# Duality Explored: The Algorithmic Management - Autonomy Interplay.

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## Abstract

This paper delves into the intricate interplay between algorithmic management (AM) and worker's autonomy, addressing the existing theoretical ambiguity surrounding their relationship. While prior research has predominantly painted a negative picture of AM's influence on autonomy, this study adopts a neutral stance, aiming to answer the research question: "What characteristics of algorithmic management enable and/or restrain different dimensions of autonomy?" To achieve this, AM is deconstructed into three distinct characteristics, while autonomy is divided into three overarching dimensions. The research employs a qualitative strategy, utilizing semi-structured interviews with delivery workers from the company Flink, who are subject to AM. The results reveal that each AM characteristic exerts both enabling and restraining influences on worker autonomy, presenting a comprehensive understanding of these dynamics. Furthermore, the study emphasizes the significance of contextual factors, such as human involvement, the support or replacement of AM managers by the system, and the technological interface, in comprehending the AM-autonomy interplay. In showcasing how algorithmic management simultaneously restrains and enables autonomy, this study challenges prevailing narratives in the literature. It argues that the desired consequences of algorithms for workers coexist with the undesired consequences often reported in existing research. Through this nuanced exploration, the paper contributes to a more comprehensive understanding of the intricate dynamics between AM and worker autonomy.

Keywords: algorithms, algorithmic management, job autonomy, duality

# Preface

For the past two years, I have dedicated my efforts to addressing a research question that holds significant importance for me. This master's thesis provides an in-depth exploration of the complex dynamics between algorithmic management (AM) and worker autonomy, aiming to clarify the existing theoretical uncertainties surrounding their relationship.

After completing a pre-master's program for a degree that I did not wish to pursue further and the initial iteration of my master's thesis, I started my thesis work in February of 2022 and over the last 2 years I analyzed scientific literature, walked the streets looking for participants, conducting and processing interviews. All this research has been compiled in this document.

I would like to thank my supervisors, Laura and Jeroen for their support and feedback over this unusually long period. Your seemingly endless reservoir of patience and guidance was a significant contributor to me finishing this endeavour. I would also like to thank my family for their support during this difficult process. In particular, I would like to thank Robert, Sebastian and Giorgia who have supported me in more ways than they could ever imagine.

This concludes my student time at the University of Twente, which I am leaving with a master's degree in business administration. Although I had hoped for a smoother journey in obtaining this degree, I am appreciative and content as I bid farewell to the University of Twente and the Netherlands. I am grateful for the fulfilling chapter of my life spent here.

Michael Libbertz,
January 2024, Ginsheim

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# Introduction

Originating in the research of online labour platforms, algorithmic management (AM) has gained more attention from researchers and practitioners alike. AM has been defined as a system of control where algorithms are given the responsibility for making and/or executing managerial decisions (Duggan et al., 2020). Furthermore, by means of algorithmic decision-making, human involvement, and oversight, especially in Human Resource Management processes like hiring, are limited (Duggan et al., 2020). Since HRM algorithms influence or execute decisions regarding workers, researchers have paid much attention to the potential impacts of AM on workers. Arguably one of the most identified influences of AM impacting workers is a shift in autonomy, meaning the degree of control or discretion workers have over their tasks (Hackman & Oldham, 1976). For example, AM, as a tool for control, is theorised to empower managers and by that shift a balance between integrity and compliance (Leicht-Deobald et al., 2019). According to Kellogg et al. (2020), the means of control provided by AM are perceived as a direct threat to workers' autonomy. Jarrahi et al. (2021) identify other reasons for a loss of autonomy. The researchers argue that due to the complexity and opacity of algorithms, workers are unable to navigate and control important aspects of their work and ultimately lose their autonomy. Another potential impact on autonomy can be seen in nudging. Algorithms can be designed to actively influence workers' decisions and by that limit their autonomy (Gal et al., 2020). These three examples illustrate the dominant perspective in the AM literature that AM impacts autonomy negatively. In contrast to the mentioned examples of adverse effects of autonomy, Meijerink and Bondarouk (2021) introduced the concept of duality in algorithmic processes. They argue that AM can enable and restrain autonomy. An example of enabling aspects can be found in the research of Healy et al. (2017), who argued that AM in online labour platforms gives workers the freedom to choose where and when to work and by that increase their autonomy. Overall, scholars in the AM literature come to different, sometimes even contradicting results and suggest that there is no clear answer as to whether AM enables or restrains autonomy. This paper makes two critical presumptions. First, it seems like it is unknown how AM and autonomy relate exactly. Second, following the example of Meijerink and Bondarouk (2021), the questions that should be asked is not 'enable or restrain' but how AM is simultaneously enabling and restraining autonomy.

