamic question ‘What do we desire?’, once quantified such a discovery procedure of needs results in a plan target, in a second step, the right means to best fulfil this target have to be identified, which can also be understood formally as an optimisation problem ensuring allocative efficiency, or expressed in a more qualitative way by asking: ‘How can we best realise the satisfaction of our needs with given means and constraints?’ While the historical discussions, such as the socialist calculation debate, circled mostly around the latter problem of static efficiency, the dynamic aspect concerned also with investment functions has attracted increasing interest in recent years. Yet, in the rich corpus of planning literature the epistemic challenges of needs discovery, especially for private consumer goods, remain rather under-theorised. As we will see, many theorists striving for the participatory ideal overestimate the capacity of consumers to accurately assess their needs, believing that in a socialist economy consumers would finally have the chance to express them in meticulous detail so that production can be aligned towards their satisfaction. But also in the algorithmic tradition, the discovery procedure of needs is insufficiently addressed and rather mechanical.

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3 See Cockshott and Cottrell 1993; Dapprich 2022; Härdin 2021; Kantorovich 1965; Samothrakis 2021.
To explore the discovery procedures of material desires, the first part of the paper engages with the state of the art in forecasting to show how capitalist enterprises like Amazon deal today with the uncertainty of future demand. The middle part picks up the question of reconfiguring capitalist infrastructure for socialist ends and critically discusses the tension between economic feasibility, complexity management, questions of heteronomy, and competing rationalities at play within the two rival trajectories towards communal production by providing critical outlines of the currently discussed planning frameworks. Eventually, in the final part, the piece calls for an algorithmic realism in approximating consumer demand and closes with some reflections on the political consequences of implementing such a predictive apparatus. In view of this, the following can be read as the confessions of what one might call a cybernetic socialist.

**Mastering the Future? The Algorithmic State of the Art**

Capitalism is a profoundly future-oriented system in which the success of capital-accumulating agents is highly dependent on their capacity to accurately predict the future. From the estimates of Venetian merchants in calculating the costs and possible future revenue of their voyages to the sales and operations planning of multinational corporations such as Apple, forecasts have always been the starting point of capitalist production. At any business level, present actions are aligned to the most probable future identified by entrepreneurial decision-makers. Regardless of whether it is anticipated sales, future product prices, or the likelihood of supplies arriving in time during bad weather conditions, forecasts set the basic conditions for economic decision-making. A socialist mode of production is no different in this regard; production will be just as dependent on the capacity to anticipate the future as it is in capitalism. The fundamental question is who will perform these predictions and which epistemic technologies will be applied.

To approach the issue of forecasting it might be helpful to begin with some distinctions. A central one is the difference between data and models; information ought to be distinguished from its interpretation. Data then can be further differentiated into qualitative and quantitative sources. The former could be the liver of a sacrificed animal ancient seers examined to make predictions or the gut feeling of an entrepreneur assessing market sentiment, while an example of the latter could be a time series of annual sales data. A common distinction separating types of data analysis is the differentiation of subjective models, which is just another word for the human brain, from objective
models that are given by formal algorithms. Although quantitative data might have been available within most companies when the ‘avalanche of printed numbers’\textsuperscript{4} rolled out over the course of the nineteenth century, and a trust in numbers was well established in other areas of business like workforce governance,\textsuperscript{5} predictive models were still ruled almost entirely by subjective judgment and calculative contemplation, namely the interpretation of charts or tables by the mental apparatus of the responsible individuals. Not too long ago statistician Gwilym Jenkins stated, the ‘fact remains that model building is best done by the human brain and is inevitably an iterative process’\textsuperscript{6}. We will see that a fundamental shift in the prophetic capabilities of predictive analytics is challenging this statement today.

Objective forecasting, often also called quantitative, statistical, or even scientific forecasting, is a quite recent phenomenon, since its mathematical foundations were not fully laid until the 1930s.\textsuperscript{7} But only the necessity of war and, as a consequence thereof, a leap forward in the development of information technologies\textsuperscript{8} and management science, in particular operations research and cybernetics, really accelerated the field. After the Second World War, emerging in many cases directly from out of military research, statistical forecasting methods like exponential smoothing, which was initially developed for naval fire control in anti-submarine warfare, soon trickled down to the private sector, where an ever-increasing number of statistical models became an essential part of basically any business-management paradigm, from material resource planning to the sales and operations planning now current.

\textsuperscript{4} Hacking 1982.
\textsuperscript{5} See Miller and O’Leary 1987.
\textsuperscript{6} Newbold and Granger 1974, pp. 149–50.
\textsuperscript{7} The reason why statistical forecasting methods are typically associated with objectivity in the literature is that given the same data inputs a statistical model will produce the same forecast regardless of who does the forecasting. This does not mean that these objective forecasts are necessarily closer to reality; what the elimination of subjective judgment, personal experience, intuition and informed opinion from forecasting allows is the reproducibility, comparability of methods, ultimately enabling peer review, which constitutes the foundation of the scientific method and allows forecasting practitioners today to enshroud their methodology with the authority of science.
\textsuperscript{8} The first digital computers were deployed during the Second World War for cryptographic codebreaking, the simulation of the blast radius of the first atomic bomb, and the calculation of artillery firing tables. Before their introduction statistical calculations had to be done with pen and paper by arithmetically skilled individuals. Not only were these human computers error-prone and slow, their wages also posed a considerable cost factor, which made statistical forecasting economically simply unviable for most companies before the advent of digital computers.
The first accuracy studies and assessments to compare these models emerged from the late 1960s onwards. And until very recently there remained the counterintuitive fact that statistically sophisticated or complex, i.e. computationally intensive, methods do not necessarily provide more accurate forecasts than simpler ones. The only substantial accuracy gains were achieved by combining different models. In this way, over the past decades any practical forecasting progress in social settings was driven by growth in data rather than by an improvement in their analysis. This also remained true more recently, when the successes of the machine-learning revolution could not be translated to the field of time-series forecasting, as prominent deep-learning approaches have been struggling with the analysis of what is by far the most important data structure in economics, namely tabular data. One reason for this is that unlike as with image recognition or natural-language processing, where ‘ordering impacts semantic meaning’, for the analysis of tabular data and other heterogeneous datasets one ‘must discover correlations without relying on positional information’. Today, tabular data remain the last ‘unconquered castle’ for deep neural-network models, which is under heavy siege from the scientific community – and in fact, more recently the first cracks have appeared in the castle’s walls.

In 2018, for the first time an engineer working at Uber, where automated forecasts guide their dynamic pricing system, won the Makridakis Competition, the most prestigious contest in the field of time-series forecasting, with a hybrid machine-learning solution, yet the extent of its lead over the runner-ups remained unclear, and it still relied to a large extent on a simple exponential smoothing method. At the fifth iteration of the competition that

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9 See Makridakis and Hibon 1979. When they first presented this claim at the Royal Statistical Society, the authors were met with outright hostility from influential senior members, who refused to acknowledge the results and questioned the ability of the authors to apply these sophisticated methods properly. See Hyndman 2020, p. 8. In what can be described in psychological terms as a healthy instance of reactance, Makridakis and Hibon responded to this slur of incompetence by following up with a competition, which confirmed their findings. If it were not for the pride and stubbornness of these young researchers, this incident could have been a startling instance of the dysfunctional power relations that have always been in play within the system of science when dealing with anomalies. However, their treatment was still rather humane compared to the way the Soviet Union dealt with critics of their planning procedure, where forecasting pioneers like Nikolai Kondrat’ev were rewarded for their scientific contribution with execution. See Rindzevičiūtė 2023.

10 Somepalli, Goldblum, Schwarzschild, Bruss and Goldstein 2021.


12 See Smyl 2020; Makridakis, Spiliotis and Assimakopoulos 2020.
took place during the first months of the Covid pandemic in 2020, over 5000 teams competed to predict future sales of 3049 distinct products sold across ten stores based on historical real-life data provided by Walmart. The teams had to make hierarchical forecasts for each product at 12 different aggregation levels. In both the Accuracy (point forecasting) category, which was won by an undergraduate student, and the newly established Uncertainty (probabilistic forecasting) category, the top of the field was dominated by machine-learning solutions, which achieved an overall 20% improvement over the best performing benchmark. While on the most disaggregated store level the top-five performing machine-learning solutions only resulted in modest accuracy gains of about 10.6%, more impressive results were achieved on the aggregated levels, where they offered a remarkable 63.1% percent improvement. Although gradient-boosted decision trees were the most successful class of machine-learning algorithms, the hierarchical data set was seemingly also a good fit for deep-learning models, as the third place in the accuracy challenge was secured by a team that applied a deep neural network (DeepAR) Amazon had developed for its internal demand forecasts.

For years Amazon has been a major player in pushing the field of deep learning, without doubt in large part also because they sell the required infrastructure. After the metamorphosis of shedding its larval state as an online bookstore and Jeff Bezos’s decision for Amazon to become the Everything Store ruling e-commerce, the required infrastructure materialised in the form of a vast network of so-called Fulfillment Centers that now span the globe, as well as the necessary software to administer this logistical hardware. Today, Amazon is responsible for about 40% of all online sales in the United States, offering over 500 million products of which half are sold through third-party sellers on Amazon Marketplace. And this success cannot be reduced to tax evasion or the exploitation of workers and suppliers alone. Pretty early on the management realised that infrastructure has always been the actual product

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13 See Makridakis, Spiliotis and Assimakopoulos 2021a.
14 What is forecasted here is not only a single value, as is the case with point forecasting, but the uncertainty distribution in different quantiles. In weather forecasting, for instance, we are already quite familiar with conical projections of hurricanes, whose paths widen the further they run as uncertainty increases with the forecasting horizon. The margins of these cones represent the upper and lower bound, which indicates the probabilistic range, most commonly .9 or .95%, of all the possible values that can be found within this area. Because of their probabilistic nature, neural networks are a natural fit for this type of forecasting.
15 See Makridakis, Spiliotis and Assimakopoulos 2021b. However, for operational planning, the most relevant levels are in fact the disaggregated ones (level 9–12), where the sales for each product are predicted for each store (12), each state (11), and all stores/states (10).
of Amazon and discovered additional growth potential beyond retail in the sphere of production. As an expression of Bezos’s Napoleonic ambition to run the entire world economy on his platform, Amazon Web Services (AWS) was founded in the early 2000s as a subsidiary to turn Amazon’s internal infrastructure knowledge into a product. As a cloud computing platform offering on-demand and state of the art computing instances, storage solutions, fully managed databases, networking services, IoT software environments, and an ever-expanding set of analytical tools, AWS developed into by far the most profitable part of the company and its importance today rivals the retail-core of Amazon.

Their predictive analytics have been critical to the success of the enterprise. For their own internal demand and sales forecasts, Amazon utilises today a unified forecasting model\(^ {16}\) which allegedly has resulted in a ‘15-fold improvement in forecast accuracy’ compared to their legacy system and allowed the automation of the labour-intensive process of feature engineering, since ‘the model was smart enough to learn business-specific demand patterns all by itself.’\(^ {17}\) In 2019, AWS launched Amazon Forecast, a fully-managed forecasting service similar to the technology the company had developed for their internal planning processes. What it offers to customers is the automation of machine-learning workflows, making the technology available to businesses without requiring internal machine-learning expertise. While data pre-processing remains a manual task that requires data scientists, everything happening thereafter in the forecasting pipeline can be automated through AutoML, an automated self-tuning strategy, which trains different models and chooses the best one for the dataset based on specific error metrics.\(^ {18}\) Yet in reality, most companies will lack the data to make use of this technology and for now the accuracy of these techniques stands in contrast to their advertised claims: highly dependent on experts, as tailoring neural nets to data sets still remains ‘more of an art than a science’, requiring ‘skillful model adjustments to achieve competitive

\(^ {16}\) Eisenach, Patel and Madeka 2022.
\(^ {17}\) Amazon Science 2021.
\(^ {18}\) Beyond automating the implementation and comparison of different models, machine-learning researchers are currently attempting to extend the process of automation further to model building itself, with the goal in mind to eventually delegate everything from model building, data pre-processing, feature engineering, algorithm selection, and hyper-parameter optimisation to machines. Recently, the team around DeepMind developed an AI system that discovered a novel and more efficient algorithm for matrix multiplication. In view of this creative potential, it is very likely that in the near future the most potent machine-learning models will no longer be written by humans but by machines. We return to the promises, risks and limitations of such plug-and-play phantasies below.
Nevertheless, compared to traditional forecasting methods, deep-learning approaches have critical advantages according to Amazon engineers that in specific use-cases already today outweigh the shortcomings mentioned above: ‘Neural forecasting methods excel at addressing forecasting problems with many related time series and at extracting weak signals and complex patterns from large amounts of data’; yet the authors admit that neural networks are ‘not a silver bullet. For many important classes of forecasting problems such as long-range macro-economic forecasts or other problems requiring external domain knowledge not learnable from the data, neural forecasting methods are not the most appropriate choice and will likely never be.’

Although for such problems, or the extrapolation of isolated time series and small datasets, neural networks seem not to be the first option, the major advantage of such global models lies in forecasting-related time series as found at gigantic retailers such as Amazon, where ‘it can identify patterns that are not distinguishable in a local model but become so when aggregated over multiple series’. Demand patterns emerge that could not be rendered visible by forecasting techniques that only incorporate the data points of a single time series but do so when superimposing a multitude of interrelated time series. Also, the possibility to integrate multidimensional data sources into the model such as relational data like promotions, lockdown measures or customer reviews as well as metadata such as weather data, which have hitherto always been external to statistical models, gives deep-learning models a decisive advantage. This modelling of interdependencies also allows what Amazon engineers call cold-start forecasting, a heuristic forecasting method that is able to output predictions for newly introduced products with next to no historical data by drawing from the past performance of similar products.

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20 Benidis, Rangapuram, Flunkert, Wang, Maddix, Turkmen, Gasthaus, Bohlke-Schneider, Salinas, Stella, Aubet, Callot and Januschowski 2022, p. 22.
22 See Gilliland, Tashman and Sglavo (eds.) 2021 for the emerging role of machine learning in business forecasting. Recently, deep-learning approaches won Alibaba’s internal forecasting competition, and also Jon Bowman, head of Walmart’s data-science team stated that the company has reopened their research on neural nets again due to the latest successes. See also Seaman and Bowman 2021, for the applicability of the insights gained from the M5 competition to Walmart. It appears to be the consensus within the field that in the future ‘the value of knowledge and experience will become less important for
Despite potential gains in predictive accuracy, neural networks also suffer from serious shortcomings like the inability to comprehend on what basis such black-box models output a specific result, which is why critical voices from within the industry go so far as to call machine learning ‘alchemy’. Although such issues of interpretability and accountability are addressed today by the growing research field of Explainable Artificial Intelligence (XAI), it is questionable whether the opaque nature of deep-learning algorithms will ever be transformable into a transparent glass box model that is truly comprehensible for the user. Another serious weakness of these models is their hunger for computational power. In their analysis of image-recognition competitions, researchers recently have exposed the diminishing returns of deep-learning algorithms. The resulting computational cost–performance curve they have drawn from the available data states that to halve the error rate one has to expect to need more than 500 times the computational resources. However, other than in the case of autonomous vehicles, where even object recognition of greater than 90% accuracy will result in an unacceptable level of fatalities – as can be observed today with Tesla’s malfunctioning autopilot –, economic forecasts should not require total mastery to be allowed out into the wild; on average they just have to do significantly better than competing methodologies.

And of course the robustness of these algorithms also remains an issue, as has been demonstrated by the outbreak of Covid-19. Before the pandemic, global supply chains ran like clockwork, but the singular black-swan event of a virus mutation leading to the infection of patient zero humbled human control phantasies and reminded the Promethean spirit about the uncertainty of the future. During the pandemic, machine-learning models also broke down en masse and forecasters had to muddle through these times of extreme uncertainty for which no historical data existed. Without historical data, demand surges for toilet paper during the first months of the pandemic could not have been anticipated, by either algorithms or humans:

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23 Rahimi and Recht 2017.
24 While it is certainly true that with deep-learning networks the model training is an extreme costly task with respect to computer time, their proponents argue that the initial training cost amortises over the long run as the execution of a trained model, i.e. the output of forecasts, is far more economical compared to traditional forecasting algorithms.
With projects of great novelty, such as a military invasion, an all-out war, or something entirely new, errors explode upward. In fact, the more routine the task, the better you learn to forecast. But there is always something nonroutine in our modern environment.26

This is why no serious forecaster today would ever claim to be able to master the future: forecasting is a game of probabilities, a competition between different epistemic methodologies, whose accuracy rates are measurable over specific time frames and contexts through error metrics, and in cases like demand forecasts under routine conditions, human judgement seems not to be able to keep up with the accuracy of contemporary algorithms that extract their predictions from gigantic data masses, albeit that their prognostic horizon will always be bound to an extrapolation of the past. What is so irritating about this epistemic contest, though, is that we will only ever have certainty about the actual outcome of specific predictions ex post and past performance is never truly indicative of future results; what has been considered a highly robust model can break down at any time and in the next moment output the most preposterous results. In forecasting, the only thing that seems to be certain is that there will always be black swans lurking beyond our perception and therefore, the longer the forecasting horizon will be, the more inaccurate the results will become, to the point where these projections become practically useless. This is an inductive dilemma we will simply have to live with; incomplete data and imperfect knowledge models to interpret it with are all we humans have to make informed guesses about the future, yet none of these techniques will ever produce true certainty. This is what statistician George Box humbly insinuated when he said: ‘all models are wrong but some are useful’.

Since any model will break down at some point, forecasting systems should never simply be executed in the dark and must always be monitored and judged by humans, who at least have a chance to detect and correct the most absurd irrationalities that failing predictive systems may produce at times. This is especially true when it comes to black-box algorithms. At present, judgmental overrides of statistical forecasts, based on external domain knowledge, intuitive thinking, and extensive experience, remain the norm within the industry, and also in automated forecasting systems such adjustments remain common; however, the question of detecting model failure poses a difficult problem for forecasting practitioners. There are certainly so-called ‘broken leg scenarios’,

forecasters the confidence to overrule algorithms, such as instituting lockdown measures in the face of a ravaging global pandemic. But without such domain knowledge, it is far more difficult for a human to judge whether an algorithm is working properly, which leads in practice to false negatives, where the algorithmic model breaks down but the forecaster did not realise this in advance, and false positives, where the forecaster intervenes and it turns out their mental model was wrong.

Research indicates that in most cases the forecast value added (FVA) is negative through judgmental overrides, which means that on average human intervention reduces forecast accuracy.28 Recent experiments have also shown that lay people do better in such situations compared to experts because they tend to trust the better-performing algorithms more due to their lack of expertise than professionals who overestimate their predictive abilities.29 Beyond this is the widespread psychological phenomenon of ‘algorithm aversion’:30 humans tend to tolerate the errors of their kin more than those of machines. Since technical infrastructure operates in the background, it mostly becomes visible only in the event of a breakdown.31 Thus automation has something uncanny about it, and at the same time, our unrealistic expectations demand total mastery from these technical systems. This however does not mean that we should blindly hand over every human decision-making process to predictive algorithms, as in the case of jurisprudence32 for instance, but there are use-cases such as the quantitative determination of future demand for private consumer goods where such a delegation might certainly be reasonable.