An obstacle in the current debate is that autonomy is used as an umbrella term describing different kinds of autonomy. This makes autonomy in the context of AM less comprehensible and understandable even though the literature on autonomy outside the AM context has already further progressed in the clarification of autonomy. As early as 1985, Breaugh (1985) argued that autonomy should not be operationalized as a global construct but differentiated into different dimensions. The researcher identifies three dimensions of autonomy. First, *work method autonomy* describing discretion of an individual regarding the process and methods of a job (Breaugh, 1985). Secondly, *planning autonomy*

which represents agency in scheduling or timing the work (Breaugh, 1985). Lasty, *performance evaluation autonomy* which empowers workers decisions on how work and performance should be evaluated (Breaugh, 1985).

Integrating Breaugh (1985) in the debate of AM reveals that most research talking about autonomy focussed on certain dimensions of autonomy and not the concept as a whole. Deconstructing autonomy in the context of AM would benefit the current debate as it would move from questions of whether AM does impact autonomy to what characteristics of AM do influence what kinds of autonomy and in what ways. In the same manner, deconstructing AM could enrich the current debate. In general terms, AM does not influence autonomy but certain characteristics, like datafication, of AM influence autonomy. The investigation of AM and autonomy in sub-categories which are part of a greater whole has several benefits. First, it would contribute to the general understanding and second could explain how AM can enable and restrain autonomy at the same time.

Thus, the exploration of various dimensions of autonomy, as delineated by Breaugh (1985), alongside different aspects of algorithmic management (AM), represents a pivotal step toward unravelling the complex interplay between these entities. It becomes evident that the current debate on AM's impact on autonomy lacks a nuanced understanding of their multifaceted relationship. Therefore, the overarching question guiding this inquiry is: *What characteristics of algorithmic management enable and/or restrain different dimensions of autonomy?"*

To answer the research question, a qualitative strategy employing semi-structured interviews was adopted for its adaptability in delving into the details of algorithmic management and autonomy. Recruitment targeted food delivery workers within the company Flink, chosen for its unexplored business model and significance in the food delivery sector. A diverse recruitment strategy was employed, including personal connections, social media outreach, and in-person street intercepts across Germany and the Netherlands. This research endeavours to bring clarity to the ongoing debate surrounding AM and, to some extent, reconcile the contradicting results present in current scholarly discourse. Furthermore, it aims to serve as an exemplar, showcasing how deconstructing AM can enhance the depth of understanding within this field of study. This paper is structured as follows: The subsequent theory section delves into an extensive exploration of existing theories and research surrounding the characteristics of algorithmic management and the dimensions autonomy. Following this, the methodology chapter details the research approach, data collection methods, participant recruitment, and analysis techniques employed. The findings section presents the discovered relationships between algorithmic management characteristics and autonomy dimensions. A discussion chapter interprets and links these findings to existing literature, exploring their implications. Lastly, the conclusion summarizes key findings, acknowledges limitations, and offers suggestions for future research in this domain.

# Theory Section

## Algorithmic Management

The earliest considerations of Algorithmic management (AM) as a concept have been made in the context of ridesharing platforms. Lee et al. (2015) investigated how drivers of Uber and Lyft are managed with the help of algorithms and defined AM as algorithms that assume managerial functions. The researchers identified work assignment, informational support, and performance evaluation as functions that, before automation, were typically tasks of middle management. Other definitions within the scope of ride sharing platforms include Möhlmann and Zalmanson (2017). By including insights from information system research and emphasising how AM changes the relationship between management and workers the researchers defined AM as oversight, governance and control practices conducted by software algorithms over many remote workers (Möhlmann & Zalmanson, 2017). Later contributions to the understanding of AM were made in the context of Human Resource Management. Duggan et al. (2020), still looking at the gig economy, theorized changes in employment relations and resulting implications for HRM. They defined AM as, "management as a system of control where self-learning algorithms are given the responsibility for making and executing decisions affecting labour, thereby limiting human involvement and oversight of the labour process" (Duggan et al., 2020, p.6). Building on existing definitions and assumed functions of AM, Meijerink & Bondarouk (2021) developed a simple three-step model to conceptualize AM. According to the researchers, AM consists of input in the form of machine-readable data, the automated processing of said data and output in the form of a decision or execution of tasks (Meijerink and Bondarouk, 2021). The research of Meijerink & Bondarouk (2021) will be used as a starting point to identify characteristics of AM. Characteristic in this context means distinguishing traits or properties without AM could not function. Datafication, the first discussed characteristic, can function as an example as without datafication of business processes AM could not exist.

### Datafication

Coined as *"the new oil"* by The Guardian (Tarnoff, 2017) it is not surprising that data is needed to get and keep the algorithmic machine running. The dependency of data can be further demonstrated by an extract by Gillespie (2014) who described algorithms as "meaningless machines until paired with databases upon which to function" (p.169). The importance and dependencies attributed to data are best showcased by the term Big Data which can be explained in the context of volume, variation and velocity of data (Sagiroglu & Sinanc, 2013). Originally developed by Laney (2001) the 3 Vs are a well-known definition of Big Data within management research (e.g., Frizzo-Barker et al., 2016; Garcia-Arroyo & Osca, 2019; Wenzel & Van Quaquebeke 2018). Volume describes the collection of huge quantities of data which in an organisational context often means petabytes' (petabyte = 1 million gigabytes) worth