Reconfiguring Capitalist Infrastructure

These days, the most useful models, the fastest computers, and the brightest forecasters are increasingly drawn into the gravitational well of capital, where they become potent means to the end of profit maximisation. And in the capitalist administration of things, human labour is also subject to the same predictive algorithms. When Amazon decides to raise the wages of their workers at a warehouse, this is not out of humanitarian generosity but in part because their internal planning forecasts predict that their unsustainable turnover rates

28 See Fildes, Goodwin, Lawrence and Nikolopoulos 2009; Fildes and Goodwin 2021.
29 See Logg, Minson and Moore 2019.
30 Dietvorst, Simmons and Massey 2015.
31 See Star 1999.
will make them run through the entire available workforce in a given locale since not enough people are willing to endure the alienating reality of life as a warehouse picker for the wages they pay. When Foxconn, formerly known as the labour-rights violating main supplier to Apple, which has since grown into the largest electronics manufacturer in the world, applies Amazon Forecast to their factories to increase the accuracy of their labour-force demand forecasts, it is not in order to enhance workers’ well-being but rather to cut costs within a lean production framework by simply hiring the human resources actually required to ensure maximal profitability for the plant.

And on a macroeconomic scale, these developments will potentially have a whole set of other effects on the capitalist system. An increase in global forecasting accuracy by only a few percent will further fuel the persistent structural unemployment induced by an ongoing process of automation, which cannot be soaked up any longer due to a slowdown in global economic growth rates, as more accurate forecasts mean that resources are used more efficiently and less waste will be produced, which in turn reduces the global demand for labour and will likely also have a positive impact on productivity rates. Yet, an aggravated growth of a global labour reserve army will ultimately increase public welfare expenses, lower wages, and intensify labour for the remaining workforce. It seems workers around the globe have hardly anything to gain from the current application of this predictive apparatus, as potential efficiency gains will not be passed on to them in the form of a reduction in working hours or rising wages. And also from an ecological standpoint, potential efficiency gains will likely vaporise due to rebound effects. But what if these algorithms were liberated from their initial purpose and put to use for another end, much like the early hackers wrested the computer from the American war machine? What if individual profit functions are replaced by one that maximises collective use-values while simultaneously being constrained by the metabolic limits of our planetary ecology as well as by the preservation of worker self-management and democratic rule? What if forecasting algorithms were assigned to serve labour and not capital? And finally, how do we have to alter these techniques to do justice to what Justin Joque calls ‘revolutionary mathematics’?

The question of whether it is expedient to salvage parts of the capitalist machinery for a communist endeavour is as old as the idea itself and has historically been discussed under the umbrella of the machinery question. Ignoring the question of alienation for a moment, Marx and Engels were both

33 See Benanav 2020a.
34 Joque 2022.
in awe of the technoscientific apparatus capitalist modernity had created and were convinced of the need not only to appropriate the parts worthy of retention but also to develop them even further. This becomes evident when they wonder in the Manifesto ‘what earlier century had even a presentiment that such productive forces slumbered in the lap of social labour’ or in their ridicule of technophobic ressentiment shared by figures such as Proudhon. Both stressed that the industrial revolution only appears to be the root of alienating pauperism whereas in fact it provides the material substrate for the liberation of the working class. In Capital, the critical role of technology can be identified as well, when Marx emphasises the importance of ‘distinguishing between machinery and its employment by capital’, and praises the learning process of the working class in overcoming this false consciousness by directing their attacks ‘not against the material instruments of production, but against the mode in which they are used’, hinting with this also at a possible rearrangement of the inherited machinery under alternative societal conditions of communal production. In one of the rare moments of dismissing the self-imposed Bilderverbot of materialist thought, Engels offers us a glimpse in Anti-Duhring into his interpretation of the coming society, where he outlines the communist project as a large self-managed factory in which ‘the government of persons is replaced by the administration of things’. This idea of identifying the planful social production within enterprises, that only has to be rearranged in a democratic way, as the seed from which an economy-wide communal production might spring also reappears in Lenin’s fascination with the administrative efficiency of the Prussian postal system and his demand to ‘organize the whole economy along the lines of the postal service’. But when in the aftermath of the Russian Revolution the Bolsheviks tried to expand such forms of administration to the whole economy, they abandoned the democratic reorganisation of management structures, which was still present in Engels’s vision, by first subordinating factory committees to trade unions and finally replacing them with managers appointed by the party, until the Soviet top-down imbalance of planning turned into the grotesque red bureaucracy Bakunin had already warned us about, in which the lived experience of workers did not differ much from that under Taylorism.

37 See Adorno 2004, pp. 204–7, for his comments on imageless materialism.
38 Engels 1987, p. 268.
39 Lenin 2015, p. 88.
40 See Wetzel 2008.
In recent years, the reconfiguration question has remerged in the logistics debate between Alberto Toscano, who attacked the Invisible Committee for their destructive politics and argued instead to evaluate and repurpose existing infrastructure rather than to sabotage it, and Jasper Bernes, who, basing his argument on the empirical case of the port of Oakland, made the compelling argument that the *raison d'être* for large parts of today’s existing infrastructure is the imperialist exploitation of cheaper labour in the so-called Global South. Later further reconfiguration arguments were put forward in the accelerationist writings of Nick Srnicek and Alex Williams and most explicitly in *The People’s Republic of Walmart*, which popularised algorithmic approaches to planning and the idea of appropriating and repurposing the planning techniques of multinational corporations for socialists ends. Such cybersocialist planning propositions did not go unanswered by their critics, who believe that the administrative practices and technologies within companies like Amazon cannot be divorced from their tainted origin and would inevitably work behind the back of producers, eventually reproducing the very rift between workers and an alienating totality that is dominating people through their labour and reinstating new despotic structures by abandoning the egalitarian and emancipatory commitments that are its reason for being. What might succeed is something no one would desire – a system requiring both surveillance and automatic coercion, a system which, in order to be efficacious, reproduces much of what we find intolerable about capitalism.

What Bernes fears here is the ‘complete subjugation of the worker to capital’, and it is surely true that it needs little imagination to envision how these algorithms could be employed in a totalitarian top-down planning system, which could slip into some form of neocameralist dystopia as envisioned by thinkers of the Dark Enlightenment, dividing workers and a new administrative class, a priesthood of data scientists with god-emperor Bezos sitting at its top. Such a framing, however, rests upon a severe misunderstanding of what algorithmic planning would encompass in a communist society and is a consequence of fundamental misconceptions.

41 Toscano 2011; Toscano 2014.
42 Bernes 2013.
43 Srnicek and Williams 2015.
45 Bernes 2020, p. 68.
Statics and Dynamics in Economic Planning

First of all, such criticism drastically overestimates the extent of algorithmic decision-making within such a cybersocialist planning framework. According to this distorting critique, every economic decision seems to be subjugated to a master optimisation algorithm that would terminate politics by turning workers into automata, and give birth to another mode of production under heteronomous rule, characterised by an ‘impossibly automatic control of labor, automation of politics, and the reduction of questions of how and where people work to entirely technical matters’.

On looking closer, though, and actually engaging with the specific purpose of optimisation algorithms, one recognises that they have little in common with the Soviet planning system. Where in the Soviet Union, Gosplan, the state planning commission, drafted a highly aggregated plan that set the frame for all underlying planning processes, optimisation solvers actually enable a detailed planning process that could emerge from the bottom up. Where the administrative centre once set the despotic truth that the periphery was obliged to execute, these algorithms may automate away much of its administrative processes that formerly restricted the autonomy of the periphery due to the bureaucratic limitations of the planning committees.

What these algorithms structure are the flows between working groups; what is happening within the production units could be left almost entirely to the self-management of workers. Virtually the whole organisation of the workplace – the internal management structure, division of labour, working hours, decisions on the identification of production methods an optimisation algorithm could take into account, and the maximum output the group is willing to produce – could be decided ‘decentrally’ on the ground. However, this freedom of what and how each unit actually produces should not be left entirely to the local producers themselves but ought to proceed in consultation with coordination bodies and other groups that are affected by their decisions. In the Grundrisse, Marx framed this relation between autonomy and heteronomy in a dialectic manner:

Free individuality, based on the universal development of individuals and on their subordination of their communal, social productivity as their social possession [Vermögen], is [communism].

47 Bernes 2020, p. 69.
48 Marx 1986, p. 95.
What lies behind the cipher of the plan for Marx is this sublation of individual freedom and social subordination, ‘the negation of negation’ as he put it. In this sense, economic planning requires both self-determining cells that are connected through horizontal and vertical links, that involve verbal negotiations on the best use of scarce resources, as well as a centralising force to resolve the coordinative complexity of the task. In doubting that human negotiation processes alone will suffice to settle this matter within a reasonable time frame, optimisation algorithms could assist in determining contestable solutions. Although they would have to be binding, these algorithmically derived allocations would be far from delivering the ultimate truth of a final and immutable plan, and are best understood as snapshots within a highly iterative planning process. By indicating what constraints are preventing further optimisation, this factual foundation is never an endpoint but rather constitutes the beginnings for new negotiations, so that between algorithmic optimisations production cells that are dissatisfied with their allocation can initiate further negotiation with other groups to convince them to increase production or pool excess resources. Contrary to Berne’s initial critique, there can and there must be room for politics within a cybernetic planning framework and there is no reason to believe that workers will be plagued by apathy simply because they are confronted with the outputs of an algorithm that affects their work solely in a quantitative way, that is, the actual allocation of scarce resources.

In regard to investment decisions, for which Aaron Benanav has recently demanded a set of democratic ‘planning protocols’, it is a common misconception that such protocols could not be implemented as part of an algorithmic planning framework. And in fact, when it comes to investment decisions, the algorithmic tradition embraces participatory protocols as well. In his recent article on socialist entrepreneurism, Maxi Nieto outlined how in the context of innovation such protocols could function in allocating resources for the introduction of new products. This kind of economic coordination, which ensures dynamic efficiency, that is the ‘social control of investment and the promotion of new products, technologies, and enterprise projects’, would be in the hands of democratic investment councils that would allocate resources to innovators

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49  The exact same dialectical logic reappears in Stafford Beer; for him freedom is never understood in the negative sense of the word, a freedom entirely free of constraints and coercion, but an ‘effective freedom’, acknowledging that ‘a degree of autonomy, and its complement the degree of centralisation, are computable functions of viability’ (Beer 1973, p. 11).