of storage capacity (Haas & Pentland, 2014). The main challenge for organisations is the separation of useful data, which can be used to extract practical knowledge, from non-useful data (Mari & Masini, 2017). The term variation includes different types of data, e.g., structured, and unstructured data (Frizzo-Barker et al., 2016), or different types of data sources (Garcia-Arroyo & Osca, 2019). In a company different type of data on workers' attributes can be collected by means of smart mobile technologies like phones, watches, GPS tracking or sociometric badges (Strohmeier, 2020). Velocity is the pace data is generated by or used for interactions (Laney, 2001). This means the meaning of velocity is twofold. First, velocity is the speed data is generated by the interaction of an individual using a digital device and second the time needed to sort, clean, combine, analyse and act upon the collected data efficiently (Gandomi & Haider, 2014). As already mentioned, extensive data collection methods in the scope of the Big Data context are necessary for AM. Nonetheless, research has criticized the process of datafication regarding the implications for workers. The data collected can disclose aspects of the employee as a person like competences in various skills and settings, as well as physical or mental health conditions (Bock, 2015). Additionally, the extensive data collection is reprehended as a surveillance mechanism (Rosenblat & Stark, 2016) especially when considering that some employers have given wearable devices to employees that rewarded lifestyle choices such as exercise and sleep (O'Connor, 2015). Another example is the data aggregation on courier or ride-hailing platforms while waiting to be assigned a task. During these "dead miles" workers are not paid for driving while waiting for a task to appear but platforms still generate useful data for analytics (Thomas, 2018, as cited in Duggan et at., 2020). Kellogg et al. (2020) note that algorithmic supported surveillance expands the previous control mechanisms in scope and frequency and thus can often lead to a loss of privacy for the workers.

### Automation

The second characteristic of AM is automation. Some degree of automation is necessary to process the enormous amounts of data (volume) in a fast manner (velocity). Processing of data includes the cleaning, extraction, sorting, structuring of data generated by workers (Garcia-Arroyo & Osca, 2019). To illustrate the automated data processing résumé data acquisition, as described extensively by Strohmeier and Piazza (2015), will be used as an example. Organisations receives applications within the recruiting process which contain textual information on the applicants. Without automation these text documents have to be processed by humans which extract relevant information manually and enter the information in HR information systems. This extraction can be automated by identification of different essential information like name and address or even qualifications by a computer system (Karamatli & Akyokus, 2010). Furthermore, an automated system is able to sort or structure different applications based on keywords such as "bachelor's degree" or "master's degree" (Sen et al., 2012). Staffing in terms of résumé screening is not the only HRM practice that can be automated by the means of AM. Other practices include training, appraisal, workforce planning and compensation/rewarding. Regarding training Ramamurthy et al. (2015) developed an algorithm which based on historical data can identify workers in need of re-skilling and quantify the likelihood of successfully (re)training a needed skill. Lin

and Hsu (2010) used algorithms to automatically rank the importance of HR capabilities against developmental needs. Lastly, Colomo-Palacios et al. (2014) used algorithms in similar manner by predicting competency gaps in the management of software engineers. Automated appraisal can be observed in the context of performance measurements within platform work. Veen et al. (2019) discuss in their research how UberEATS collects data to generate performance metrics on drivers automatically. According to the researchers, UberEATS key performance criteria are acceptance ratings of accepted or rejected orders, cancellation ratings based on cancelled orders that have been accepted initially and customer ratings given the driver. Similarly, Kinder et al. (2019) investigated how workers performance is measured by the digital labour platform Upwork. Upwork collects data on a freelancers' contract completion rate and client feedback to feed into an HRM system which then generates a job success score for workers (Kinder et al., 2019). The next practice is workforce planning where algorithms are used among other things to solve optimisation problems for assigning employee to shifts. The problem to be optimized involves different criteria such as labour costs, job-person fit and employee preferences or constraining factors like maximum working time, recreation times and qualification requirements (Strohmeier & Piazza 2015). As an example, Instacart, a platform-based grocery delivery service, uses its system to assign workers, based on anticipated labour demands, different statuses (Griesbach et al., 2019). Theses statuses are used to enable different workers to sign up for shifts earlier than other workers (Griesbach et al., 2019). Lastly, the HRM practice of compensation, where algorithms are used to dynamically reward high performing workers (Kellogg et al., 2020). Studies on platform work has shown that the rewards include benefits like additional work possibilities, higher pay or increased flexibility in work times (Rahman, 2019; Rosenblatt & Stark, 2016; Shapiro, 2018).

In sum AM is supported by algorithms to automate to process the data in terms of sorting and cleaning and then feed the data into an HRM system to support different practices within the HRM function. It is important to note that despite the overall automation human involvement is not fully eliminated. Meijerink and Bondarouk (2021) point out two steps that require a human touch. First data is not automatically generated meaning it needs workers performing activities, interacting with colleagues or a digital device. This means the data and the automation process is dependent on workers behaviour. Second, the process requires programmers who write the software algorithms and by that deciding on parameters and weights of different parameters.