50  Benanav 2020b.

51  Nieto 2021, p. 19.
or existing working groups, who would wish to expand their product line.\footnote{To prevent an administrative overload in these councils, successful production units should also have a degree of autonomy in altering their own product line and expanding capacity.} What many critics of an algorithmic road to socialism seem not to understand is that new consumer products, and also other investment decisions concerning public infrastructure like railroads, or indispensable goods like specific quantities of some medical product, as derived through democratic negotiation processes, can be introduced into an algorithmic optimisation process as part of the plan target or even as constraints to ensure their production. What limits algorithms is that they can only deal with actualities, i.e. the quantitative determination of known products or their pathway through the economy, and are completely useless in regard to potentialities or innovation. The latter is where human creativity reigns supreme and an integration of these qualitative judgements into an algorithmic planning process to determine the quantitative composition may not present any insurmountable difficulties.

Concerning the participatory nature of these dynamic aspects surrounding socialist investment, there exists a widespread consensus among participants in the debate, and, while there remain fundamental differences regarding the degree of involvement and detail, these are marginal compared to the question of how to achieve static efficiency, and this is where the contemporary models differ the most. Still, the complexity involved in achieving such allocative efficiency for economic planning is widely underestimated: the socialist mode of production suffers from a pivotal scaling problem, which is especially true the closer one moves toward the participatory ideal.\footnote{See Apolito 2020.} The actual difficulties of marketless economies are not found in production – here the problems are trivial in comparison and have been historically well addressed by the rich literature dealing with worker self-management –, but in the sphere of circulation. Without the lubricant of money that mediates commodity production throughout all levels in market economies, an efficient allocation of resources has to be realised via other means. In achieving static efficiency, economic systems are ultimately confined to four fundamental trajectories: market exchange, horizontal human negotiation, vertical administrative direction grounded in the subjective decisions of bureaucrats, and algorithmic optimisation. Within the participatory spectrum this problem is answered either by the reintroduction of pseudo-market exchange as in the case of Pat Devine’s model of negotiated coordination, a resort to decentralisation, which by itself means nothing more than localism or the withdrawal to small-scale
intentional communities operating under the logic of gift economies such as we encounter today within the proximity of the Commons movement, or some form of nested council system as proposed in the Participatory Economics model developed by Michael Albert and Robin Hahnel.

At the core of Devine's model stands the distinction between market forces and market exchange. While Devine wishes to overcome the regulatory function of the law of value by administering changes in productive capacity through a system of negotiated coordination, he still upholds an idea of static market exchange. However, it is highly questionable whether his pseudo-markets are able to achieve allocative efficiency in practice, as prices are envisioned by him to be entirely static and fixed according to the long-run cost of production, with production units therefore not able to outbid each other like in capitalist markets, where scarce resources are allocated towards the most profitable enterprises. Rationing of scarce goods, which Devine believes to be a rare exception in socialism, is thus not solved through a price mechanism but is again delegated to a process of negotiated coordination, where ‘qualitative judgement, on the basis of guidelines agreed by representatives of those affected and detailed qualitative knowledge’, promises to establish consensus between the competing parties.54 Yet, to make rational decisions on allocation would require us to solve Hayek’s knowledge problem within every production group in collaboration with representatives of those affected, since one would have to oversee every single supply chain of interested customers up to the final consumer product to actually incorporate the necessary information. In contrast to the iterative optimisation process introduced above where coordinative realities are established through algorithms that can be altered subsequently through qualitative negotiation processes, this model entrusts coordinative responsibility entirely to the producers and those interested in their goods. So in all cases where demand exceeds supply, workers would not only have to carefully select the inputs they require, they also would ultimately have to anticipate these bottlenecks and figure out where the product of their labour is best put into use in the economy. Such a cumbersome solution to achieving static efficiency, that might arguably also be prone to nepotism if not done thoroughly, is the epitome of the too-many-evenings argument that has been hurled at socialists ever since.55

54 Devine 1988, p. 243. Even Maurice Dobb, whom Devine cites in this call for negotiated rationing, acknowledges that price adjustments diverging from long-run costs will be necessary ‘in the case of particularly stubborn supply-inelasticity’ (Dobb 1967, p. 202).

55 What might be appealing to some on paper would in practice be a negotiated purgatory, as this participatory overload only worsens through so-called interest groups Devine envisions as sitting in on the governing body of each production unit. The diverging interests
In the Participatory Economics model the negotiation process of deriving a coherent global production plan is achieved in an annual planning procedure through the bureaucratic means of a gigantic consensus machine of worker and consumer councils in relation to a central Iteration Facilitation Board that sets indicative prices like a Walrasian auctioneer and constitutes the locus where ‘actors “bargain” with one another through successive “iterations” (or rounds of bargaining)’ about adjustments to the individual plans of consumers and worker councils until ‘the process converges to an implementable plan’.\(^56\) Not only would such a quantitative negotiation process be sluggish, within such a framework it would be impossible to quickly adjust the global production plan to sudden changes in the economy without reopening this tedious negotiation process because any single change in price will have cascading effects demanding further adjustments, and it is also questionable whether the determined prices would reflect the actual preferences of producers and consumers as the councils would only react to price proposals of the iteration facility board in a binary manner by voting yea or nay, and would eventually be forced to consent at some point if they do not want to bring the whole economy to an halt in an endless loop of iterations.\(^57\)

For Joseph Schumpeter, the task of economic planning is to derive a production plan ‘which will result in a maximum of consumers’ satisfaction subject to the limits imposed by the available resources, the technological possibilities and the rest of the environmental conditions’.\(^58\) In the absence of real markets for intermediate and capital goods, the only rational answer in the author’s view to getting anywhere near such a maximum in practice would require one to rely to some extent on algorithmic mediation to account for the coordinative complexity. If political economy is concerned with the allocation of scarce resources among competing ends and one wishes to transcend the price mechanism while accepting that deliberative negotiation processes alone will

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56 Albert and Hahnel 1991b, p. 75.
57 The iteration facility board can be interpreted either as a despotic algorithm, a significantly worse one than the optimisation algorithms mentioned above, or, as intended by the authors, as a perfunctory facilitator of a decentralised planning process that leaves decision making entirely to the local councils, potentially crippling the economy by granting them the power to reject any price proposal made by the centre.
58 See Schumpeter 2003, p. 175. Another assessment criterion next to the maximisation of use-values in regard to metabolic limits Schumpeter brackets here is the lived experience of people participating in the economy, or in other words those social needs beyond material stuff, the degree of heteronomy and alienation, which are especially emphasised by the participatory tradition.
not suffice, then the last resort is the possibility to resolve this optimisation problem in a gargantuan system of (non-)linear equations incorporating the entire economy in fine-grained detail. A dizzying task to say the least, but it is at least a path that would not end up in some local maximum.

Concerning the feasibility of such algorithmic coordination, Hayek’s knowledge problem remains of utmost importance, which can be further divided into two smaller problems. The less challenging part is the problem of computational complexity in processing the data. While the polynomial run time of classical linear-programming algorithms faces practical limitations in regard to input size, more recent proposals are able to process disaggregated input sizes with billions of variables by aiming for approximate solutions, deal with non-linearities, and take into account variable production possibilities and transportation costs, and output the results of such an optimisation in a matter of hours. We can be certain that today the too-many-equations part of Hayek’s knowledge problem may be considered as solved. The second and more severe part of the knowledge problem is the access to dispersed economic knowledge. But also the challenge of data aggregation seems not to be an insurmountable obstacle since not all the knowledge has to be extracted from ‘the man on the spot’, at base it concerns only such information as is communicated via price signals. In optimal planning, the dynamic information regarding relative scarcity money prices entail in competitive market environments becomes visible through the optimisation process and can be addressed subsequently by coordination bodies or the producers themselves by substituting inputs between iterations to account for bottlenecks, which will in turn alter the opportunity costs of scarce resources. Enabled by the velocious calculations of interconnected logic gates, producers would not simply be passive price takers but active price makers; their evaluations would be based on dynamic valuations, and planning would then become ‘a social learning process’ between centre and periphery that could indeed ‘discover, utilize and disseminate context-specific knowledge in society’ that Austrian economists such as Peter Boettke and Rosolino Candela claim to be a unique property of capitalist markets.

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59 See Härdin 2021. As the dynamic nature of real economies will demand such a global production plan to be updated constantly, solutions that are close enough to an optimum will suffice for the task. This allows one to drastically reduce the run time of these optimisation solvers. See also Samothrakis 2021 for a recent machine-learning approach.

60 Hayek 1948a, p. 83.

61 Boettke and Candela 2023. It speaks for itself that this most recent charge against what they refer to as ‘Technosocialism’ hardly engages with current scientific planning literature but targets some popular scientific work without any relevance in the discourse.
Despite their ideological blinders that restrict them from exploring such a possibility further, the Austrians are at least right in two regards. First, for correctly pointing out the motivational benefits in material incentives and the value of communicating planning errors as losses. And second, for having identified that what is at stake is not whether the economy fits into a matrix or whether such a system can be optimised in reasonable time but rather how the necessary economic data is generated. At question is how the underlying production functions, the individual plans determining the relation of inputs to outputs of each workplace, can be articulated in detail to even constitute such a system and whether in the absence of the law of value such an algorithm that optimises for plan fulfilment would not require in addition a hierarchy of ends that finds expression in countless weights or constraints, which would ultimately have to be grounded in consumer valuations if one wishes to circumvent their postulation by some bureaucratic authority.