### Decision-making

Heretofore two of the three AM characteristics have been described. Datafication as the mechanism which transforms workers behaviour and attributes in machine-readable data. Automation as the process of preparing the data by, for example, cleaning and then feeding the data into HRM systems. The last characteristic is decision-making in which the organized data is used to make decision. Lamers et al. (2022) differentiate between semi-automated decisions, where algorithms augment decisions made by HR managers and fully automated decisions, which are decisions without any human involvement. To

further comprehend algorithmic decision making it is helpful to understand different kinds of algorithms and what decisions the algorithms afford. For example, Cheng and Hackett (2019) distinguish between descriptive and predictive algorithms, whereas Leicht-Deobald et al. (2019) mention descriptive, predictive and prescriptive algorithms. In a nutshell, descriptive algorithms answer the questions "What has happened"? and "Why did it happen?", predictive algorithms answer the questions "What will happen?" and "Why will it happen?" and prescriptive algorithms answer the questions "What should I do?" and "Why should I do it?" (Lepenioti et al., 2020). In the next paragraphs the three mentioned types of algorithms will be further illustrated and possible decisions afforded by the algorithms explained.

*Descriptive algorithm.* Many of the already described automated data processing methods function on the basis of descriptive algorithms. This type of algorithm makes use of past data to integrate the data into information systems based on set criteria. Furthermore, simple statistics, such as means or distributions between variables can be computed by the algorithm. These statistics enable managers to make decisions based on their overview of relevant metric on aspects like performance. Decisions based on descriptive algorithms go as far as firing workers fully automatically, as seen in the platform economy. Rosenblat and Stark (2016) report that the platform Uber automatically kick workers off the platform if their ratings fall below a certain threshold. Similarly, Jarrahi et al. (2019) point out that freelance accounts on the platform Upwork can be automatically closed if workers do not gain any projects despite submitting project proposals.

*Predictive algorithm.* As the name already suggests, this type of algorithm is used to predict or forecast outcomes in the future. The already mentioned study by Ramamurthy et al. (2015) can serve as an example. The researchers were able to predict the likelihood of a successful (re)training of workers for different skills. The results of this algorithms, as seen in the example, are outputs based on likelihood which are generated by advanced regression techniques, machine learning algorithms and data mining approaches (Davenport, 2013).

*Prescriptive algorithm.* This type of algorithm seeks to find the best course of action among various choices to achieve a desired future outcome, considering a set of known parameters, objectives, requirements and constraints (Šikšnys & Pedersen, 2016). Prescriptive analytics has been considered as the next step towards increased data analytics maturity and optimized decisions (den Hertog & Postek, 2016). In contrast to descriptive and predictive algorithm, prescriptive algorithms not only see issues and opportunities by looking into the past, presence or future but also actively suggest decision options and illustrates implications of each decision option (Šikšnys & Pedersen, 2016). The prescriptive model of Berk et al. (2019), who examined a human resource planning problem of a consulting firm, can serve as an example. Generally, the workforce planning consisted of a choice between type of workers meaning either workers within the company that are not assigned to a project yet hire contractors or

make new hires. The three options are further depended on skillsets of each worker and time it takes to find the right person for the project and cost of each option. For now, the example sounds like an optimization problem to minimize costs or maximize successful projects. However, Berk et al. (2019) also included a component that was able to forecast uncertainty within the optimization model. These uncertainty parameters were modelled into simulations based on, for example, one or two standard deviations from mean values. Based on parameters up to 500 scenarios were simulated by using real data and the model is reported to improve profitability and reduces volatility in the planning (Berk et al., 2019).

## Autonomy

In order to comprehend the notion of autonomy in the context of this paper, one best starts with job design as it can be seen as an antecedent of autonomy. Simply put, job design refers to the characteristics of jobs that employees perform and how to design these characteristics to enhance beneficial outcomes like job performance (Oldham & Fried, 2016). Much research has been undertaken to investigate job design and the characteristics that are designed. Most prominently the research of Hackman and Oldham (1976) who introduced the job characteristic model. The researchers made two contributions in the context of job design that are relevant for this paper. First, Hackman and Oldham (1976) identified autonomy as a core job characteristic and second found a positive relationship between autonomy and job performance. The found relationship between autonomy and job performance has been investigated and confirmed up until present research (Langfred & Moye, 2004; Langfred & Rockmann, 2016; Morgeson et al., 2005). Furthermore, the lack of autonomy has been connected to a reduction of workers well-being (Park & Searcy, 2012) and is regarded as a trigger for stress, frustration and anxiety (Tai & Liu, 2007). The relation of autonomy to performance and well-being demonstrates the importance for employers and employees alike. Having established the importance of autonomy, the focus of this paragraph will shift towards different definitions of autonomy.

Starting with the already mentioned findings of Hackman and Oldham (1976) who defined autonomy as the degree to which the job provides substantial freedom, independence and discretion to the individual in scheduling the work and determining the process to be used in carrying it out. This definition and the underlying dimensions of scheduling and choosing of procedures is generally accepted by scholars as many other researchers defined autonomy using said dimensions (e.g., Adler 1993; Burcharth et al., 2017; Ho and Nesbit, 2014; Langfred & Moye, 2004; Saragih, 2015). In contrast to the mentioned definition, Breaugh (1985) argues that autonomy and independence are distinct constructs and should be conceptualized as such. The researcher explains the distinction between autonomy and independence using a vivid example. In the example, a city bus driver serves as the focal point of distinction. The city bus driver's daily routine is characterized by a schedule imposed by their employer. They are instructed when to initiate their route, the precise timing of each stop, when to take prescribed rest breaks, and even the timing of lunch breaks. Consequently, when asked to evaluate the extent of

control they possess over the pace of their work, the driver's response aligns with a perception of having minimal autonomy. However, upon departure from the depot until the return at the end of the workday, the driver operates in relative isolation. During this period, the driver seldom encounters their supervisor or engages in work-related interactions with other bus company personnel. In response to inquiries regarding their ability to act independently of their supervisor and to perform their job tasks without reliance on others, the driver's responses would indicate a heightened sense of independence. From the example by Breaugh (1985) it becomes apparent that autonomy involves the freedom to make decisions and take actions within a specific framework, whereas independence signifies self-reliance and self-sufficiency, emphasizing detachment from external influences. Thus, the researcher defines autonomy as the degree of control or discretion a worker is able to exercise with respect to work methods, work scheduling and work criteria (Breaugh 1985).

Another noteworthy aspect of the definition of Breaugh (1985) is the inclusion of an additional dimension. Hackman and Oldham (1976) defined autonomy in regard to scheduling and work process whereas Breaugh (1985) adopts scheduling, work method and work criteria for his definition. Other researchers define job autonomy as a responsibility to make decisions (Kim et al., 2009). For example, Lin et al. (2011) define job autonomy as having decision-making authority with respect to execution of primary tasks. Additionally, Wu et al. (2015) suggest that autonomy can be understood as the freedom to formulate and pursue personal values and goals by crafting individual meaning into an individual's work. Lastly, the more general definition of Lopes et al. (2014) who define autonomy as behavioural regulation meaning whether a given action is regulated and/or determined by the self or by external contingencies. The many different definitions of autonomy demonstrate that the conceptualization of autonomy depends on the scholar or the context of the research. In the following paragraph, the many elements of autonomy will be classified into dimensions and sub-dimensions of autonomy. By doing so the paper follows the approach of Breaugh (1985) who argues that autonomy should not be operationalized as a global construct but differentiated into different dimensions.

## Dimensions of Autonomy

Based on the combined findings of Hackman and Oldham (1976) and Breaugh (1985) three primary dimensions of job autonomy can be identified. The three dimensions are planning autonomy, method autonomy and performance evaluation autonomy. Furthermore, due to considerable overlap of different dimensionalities, sub-dimensions are introduced which can be seen as part of the corresponding main dimensions.

### Scheduling autonomy

*Scheduling autonomy* can be defined as the extent to which workers can control the sequencing and timing of their work activities (Breaugh, 1985). This dimension of autonomy gives employees a sense of control over the work by enabling them to react to different job demands through changes in, for example, the sequencing of their tasks (De Spiegelaere et al., 2016). The importance of planning

autonomy is demonstrated by Schieman (2013) who investigated the effects of planning, compared to work method autonomy and concluded that both have a negative relation to work pressure. Corresponding to this dimension of autonomy is working hours autonomy introduced by De Jonge (1995). Sometimes also referred to as flexitime (Popma, 2013), these work arrangements allow workers to choose the beginning and finishing hours of their day. Like scheduling autonomy, working hours autonomy seems to have several positive effects on employees. For example, reduction in exhaustion of employees (Barney & Elias, 2010), positive relation to intrinsic and extrinsic motivation (Kattebach et al., 2010) and a negative effect on stress and burnout (Grywacz et al., 2008). The findings of working hours autonomy are further extended by Friedberg et al. (2013), who suggest that working hours autonomy could be represented by time flexibility as well as the possibility of part-timing. Another sub-dimension mentioned by De Jonge (1995) and later included in the Maastricht Autonomy Questionnaire (de Jonge et al., 1999) is discretion regarding the pace of work and gives workers control over the speed at which tasks should be performed. The researchers relate pace of work to stress and argue an increased pace of work results in improvement of workers health. Unlike De Jonge (1995) this paper will treat work pace autonomy as a part of scheduling autonomy as the two dimensions are interrelated. Changes in work pace inevitably influence the timing of tasks because when employees work significantly faster, the time required to complete a task decreases, illustrating how work pace autonomy is integral to scheduling autonomy, defined as the extent to which workers can control the sequence and timing of their work activities (Breaugh, 1985).