It has to be emphasised here that the technical coefficients of those production functions would not be set by the centre, as was the case in Soviet command planning, where producers could in most cases not choose their supplier, but by the working groups themselves, preferably in coordination with others, thus local information could in fact constitute the fundamental building block of such a planning process. Indeed, the practical challenge is to determine the exact relation of the technical coefficients, since in the absence of markets for producer goods it is not only the direct inputs that have to be listed but eventually all fixed capital like machinery, bringing with it the challenge of estimating depreciation rates, and also indirect inputs such as the sheets of paper that are consumed to keep an operation running. Although undertaken in the Soviet economy to a degree, these operational requirements cannot be foreseen for longer time horizons in complete detail and would have to be articulated within fully disaggregated input–output equations for each product. Today, such input–output planning is not done at the enterprise level in such detail, and this might be for a reason, or does anyone at Volkswagen know how many forklift hours it takes to manufacture a specific car model?

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62 So far this link between motivation and personal gain has been proven empirically in all socialist experiments and can be observed today with Cuba’s liberalisation reforms, where under the scorching sun small-scale entrepreneurial effort is again rewarded by monetary profit. Likewise, the Soviet experience has demonstrated the necessity within a socialist economy to reintroduce economic pain in the form of bankruptcy. On the design of a socialist rate of return, see Laibman 2015, pp. 317–23.

63 In his model, Paul Cockshott proposes in fact three matrices: a flow matrix for intermediate goods, a corresponding capital-stock matrix, and a depreciation matrix.
Again, not computing but composing these functions is the real challenge, the hurdle indeed consisting in the formalisation of tacit production knowledge.\textsuperscript{64} Due to this imperfection of available information the outputs of optimisation algorithms will never be truly optimal, as Leonid Kantorovich had already admitted. The challenge, however, is not to achieve cooperative perfection but to do better than the legacy system – and coordination in capitalism lies far from a theoretical optimum. If one acknowledges that even with a degree of imperfection production functions could serve as essential constituents then such a system could indeed enable a highly dynamic planning process that would leave much room for decentralised and spontaneous decision-making. Unlike the rigid one-year timeframe encountered in the Participatory Economics model, optimisation solvers as proposed by Tomas Härdin or Spyridon Samothrakis would allow one to run iterations within short intervals to integrate missing inputs and correct the planning errors that will inevitably emerge. Plans will break down due to erroneous formalisation, dynamic changes in the economy, resistances in implementing the plan, false information provided, production units failing to deliver on time, trade embargos, machinery requiring replacement, strikes, forecasting errors, labour shortages, or other ripple effects in supply chains, but the pressing question is how fast these changes can be addressed to update a global production plan. And the rapid pace of algorithmic calculations processing such changes followed by qualitative negotiations along horizontal and vertical lines to settle potential disagreements and persistent planning errors seem to the author the only viable trajectory for replacing the market order.

Such an acknowledgment of the necessity of algorithmic complexity management for solving the scaling problem of planned economies is what I call algorithmic realism, posing an escape pod from Mark Fisher’s capitalist realism,\textsuperscript{65} which is similarly constrictive of the space of the utopian imaginary. It is neither a metaphysical realism nor does it claim to achieve the best possible planned solution, but should be understood more in its everyday sense as constituting the realm of possibility for an economically feasible alternative to market economies, while at the same time reflecting on the limitations and biases of such algorithmic governmentality in the sense of a sceptical realism grounded in the practical problems surrounding the formalisation of

\textsuperscript{64} The Achilles heel of such an algorithmic approach is not only the epistemic capacity to compose these functions but also the will to do so in good faith, as this system relies on the periphery to report this information truthfully, thus requiring an appropriate incentive or disciplinary measures to ensure this.

\textsuperscript{65} Fisher 2009.
production knowledge stated above and the administrative necessity to manually tweak the constraints of such a system, which threatens to bring with it the menace of bureaucratisation, since the true price for taming complexity will be of a political nature. If there is a way to consciously plan entire economies, let alone the world economy, then there is no way around some form of algorithmic mediation, and whether this takes the form of disaggregated input–output planning remains an open question demanding further exploration. This algorithmic a priori however never itself constitutes a sufficient ground for communism; political struggle, including human planning processes, has to operate around and through them: feasible communism can only be Soviet power plus the cybernetisation of the whole country.

Conflicting Rationalities

In sustaining a questionable integrity of communist principles by abstaining from the use of such algorithms as well as rejecting market exchange with money prices to solve this scaling problem, the participatory extreme ultimately gives up on a specific form of economic rationality. Already, Max Weber had identified this tendency by many socialists in the exchange with his dear friend Otto Neurath, which gave Weber the initial impulse for the differentiation of what he refers to as the formal and substantive rationality of economic action. While the former enables economic actions like cost–benefit analyses or the discovery of the optimal means to realise a narrow end like profit maximisation, substantive rationality is more qualitative, or axiological, in the sense that it is also guided by the subject’s value system and is therefore related to value rationality. Economic action informed by substantive rationality also means to act according to one’s ethical conviction by complying with multidimensional success criteria, regardless of whether this leads to the actual realisation of a specific end such as the collectively shared increase of society’s material wealth. When Weber differentiated these two ideal types he was well aware that in practice a degree of both exists in all economic action; however, with its emphasis on radical self-determination, in the participatory

66 A confusion of necessity and sufficiency when it comes to algorithms appears to be the issue with many misunderstandings in the planning discourse.

tradition formal rationality is seemingly sacrificed in favour of the more holistic substantive rationality.68

As money constitutes the purest form of formal rationality, this becomes most evident in the rejection of cost metrics, accounting prices, or what Max Weber called value indices, taking place under the utopian demand to abolish the value-form encountered only at the end of the participatory spectrum. What is feared here is the domination of the concrete by the abstract, which results in a fundamental rejection of calculation and parameterisation in favour of qualitative evaluations. But scaling requires abstraction, because without such a process that reduces qualities to a unit of account the complexity of economic decisions becomes unprocessable at some point, as the comparison of plans becomes practically impossible. Proposals arguing for a calculation in kind without such accounting metrics revert back to the very beginning of the socialist calculation debate by completely ignoring objections put forward by Max Weber and the Austrians in regard to value judgments and substitution relations.

Far from simply overcoming the dichotomy of use-value and exchange-value in capitalism, this relation will have to be transformed to one of use-value as opposed to opportunity and social cost. It is important to note here that socialist accounting metrics certainly should not be based entirely on one dimension such as labour time; following Kantorovich, other forms of valuations such as mathematically derived valuations allow one to price in externalities like CO₂ emissions, for instance,69 facilitating a form of calculation in kind that fulfils both the calculatory criteria of formal rationality while accounting as well for the axiological ones of substantive rationality. Designing such a socialist unit of account, and deciding which qualities are to be represented by it, will be a central task for the society to come.

Although at its fringes the participatory extreme tries to put forward a type of economics that is by their own lights quasi-void of formal rationality, it is not that the case that their proposals are irrational, rather they simply maximise another form of rationality, which ultimately aims at an ostensibly more sublime form of equality with an emphasis more on egalitarian participation in decision-making processes, a reduction of alienation and a needs-oriented system of distribution, rather than on economic efficiency. With the algorithmic tradition, it is the other way around; here we can observe that the subordination of substantive to formal rationality to ensure economic feasibility

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68 Most disagreements in the planning debate can in fact be attributed to different preferences in regard to either of the two types of economic rationality.

69 See Dapprich 2022.
threatens to dissolve the communist project on a political basis, since the instrumental character of the calculatory machine is always at risk of losing sight of those qualities that remain unrepresented, thus potentially opening doors to despotic forms of management and inviting a totalitarian efficiency paradigm to creep in that could dissolve social cohesion.\textsuperscript{70} It seems almost as if one extreme will not work economically, while the other threatens to fail on a political basis. We are facing a dilemma at both ends because the case for libertarian communism has to be convincing in both regards: first, that communism does not realise equality in poverty and, second, that economic feasibility comes not at the price of undermining democratic structures and disregarding the carrying capacity of our planet. The political question going forward is how a middle ground could be established between the two spheres of rationality, how algorithms could be integrated into a participatory planning framework without dissolving its democratic integrity. What is needed is model pluralism, and contours of this are already becoming visible in the work of David Laibman and his attempt to synthesise the different models currently discussed.\textsuperscript{71} Ultimately, such balancing of substantive and formal rationality is always a trade-off and a question of democratic negotiation. While sacrifices in regard to maximising their favoured form of rationality are demanded from both sides, in the end they complement each other rather than standing in a relation of contradiction.

The Discovery of Needs

After that more general excursion on the planning debate, we now return to the question of needs registration, understood here as a forecasting problem.\textsuperscript{72}

\textsuperscript{70} Such differences in favouring a specific form of economic rationality is also observable when it comes to the division of labour. Under the guise of formal rationality, authors from the algorithmic tradition tend to embrace specialisation to ensure economic efficiency, thus accepting a degree of hierarchy in the workplace that will inevitably emerge from such a division despite all democratic structures, while many on the participatory side maximising substantive rationality tend to promote the rotation between different vocational tasks, resulting in an organisational structure that might ensure a radical horizontalism in economic decision-making but that will inevitably come at the cost of decreased productivity.

\textsuperscript{71} See Laibman 2022.