## Method Autonomy

M*ethod Autonomy*. Breaugh (1985) defined work method autonomy as the degree of discretion individuals have regarding utilized procedures on how the work is performed. Method Autonomy enables employees to get deeply involved in their work as they have more control over how to tackle a task. An example could be the previously mentioned job characteristic model by Hackman and Oldham (1976) who not only included method autonomy but also identified it as a predictor of positive motivational effects. Other examples include Bakker and Demerouti (2008) or Halbesleben (2010) who both found a positive relationship between this type of autonomy and work engagement. Another body of research employs the term "task autonomy" to clarify the concept denoted as "method autonomy" in this paper. This phenomenon is evident in the works of Zhou (1998) and Langfred (2004). Similar to scholars investigating method autonomy, both researchers draw upon the foundational contributions of Hackman and Oldham (1976) and Breaugh (1985) in their exploration of the concept of method autonomy. This alignment in the utilization of these seminal works suggests that, for numerous researchers, task autonomy and method autonomy are used interchangeably to represent a comparable construct. An extension of the concept of method autonomy can be observed in workplace autonomy, which refers to the extent of an individual's discretion when it comes to choosing where they work, such as whether they work remotely from home or from various locations affiliated with the same company.

Said discretion enables workers to organize their work more effectively and become more engaged (De Spiegelaere et al., 2016). Arguably, the most often studied situation is the choice between working at the company or remotely from home. Especially during the COVID-19 pandemic, these possibilities have attracted much attention from researchers like Wang et al. (2021). The researchers chose a job design perspective for remote work and concluded that autonomy specifically in remote work plays a critical role in performance measures. Workplace autonomy is presented as a part of method autonomy as it can be argued that the choice of whether a worker or a team of workers want to work remotely can be seen as methodical decisions towards the completion of a task. Lastly, two more sub-dimensions mentioned by De Jonge (1995) namely autonomy over the kind and amount of work. Discretion over the kind of work enables workers to choose what type of task they want to work on. This so-called task variety can influence workers well-being (Zaniboni et al., 2013) as well as performance (Morf et al., 2017).

### Performance evaluation autonomy

*Performance evaluation autonomy.* Describing the ability of workers to choose or modify the criteria used for evaluating their performance (Breaugh, 1985). Out of the three dimensions identified by Breaugh (1985) performance evaluation is the one the scientific world caught on the least. Outside the job design / autonomy literature researchers have established the importance of participation of workers in performance measurement systems. De Haas and Kleingeld (1999) theorize that through the increase of information, knowledge and creativity participation of workers in performance measures will lead to a better system. Furthermore, the increased understanding and control, caused by the participation, over the performance measures can decrease resistance and reduce stress (De Haas & Kleingeld, 1999). Burney and Matherly (2007) studied the impact of participation empirically and found evidence that participation increases job satisfaction and the system comprehensiveness, a measure of the system quality based on the number of meaningful measures. These findings are supported by Zuriekat et al. (2011) who also suggest that participation increases satisfaction in managers and employees and increases performance measure diversity. Another question is whether participation induces autonomy or if the benefits theorized for participation applicable for performance evaluation autonomy. Due to the broad nature of the definition by Breaugh (1985) it can be argued that modifying criteria and participating in measure identification theoretically can be regarded as similar. Correspondingly De Jonge (1995) suggested work goals as a part of autonomy in which workers have control over which aspects of a task are used to assess success.

Table 1.

*Overview of Dimensions and Sub-Dimensions of Autonomy*

| Dimension of Autonomy | Sub-Dimension of Autonomy | Description | Authors |
|---|---|---|---|
| **Scheduling Autonomy** | | Freedom to decide on the scheduling, sequencing or timing of their work activities | Hackman and Oldham (1976)<br>Breaugh (1985) |
| | Scheduling | | Hackman and Oldham (1976) |
| | Work Pace | Freedom to choose how much work should be done given a certain time window | De Jonge (1995) |
| | Working Hours | Freedom to choose how much time a week/month should be spent working | De Jonge (1995) |
| | Part-timing | Freedom to choose to work part-time | Friedberg et al. (2013) |
| **Method Autonomy** | | Freedom to choose a procedure to go about the work | Hackman and Oldham (1976)<br>Breaugh (1985) |
| | Workplace | Freedom to choose the location of the work. Usually working from home vs. At the company | De Jonge (1995) |
| | Kind of Work | Freedom to choose different types of work within an organization | De Jonge (1995) |
| **Performance evaluation autonomy** | | Freedom to decide how the work performance should be evaluated | Breaugh (1985) |
| | work criteria | Freedom to co-determine what 'work' is comprised of | De Jonge (1995) |
| | work goals | Freedom to co-determine what the finished job requires | De Jonge (1995) |

## Combining AM and Autonomy

So far, multiple definitions of AM were discussed and based on the research of Meijerink and Bondarouk (2021) datafication, automation and decision-making were identified as initial characteristics of AM. Furthermore, the notion of job autonomy was explained and on grounds of Breaugh (1985) scheduling autonomy, method autonomy and performance evaluation autonomy were identified as dimensions of autonomy. In this paragraph AM and autonomy will be combined. Therefore, a selection of relevant literature investigating an enabling and/or restraining relationship between AM and autonomy will be presented. Afterwards, the concepts of characteristics and dimensions will be used to demonstrate the complex and dual nature, meaning enabling and/or restraining of autonomy by AM, will be illustrated.