\textsuperscript{72} In the following, the focus is on material needs, or, specifically, private consumer goods. Further, I would like to ask the reader's indulgence in not differentiating between needs and wants, as such a distinction leads to a long list of practical problems; for instance, what defines the line between basic food and a delicacy? When does a need become a
in the last section to underline the dysfunctionalities of the participatory extreme by illustrating the questionable presuppositions concerning the discovery procedure of needs from which the majority of economic planning proposals begin that only become truly visible when translating the ideal of participation into a specific protocol. Central to this question is the idea of *ex ante* communal production, meaning collective coordination before the event of production, which reappears throughout the planning literature. Already in Marx and Engels we encounter the juxtaposition of the blind anarchy of the market, an ‘unconscious condition of mankind’, where ‘no one knows how big supply or demand is’\(^{73}\) since production is particularised in a competitive environment guided by the forces of ‘blind laws’,\(^{74}\) and the *ex ante* communal production by freely associated workers that is ‘consciously regulated by them in accordance with a settled plan’.\(^{75}\) For Maurice Dobb, ‘the advantage of a planned economy *per se* consists in removing the uncertainties inherent in a market with diffused and autonomous decisions, or it consists in nothing at all; and inconsistencies of a market-system, he concludes, ‘can only correct *after* the event; and this may be years after, and even decades after’.\(^{76}\)

In Ernest Mandel’s *In Defence of Economic Planning*, this temporal differentiation of market allocation *ex post* and the direct allocation *ex ante* of planning becomes most explicit, when he stresses that economic planning

is not equivalent to ‘perfect’ allocation of resources, nor ‘scientific’ allocation, nor even ‘more humane’ allocation. It simply means ‘direct’ allocation, *ex ante*. As such, it is the opposite of market allocation, which is *ex post*.\(^{77}\)

However, the idea of *ex ante* communal production has at least two semantic dimensions. First, in the emphasis on the political character of planning we

want? As the most basic needs like healthcare will be met in such a society by universal basic services, these highly subjective judgments should ideally be taken by consumers themselves and not by a board of planners hierarchising needs. Yet, without establishing an intersubjective hierarchy of needs all demands will be on the same plane, resulting in the highly problematic practical challenge to interface the predicted plan target and the optimisation of the plan. If not all that is desired can be produced, then prioritising decisions have to be made about what should be left out. This crucial problem will be elaborated further in a subsequent paper.

\(^{73}\) Engels 1975, p. 433.
\(^{74}\) Engels 1990, p. 274.
\(^{75}\) Marx 1996, p. 90.
\(^{76}\) Dobb 1935, p. 535.
\(^{77}\) Mandel 1986, p. 7.
encounter a social dimension, as a form of economic coordination that is, as Marx said, directly social in virtue of consciously integrating everyone into a democratic planning process that is networking production cells and is oriented towards the fulfilment of collective needs, as opposed to the unconscious and atomised market coordination driven by the self-interest and individual profit maximisation of capitalist managers. And here we are again in the realm of substantive rationality, as not much is said about the efficacy of this planful association; it is the democratic vision of a horizontal decision-making process taking place in advance of production, a type of economic coordination that involves ‘direct a priori allocation of resources (including labour) through the deliberate choice of some social body’. A second meaning of ex ante touches upon epistemic and practical questions concerning the discovery procedure of needs and the more technical alignment of production to their fulfilment, which is already hinted at in the above quote by Mandel but becomes even more explicit in the following passage:

Now, there are only two basic ways of adapting current output to needs. Either these needs are taken as given at the outset, as assessed ex ante by whatever is the dominant social body, and output is organised to satisfy them. Or else they are deemed to be unknown or at any rate uncertain, and the market is supposed to reveal them ex post through the expenditures of ‘effective demand’.  

One common argument levelled against Cockshott and Cottrell’s cybernetic planning model rests upon the accusation of them using information generated by the comparison of market clearing prices with labour values in past production periods for the determination of future consumer demand, thus simulating the law of value and the ex post revelation mechanisms Mandel claims to be unique to markets instead of relying on a conscious discovery process ex ante by a social body to unveil consumer demand before production. And to some degree the critique is justified; the cybernetic feedback loops of adjusting future demand for private consumer goods on the basis of past consumption data are rather mechanical in their model, but they are without

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78 Ibid.
80 See Cockshott and Cottrell 1993, pp. 18–19.
81 Their mechanism is mechanical because future adjustments are based on the current ratio of market prices and labour value. Yet, just because demand might exceed supply at this moment in time does not necessarily mean that a year from now demand will be at the same level. In this way the model does not apply forecasts but posits current market
doubt on the right track, as the comparison with alternative proposals reveals. Across the board, the participatory planning tradition seems to be convinced that it is rational and desirable to ask consumers to put down their anticipated needs in the form of wish lists.\footnote{The only exception here is Pat Devine, whose negotiated-coordination model begins the determination of future demand for private consumer goods on the level of the production unit and on the basis of effective demand. Later this data is enriched qualitatively by consumer representation in the governing bodies of the production units. See Devine 1988, pp. 220–1.}

To some extent this is expressed vaguely by Ernest Mandel: ‘The simplest – as well as the most democratic – way of adapting material resources to social wants is not to interpose the medium of money between the two, but to find out people’s needs just by asking them what they are.’\footnote{Mandel 1986, p. 17.} We encounter this more explicitly in the Participatory Economics model, where ‘each consumer proposes the amount of each good she or he wishes to consume’ in the next year.\footnote{Albert and Hahnel 1991a, p. 109.} These individual ‘wish lists’\footnote{Albert and Hahnel 1991a, p. 65.} are then aggregated and approved by neighbourhood consumption councils and ultimately fed into the iterative planning process. So better be prepared to be chastened for your carnivore diet and to discuss the appropriateness of your kinks with your neighbours!\footnote{In all fairness, Robin Hahnel backtracks on this point of constructive feedback from colleagues in his most recent book, proposing to anonymise the requests, and suggesting that any request with a social cost less than the household’s income cannot be rejected. The question then arises why personal consumption should have to take the detour through neighbourhood consumption councils in the first place.}

Such excitement for tally marks culminates in economist Daniel E. Saros’s proposal for a digitally accessible general catalogue, listing all available use-values for consumers, for which he has been acclaimed by prominent figures such as Evgeny Morozov.\footnote{See Morozov 2019, pp. 63–5. It is inexplicable to me how Morozov ends up with this conclusion. He starts off assessing the predictive capacities of modern capitalist enterprises and the call to regain control over this feedback infrastructure that would have made this article superfluous but concludes with the appraisal of the obnoxious idea of wish lists, which are grounded in his erroneous belief in favour of the importance of user-generated data vis-à-vis corporate data analytics, ultimately negating the predictive efficacy of machine-learning models. However, what is revolutionary is not big data as such but the leap in machinic pattern extraction from these data masses.} At the beginning of each production cycle, the length of which Saros never specifies, individuals are ‘free to select any use-values

realities as ultimate truths to govern the future. I am certain that the authors have nothing against refining the sensitivity of the servomechanism further, as I will be proposing below.

82 The only exception here is Pat Devine, whose negotiated-coordination model begins the determination of future demand for private consumer goods on the level of the production unit and on the basis of effective demand. Later this data is enriched qualitatively by consumer representation in the governing bodies of the production units. See Devine 1988, pp. 220–1.
83 Mandel 1986, p. 17.
85 Albert and Hahnel 1991a, p. 65.
86 In all fairness, Robin Hahnel backtracks on this point of constructive feedback from colleagues in his most recent book, proposing to anonymise the requests, and suggesting that any request with a social cost less than the household’s income cannot be rejected. The question then arises why personal consumption should have to take the detour through neighbourhood consumption councils in the first place.
87 See Morozov 2019, pp. 63–5. It is inexplicable to me how Morozov ends up with this conclusion. He starts off assessing the predictive capacities of modern capitalist enterprises and the call to regain control over this feedback infrastructure that would have made this article superfluous but concludes with the appraisal of the obnoxious idea of wish lists, which are grounded in his erroneous belief in favour of the importance of user-generated data vis-à-vis corporate data analytics, ultimately negating the predictive efficacy of machine-learning models. However, what is revolutionary is not big data as such but the leap in machinic pattern extraction from these data masses.
from the General Catalog and to arrange them according to preference in his or her needs profile,88 and in the planning process these personal order lists are then aggregated and constitute the plan target. The catalogue Saros envisions encompasses highly specific private consumer items like colour-coded cigarettes for indoor and outdoor smoking; public goods like healthcare are packaged into obtainable plans and even oddly abstract entries like air quality can be chosen by consumers. Not only is Saros convinced that consumers should determine the right quantities for these countless options, they would also have to rank their choices and provide information about the location and timeframe in which consumption is to take place. Regardless of whether consumers have actually ordered an item, they would still be allowed to acquire it later on a first-come, first-served basis. To make people participate in this obscure planning process, Saros introduces a draconic incentive system by handing out a bonus in purchasing power depending on the deviation of actual consumption from the estimations of their individual needs profile, which would have to constitute a considerable share of their income to function as a motivation mechanism.

What reappears here is the exaltation of participation, the political ideal of self-determination by involving those who are directly affected by the outcomes of planning decisions, regardless of whether this leads to optimal needs satisfaction or not. It is more than comical how the emancipatory politics of conscious control collapses here in a collective agony of meticulously completing wish lists at regular intervals that would be comprised of several million entries at least.89 Such a discovery procedure of needs would ultimately require running personal demand forecasts for literally every existing consumer item, for otherwise there is no possibility of determining the right quantities for the plan target. Robin Hahnel has seemingly acknowledged the absurdity of this as he proposes to demand from consumers only forecasts on a highly aggregated level to reduce the complexity of the task. So instead of ordering a 'size 6 purple women's high-heeled shoe with a yellow toe', consumers would merely have an entry for 'shoes' in their wish lists, the idea being to leave the details for the worker-councils to figure out as the 'fine level of

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89 In his critique of planned economies Alec Nove estimates that ‘12 million identifiably different products’ (Nove 1991, p. 33) existed in the Soviet Union; today Amazon alone offers more than 500 million consumer products, which does not even take into account any intermediary goods. Even if one cuts through the clutter of capitalist commodity production, one would still end up with a conservative estimate of several million different consumer products.
detail producers require is revealed as the plan is actually implemented.’