Much of the research regarding the impact of AM on autonomy has been undertaken in the context of the gig economy. Gig economy refers to people using apps (also referred to as platforms) to sell their labour (Wood et al., 2019). Although there is a tendency by scholars to outline a negative impact on autonomy by AM, both enabling and restraining influences are considered.

The most commonly mentioned benefit of AM within the platform economy is the freedom where and when to work (Healy et al., 2017; Lee et al., 2015; Möhlmann & Zalmanson 2017; Rosenblat & Stark, 2016). Through the fully automation of work-related process, workers do not need to stick to working hours or places as the app and the underlying AM structure track every performed job.

Another recurring theme is the loss of autonomy due to the automatically assigned jobs in apps like Uber or Lyft (Duggan et al., 2019; Lee et al., 2015; Rosenblat & Stark, 2016). Once workers have chosen their general working location, the app allocates drivers and passengers meaning workers have no choice whom to transport or which route to take. This is aggravated by the fact that workers are required by some apps to have a high acceptance rating and thus are unable to decide to decline jobs (Duggan et al., 2019; Rosenblat & Stark, 2016). On the other hand, different labour platforms supported by AM give workers the freedom to choose their projects and thus the corresponding AM systems are theorized to enable autonomy (Wood et al., 2019; Möhlmann & Zalmanson 2017). An additional, widely research topic is the complex nature of algorithmic management (Kellogg et al., 2020; Möhlmann & Zalmanson, 2017; Meijerink & Bondarouk, 2021). Simply put, workers cannot have discretion over processes they do not understand which impacts autonomy negatively. Workers respond to their limitation of autonomy by gaming the system. Through data forgery or other activities of resistant workers fight to (re)gain autonomy (Jarrahi & Sutherland 2019; Kellogg et al., 2020; Lee et al., 2015). The resistance to AM can go so far that some scholars argue it results into AM design choice beneficial for workers and thus an enabling aspect of autonomy (Meijerink & Bondarouk, 2021). Lastly, many scholars argue that AM limits autonomy in the area of performance measurement (Duggan et al., 2019; Lee et al., 2015). Performance evaluation systems have set criteria which make individualized performance evaluations almost impractical.

The paragraph above (see also table 2.) demonstrates that there is no definite answer to whether AM enables or restrains autonomy. The variety of results shows that the relationship between AM and autonomy can be dependent on many contextual aspects and general conclusions come to contradictory results. However, enhancing existing findings with a more nuanced view on autonomy can clear the view. Taking findings from Lee et al. (2015) and Rosenblat and Stark (2016) as an illustration, it becomes apparent that Lee et al. (2015) asserts that the automation of work-related processes enables workers to have the flexibility to select both their work location and working hours. Consequently, this leads to an increase in what can be specifically termed as scheduling autonomy, which is a sub-dimension falling under the broader concept of autonomy. On the other side, Rosenblat and Stark (2016) report that autonomy is reduced due to AM's automation as work assignments are allocated by the algorithm. The same characteristic of AM, automation, increases and decreases autonomy. Now, on a theoretical level, dimensions of autonomy can be integrated in the mentioned findings. First, instead of concluding that automation enables workers where and when to work (Lee et al., 2015), it can be derived that automation fosters scheduling autonomy. Second, the automated allocation of work assignments does not adversely affect autonomy but method autonomy. Rather than saying AM enables autonomy in one case and restrains in another, it can be said that AM enables scheduling autonomy and restrains method autonomy. This example demonstrates how dimensions of autonomy can be used to explain the sometimes contradicting observations on the AM-autonomy relation and benefit the understanding of the duality of AM.

Deconstructing AM and autonomy in smaller concepts, as demonstrated, has two benefits. First, smaller concepts are able to give improved explanation of existing results by showing that AM can enable and restrain different autonomy dimensions at the same time. Second, the deconstruction is a good basis for this explorative study to investigate further characteristics and dimensions and their interaction that have been unregarded yet.

Table 2.

*Overview of autonomy enabling/restraining*

| **Dimension of autonomy** | **Enable or restrain through AM** | **Explanation** | **Example study** |
|---|---|---|---|
| Scheduling autonomy | Enable | Platform work systems afford flexibility when to work | Lee et al. (2015); Healy et al., 2017; Möhlmann and Zalmanson (2017); Rosenblat and Stark, (2016) |
| Method autonomy / workplace autonomy | Enable | Platform work systems afford flexibility where to work | Lee et al. (2015); Healy et al., 2017; Möhlmann and Zalmanson (2017); |
| Method autonomy | Restrain | Work assignments are allocated by the algorithm and not chosen by the workers | Lee et al. (2015); Duggan et al. (2019) |
| Method autonomy | Restrain | Regulation of acceptance rate forcing workers to accept work assignments. | Lee et al. (2015); Duggan et al. (2019); Rosenblat and Stark, (2016) |
| Performance evaluation autonomy | Restrain | Performance evaluation systems have set criteria which make individualized performance evaluation impossible | Lee et al. (2015); Duggan et al. (2019) |
| Scheduling autonomy, Method autonomy, Performance evaluation autonomy | Enable | AM systems are not flawless. Workers find ways to "game" the system and fight for more autonomy | Lee et al. (2015); Jarrahi and Sutherland (2019); Kellogg et al. (2020); Meijerink and Bondarouk (2021) |
| Method autonomy | Enable | Online labour platforms grant high freedom in choosing work methods as long as the end product is satisfactory to the client. | Wood et al. (2019); Möhlmann and Zalmanson (2017) |
| Scheduling autonomy, Method autonomy, Performance evaluation autonomy | Restrain | AM systems functional principles are not shared or too complicated for workers and by that limiting discretion of workers. | Möhlmann and Zalmanson (2017); Kellogg et al. (2020); Meijerink and Bondarouk (2021) |