90 But at such a level of aggregation there would be so much information lost – for instance, to which worker-council should resources actually be allocated? – as to render the whole process of compiling these lists pointless.

It is completely unclear to the author how the annual planning procedure would take place between a variety of workers’ councils competing for resources in the shoe industry, all of them with detailed self-activation proposals, and the federation of consumer councils demanding a certain quantity of unspecified shoes. The exact same problems as had emerged in the Soviet Union would appear, where producers would have to figure out a highly-aggregated plan target, the difference this time being that it is not the brainchild of Gosplan but the product of a dogmatically participatory planning process. To make pre-orders at all useful and to overcome this mismatch between the detailed plans of various worker-councils and an overly aggregated demand on the side of the consumer, one would have to specify the demand further like Saros does, at least to the level of product type, to get estimates on required resources, and brand, and to know to whom these resources will be allocated, which would again make the task a highly complex challenge for consumers as it would drastically increase the number of possible entries.

To further reduce complexity for consumers, Hahnel also proposes to begin with their personal consumption ‘from the previous year and making adjustments up and down’,91 which is nothing but a slightly tweaked naïve forecast. Translated to meteorology this would be to say the weather tomorrow will be like today but with slight differences – is this really the best we can do?

What about consumer items that are not bought on a regular basis? People would need to anticipate whether their washing machine might break down the following year and find a replacement in this vast catalogue ex ante. If consumers fail to do so, the right amount will simply not be produced. While the sequential idea of reporting future needs at fixed intervals is already questionable, such an approach would also be exposed to certain psychological effects, where the experiences of shortages will likely lead to faulty demand spikes in the following planning cycle. Many people also have no idea of how many units of specific consumer goods they will desire more or less next year compared to the amount they have consumed in the prior production cycle, or are simply unable to express them due other limitations such as disabilities, and unquestionably a majority would certainly not have any interest in acquiring this knowledge either, yet one would demand from a feasible economic system

90 Hahnel 2021, p. 166.
91 Hahnel 2021, p. 125.
that these goods are at the disposal of consumers in sufficient quantity when needed without producing too great an excess supply. Eventually, the challenge consumers would have to face with such wish lists is of an order of magnitude more difficult. It is a way harder problem to forecast the needs of each consumer individually in the way these authors envision it than doing these forecasts on a higher level of aggregation, as errors would not simply cancel out. For the operational planning of a supermarket or an economy it is irrelevant who buys an item, what matters is the estimate of total demand in the specific time period – personal desire then dissolves in a sea of statistical data.

If such individual demand forecasts by consumers were in fact more accurate than the aggregate forecasts done by enterprises, then some capitalist firm would have already experimented with it as it would be simply more profitable. The reason why wish lists do not constitute the modus operandi of capitalist commodity production is not that firms want to hinder the self-determination of consumers, rather it is simply a bad idea or, as David Schweickart has put it, ‘nonsense on stilts’ – even food cooperatives do not operate solely on the basis of detailed annual order lists filled out by consumers in advance! To be clear, there is nothing wrong in enriching demand forecasts with information generated with binding pre-orders that exist already in capitalism and oblige consumers to honour their commitment, but we cannot rely entirely on the prophetic abilities of consumers when it comes to determining future demand and also promise freedom of choice in actual consumption. Any such proposal builds the entire planning process on the delusion of a socialist homo economicus, who abstains from blind consumerism and as they believe will finally be able to accurately express their true desires once freed from capitalist chains. But this knowledge about future needs simply does not exist in people in sufficient detail, as what is actually required is not an expression of actual

92 Schweickart 2006.
93 Those known to the author only allow for the pre-ordering of themed baskets, in which the actual composition depends on what is supplied by producers, resulting in an ascetic diet consisting almost entirely of tuber vegetables over the winter months, or operate very similarly to supermarkets, allowing more room for consumer choice and flexibility while delegating the coordinative work of ordering to core members. There do exist personal pre-orders in the latter case but these are optional, have a rather short time horizon, and, in stark contrast to the proposals above, oblige consumers to buy what they have ordered, who, in return for this loss in freedom, qualify for a discount.
94 When it comes to productive consumption, pre-orders will of course remain playing a significant role, as most machinery is produced on demand for instance, yet any quantitative estimation of producer inputs and outputs is ultimately dependent on final consumer demand at the end of the supply chain.
95 I would like to thank Guillermo Collado Wilkins for proposing this term to me.
desire but an all-encompassing prediction of future needs. Ultimately the registration of needs is a forecasting problem, and at the end of the participatory spectrum the guesses of isolated producers would simply be replaced by the even worse guesses of consumers, and the planned economy would inevitably find itself groping in the dark, to borrow Ludwig Mises’s words here.

In the past, the Austrians have been extraordinarily helpful in figuring out the challenges of a post-capitalist economy – Oskar Lange even went so far as to erect a statue of Mises in the future central planning board to honour his contribution. But it is really Hayek’s epistemic pessimism that historically has been an antidote to the hubris of conscious control over the economy restricted entirely to analogue planning processes. Throughout his oeuvre, Friedrich Hayek stressed the limitations of human knowledge of both the outside world as well as the inner mental order⁹⁶ and hurled this argument against neoclassical and socialist economists alike. And when it comes to material desires this knowledge remains in fact tacit in most cases until the moment of imminent consumption. Unlike many of his contemporaries, who attacked the homo economicus on the basis of its selfish ends, Hayek dismantled the concept on the basis of its means or capacities as for him economic actors do not have access to the information that would allow them to act truly rationally. Yet, despite this starting point of a division of knowledge and self-interested economic actors with incomplete information and faulty models, markets are an ex post discovery procedure driven by the miraculous tendency to move towards equilibrium, producing thereby the spontaneous order Hayek called catallaxy:

How can the combination of fragments of knowledge existing in different minds bring about results which, if they were to be brought about deliberately, would require a knowledge on the part of the directing mind which no single person can possess? To show that in this sense the spontaneous actions of individuals will, under conditions which we can define, bring about a distribution of resources which can be understood as if it were made according to a single plan, although nobody has planned it, seems to me indeed an answer to the problem which has sometimes been metaphorically described as that of the ‘social mind’.⁹⁷

Both Hayek and Marx would certainly have agreed that such an equilibrium of supply and demand would never stabilise: competitive markets oscillate by

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⁹⁷ Hayek 1948b, p. 54.
overshooting more than undershooting around this centre of gravity that is in motion itself. Although this ‘social mind’ of the spontaneous market order is not directly social in the sense of a wilful act of joint coordination *ex ante*, it is far from blind in contemporary capitalism; through an ongoing monopolising tendency of capitalist production and ever-expanding digital infrastructure, corporations like Amazon have an appallingly in-depth knowledge about the material desires of their customers as well as the means to shape them.

In one of the last essays before his death, and after an intensive engagement with cybernetics, Lange, picking up a thought that had already been expressed by Hayek, who described the price system as a ‘system of telecommunications’,\(^98\) noted that ‘the market may be considered as a computer *sui generis* which serves to solve a system of simultaneous equations. It operates like an analogous machine: a servo mechanism based on the feedback principle’; unlike Hayek he considered markets to be a ‘cumbersome and slow-working servomechanism’, while the computer would introduce a form of economic accounting that would fulfil a coordinative ‘function which the market never was able to perform’.\(^99\) Where Hayek regards the market as something transcendent, some sublime coordinative entity beyond human capacities, cybernetic socialists are likewise believers in the transcendence of applied mathematics. For us, the only thing that can replace the market order is the *deus ex machina* embedded in human planning processes, thereby realising a ‘synthetic catallaxy’.\(^100\)

Already the feedback process of markets or, as Hayek has put it, this ‘discovery procedure of competition’\(^101\) can be framed as a voting mechanism for evaluating the space of actuality. What this validation machine of capitalist markets suffers from, however, is the isolation of information between competing enterprises, an unequal distribution of voting power among consumers, a blindness for externalities, as well the general alignment of existing products towards profit maximization instead of needs satisfaction due to the axiological reductionism of the money form, which results in uneven access to the grotesque commodity basket of our capitalist present. Within a digitally planned economy, where production is subjugated to the satisfaction of needs and the existing stock of consumer products would be aligned to certain social criteria, socialist consumer markets would overcome these shortcomings, and conscious consumption would become a genuine *ex post*

\(^98\) Hayek 1948a, p. 87.
\(^99\) Lange 1967, p. 158.
\(^100\) Bratton 2015. Opposing this equation of computation with artificiality, one could argue that there is nothing natural about Hayek’s market order, as it was always technologically mediated itself by the price mechanism.
\(^101\) Hayek 2002.
voting system that would only be distorted by the interpretative logic of our predictive machines.\textsuperscript{102} Consumption patterns would not be extrapolated in the information silos of competitive enterprises but by a networked planning apparatus that would be able to detect and adjust changes in real-time through predictive analytics that are anchored in an interconnected production apparatus. Such a feedback system could be further refined by other qualitative channels by means of consumer panels or simply feedback systems like Amazon’s product star rating to communicate criticism or suggestions for improvement, which had long been anticipated by Stafford Beer’s ‘algedonic meters’ in a side project to Cybersyn.\textsuperscript{103}

And it is not that \textit{ex post} validation would not take place in a participatory planning framework. No matter whether plan targets are derived collectively in councils on the basis of wish lists, as individual production plans of competing enterprises or a socialist supercomputer, all of these economic approaches are subjugated to the exact same sequence of operations: first, they begin \textit{ex ante} with forecasts to determine future demand; the second step consists in a planning process to discover the optimal means to best fulfil this target; third, production itself takes place; and fourth, finally the executed plan is subject to a validation process \textit{ex post} in consumption, which will alter future demand expectations.\textsuperscript{104} Where they differ though is on the question of who is involved (social dimension), whether forecasting and planning is a collective or competitive endeavour, and what means are employed (technological dimension) in these processes.

\textsuperscript{102} Constraining consumption with an equal distribution of consumer credits would have several positive effects. This becomes evident for instance when looking at the global housing crisis. There we can see how collective management strategies break down when it comes to rationing scarce goods like public housing. Unable to identify a needs-based allocation mechanism in the absence of markets, public housing agencies from New York to Singapore have to resort to some form of lottery system. Given equal funds for all market participants, an auctioning system for housing would be by far the more elegant and fair solution in administering actual needs. Another positive aspect of consumer credits would be that it does not require a general subject form that has internalised a consumptive ethic of modesty to prevent unsustainable consumer habits, thus grounding the utopian cornucopia of proposals like fully automated luxury communism without the need to enter into any negotiation processes in consumer councils. Whether such credits are distributed truly equally or on the basis of labour contribution, effort or merit would be for the social body to decide. Special needs due to disabilities – Bernes mentions insulin and glasses in his critique (see Bernes 2020, p. 63) –, would of course be covered by universal basic services.

\textsuperscript{103} See Medina 2011, pp. 88–92.

\textsuperscript{104} In practice, these processes are of course more iterative than the linear scheme outlined here.
Anarchists like Jasper Bernes believe that a cybernetic or data-driven approach to planning would result in a ‘clumsy trial-and-error’ system. Yet, trial and error is all that humanity has got in making sense of the future, error rates and time intervals to fix them will vary dramatically within different planning functions, and in a planning framework that uncritically exalts the ideal of participation these errors would be of an order of magnitude larger and, due to the deliberative negotiation processes, slower than what can be achieved through the enhancement of planning by networked information systems. The forecasting algorithms that were introduced in the first part of this paper excel at modelling actual consumer demand at the global level, they can assist planners also in setting market clearing prices, and it is likely that their predictive accuracy will further increase in the near future, especially considering the informational depth they would have access to once production is socialised. So conforming to economic rationality in its formal sense of finding the best means to the end of needs satisfaction, it is highly questionable why consumers should themselves determine ex ante the quantities for their personal consumer items.

While in regard to the quantitative determination of how much electricity households might need in the future, an aggregated sum of individual consumer forecasts will be far more inaccurate than statistical load-capacity forecasts of network operators drawing on smart meters, on the qualitative question of what the source of this energy should be or whether such a society might rather elect to reduce the projected consumption in light of global warming, none of these algorithms will be able to provide a definitive answer. The latter is the realm of politics and participation, where opinions are certainly also informed by statistical knowledge, while the former is the realm of revolutionary mathematics; although always remaining a politically contested field and without becoming an entirely automatic process, these quantitative questions should be governed more by algorithmic expert systems than human swarm intelligence. Participation, David Laibman says, ‘is something to be optimized, not maximized’.

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105 Bernes 2020, p. 69.
106 This applies to most public infrastructure. No algorithm will be able to tell us whether to build a playground or library in a neighbourhood. On such qualitative decisions there will be no way around deliberative planning processes in the future.
107 Laibman 2022, p. 233. The same applies to the introduction of new consumer goods, which initially is not always demand driven. Even Ernest Mandel, referring to Henry Ford and Steve Jobs, acknowledged that it is not so much consumers as entrepreneurs who shape new desires. See Mandel 1986, p. 11. On the question of who the agents of innovation are, Henry Ford once famously responded: ‘If I had asked people what they wanted,
The unpleasant truth for many radical communists is that a feasible solution to improve the material living standards for the whole society while acknowledging our planetary boundaries will either entail some market-socialist framework or the unholy union of human planning processes with algorithmic systems. The latter is not the subconscious social mind of Hayek’s market but the general intellect of a planning daemon, a technoscientific assemblage that is merely another expression of the same conscious control that allows humanity elsewhere a certain degree of control over nature through the ‘vast machine’ of global weather forecasting.

Not to be mistaken for the biblical demon, the figure of the daemon has haunted human history for millennia. Daemons are helpful spirits, allegedly Socrates was possessed by one, an inner voice that prevented him from making wrong decisions; we also know about the daemons of physics, metaphysical entities in the thought-experiments of Laplace or Maxwell, and more recently daemons have reappeared as critical parts of our digital infrastructure, where system services that work tirelessly in the background, such as in the batch processing of the early time-sharing systems, the initiation process of operating systems, responsible for booting the system up as well as managing its state, or the Hypertext Transfer Protocol daemon (HTTPd), which fulfils the role for the internet of monitoring the network to answer requests from clients, became known as daemon processes.

In our case, this planning daemon is neither all-knowing nor anarchic, yet its drawing on past consumer data for an interpretation of future desire will prove closer to actual needs than any planning process based entirely on individual consumer forecasts could ever be. It supplants the pseudo-rationalist Soviet ministries with an empiricist apparatus. Such a transparency machine however would require basically all economic activity to be captured centrally and would seemingly come at the cost of radical economic transparency, establishing with it the potential foundation for an extensive surveillance apparatus

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they would have said faster horses.’ Steve Jobs repeated this argument once in the context of consumer research, stating: ‘People don’t know what they want until you show it to them.’ While there is some truth to this, production should never be blind to consumer needs. Investment councils and crowdfunding platforms that would establish feedback channels on consumer needs and allow consumers to back projects or even propose product ideas, could be a means to fulfilling this paradigm in a socialist economy, which would not only enable equal participation for consumers in decision making by supporting novel projects but also unleash the creative potential slumbering in those who do not have access to capital under contemporary conditions to realise their entrepreneurial visions.

far exceeding current ‘Surveillance Capitalism’. And it is not just economic information it hungers for; the more information being made available to the model, the more accurate the forecasts will be.

So if a society ever decides to take this path, the questions arise of how much personal data a society would be willing to provide, such as search-engine queries for instance, what kind of biases might distort its predictions, and how this daemon can remain subjugged to the will of the people by preventing this system from turning into a surveillance apparatus that might foster the materialisation of another red bureaucracy. What has to be prevented at all costs, is that the merit of computer scientists and their prominent position in the production process becomes translated into power of over people. But does the only way to prevent such a scenario really involve a communist society abstaining from applying their productive abilities to the fullest? The answer to this rhetorical question is that any communist project with hopes of success must cautiously navigate between Scylla and Charybdis, not fall into the traps of either technocracy or luddism, authoritarianism or economic infeasibility, as both the extremes of instrumental reason and substantive rationality are dead ends.

As with all analogies this figurative comparison has its limitations, but both system services in computation as well as the use of algorithms in economic planning share from the viewpoint of the user the feature that they are running in the background and are therefore at risk of being co-opted for other ends that could potentially harm the user. But just because they run below the user interface does not mean they are beyond human control. Just as daemon processes can be monitored and terminated through the command line, the same must apply to the planning daemon. What will be required to keep this apparatus in check are robust civic institutions. Further, it will need a certain degree of mathematical and coding literacy on the part of the general population to ensure a basic understanding of the technologies in use; by all means personal information must be anonymised; it will require distributed computation; the source code has to be made accessible in public repositories; open competitions should be held to improve these models; and industry forecasting boards with delegates of production units would have to be established to oversee the machine and intervene in case of malfunction, evaluating these algorithmic forecasts to restrict their application to those fields where the technology in fact delivers better outcomes, as there will certainly be cases where consensus or entirely qualitative methods such as the Delphi method, consumer surveys or simply entrepreneurial intuition turn out to be superior. Far from falling

109 Zuboff 2018.
victim to a naïve tech utopianism, the application of this machine must be subordinated to the rule of science, empirical trials will have to determine the outcome of such a methodological competition and if the local models of production units outperform such a global model there must exist democratic procedures to overrule it. On the design of such an institutional framework much can be learned from the participatory tradition. But eventually the function creep, the unforeseeable ‘divergence of its initial purpose’, is the ‘modus operandi of any algorithmic system’ and remains the inescapable destiny of a society that unleashes this daemon – a risk that should be considered worth taking.

Affirming such a degree of algorithmic governmentality will be without a doubt alien to many on the Left, as such a sacrifice of substantive rationality would be tantamount to the betrayal of their political values. For many radical communists, capitalist exploitation would simply be substituted with a form of machinic enslavement, a mere exchange of one servomechanism for another. A different composition of means will always have some effect on the end, and with such a prominent role given to algorithms many would not recognise their own vision of communism. But what is the alternative? Unable to forecast demand accurately, a planning paradigm that abstains from applying the statistical state of the art will have to sacrifice needs-satisfaction instead, workers would have to keep working longer hours due to avoidable inaccuracies in forecasts, and one would have to ask whether humanity can allow itself to neglect such questions concerned with an efficient use of resources in the face of ecological collapse. Especially under a distribution mechanism based on a needs principle, such an ideology of empty shelves would result in endemic shortages. In their despair people would consume what others have ordered, leading to discord between those who estimated their needs accurately and those who failed to do so; the situation would only worsen as some individuals start hoarding, and the emergence of black markets would reintroduce monetary logics, as has been observed countless times in the past. As a consequence of failing to provide the material substrate, the discontent resulting from such a decline in material living standards will amplify counterrevolutionary tendencies that threaten to further destabilise the socialist project. A planned economy that dogmatically embraces the participatory ideal by all available means would soon be in a situation where appeals to keep going will no longer pacify the growing revisionary sentiment and the social body would either have to watch how the political situation deteriorates further or suppress these voices by force. Sooner or later the infeasibility of such an economy

110 Kornweitz 2021.
would put an end to another socialist experiment or bring into life the very authoritarian structures these radical democrats despise so much. Algorithms in particular and the appropriation and radical development of the productive forces in general will never be a sufficient foundation for a post-capitalist future but they are a necessity for the feasibility of a socialist mode of production whose scope transcends the commune. The ‘true realm of freedom’, Marx said, can only flourish with the ‘realm of necessity at its basis’, and without a little help from some algorithmic daemons, communism will be nothing but the democratic administration of misery.

References