# Methodology

The objective of this study is to investigate the influence of algorithmic management characteristics on various dimensions of autonomy in the workplace. By addressing the research question, it is investigated whether specific characteristics of algorithmic management either enable and/or restrain the autonomy of employees. This section provides an overview of the research methodology employed to address this question comprehensively. The methodology involves four key components: study design, operationalization, recruitment, and data analysis.

## Study Design

For this study, the research approach selected is qualitative, employing semi-structured interviews as the data collection method. Semi-structured interviews were chosen for several reasons. First, semi-structured interviews enable the researcher to prepare questions ahead of time, facilitating a structured and organized approach to participant questioning (Brinkmann, 2014). Particularly when considering the extensive knowledge on AM and autonomy, it would be unwise not to leverage previous insights while preparing questions when examining the interplay between these two aspects. Contrasting with preplanned questions, the 'semi-structured' nature of interviews offers distinct advantages, notably flexibility in questioning. Specifically concerning the research question aiming to reveal factors enabling and/or restraining autonomy, adaptability becomes crucial. The above mentioned, past literature showcases scenarios where certain characteristics both enable and restrain autonomy, underscoring the significance of contextual considerations. Flexibility in questioning becomes pivotal to accommodate these contextual nuances. For instance, employing follow-up questions or seeking participant examples allows for a more comprehensive exploration of new characteristics of algorithmic management. Another advantage of semi-structured interviews is a participant-centred approach (Adams, 2015). Especially, in a heterogenous population semi-structured interviews offer many benefits. For instance, in the case of interviewees having significantly varied language skills, a semi-structured interview allows the researcher to offer supplementary explanations, a flexibility not achievable in a questionnaire. Moreover, the concept of autonomy is highly multifaceted and relies on the participants' comprehension. Offering additional explanations and asking follow-up questions can aid in addressing this complex topic, ensuring a smooth and valuable interview.

Recruitment occurred within the food delivery industry. Food delivery workers were chosen because many of the previously mentioned studies that explored algorithmic management were carried out on food delivery couriers, revealing that employees in this sector experience algorithmic management in particular. Additionally, considering the earlier definitions of autonomy, it becomes evident that autonomy involves an individual's freedom and discretion. Previous studies primarily assessed autonomy among workers rather than managers. This study follows the same approach based on the assumption that workers are susceptible to changes in their autonomy due to algorithmic management

compared to managers. Within the food delivery industry, Flink workers were chosen to be interviewees for three reasons. First, Flink operates in the food delivery sector which makes it a promising company to investigate elements of AM as the food delievery sector has been a popular point of reference for researching AM. Second, COVID-19 amplified online grocery sales, which were around 1.5% in Germany and 4% in the USA before the pandemic (Armstrong, 2017; Kühn et al., 2020). Post-pandemic projections forecast an upward trend to about 5% in both countries by 2030 (IFH Köln, 2020; Wyman, 2019), highlighting the increasing significance of studying online grocery sales due to their remarkable growth. Lastly, Flink, and its business model of distributing groceries from a central hub, as opposed to delivering food from a restaurant directly to the customer, remains unexplored in academic research. The uncharted property of Flink renders it an ideal candidate for an exploratory study, presenting the opportunity to uncover hitherto undiscovered AM characteristics and potential connections to autonomy. Within the Flink workforce, no further inclusion criteria were established, aside from being above 18 years old and having a basic proficiency in either German or English. This decision was made to maintain the exploratory nature of the study as the absence of inclusion criteria allowed for a broader exploration of AM experiences across diverse backgrounds and best reflected the heterogeneity of the Flink workforce.

The recruitment of participants can be divided into 3 stages. In the first stage of participant recruitment, personal connections were leveraged, reaching out to friends and family members to inquire about any potential links to Flink workers. This initial step allowed for a warm introduction to potential participants and facilitated the establishment of trust.

Subsequently, in the second stage, a more expansive recruitment strategy was implemented, extending the outreach efforts to social media platforms. Digital flyers were designed and shared across various social media channels, inviting individuals who may have insights or experiences related to Flink's workforce to express their interest in participating in the study. This approach aimed to cast a wider net, engaging with a diverse pool of potential interviewees, while harnessing the viral nature of social media to amplify the study's reach.

The majority of participants were recruited during the third stage, which involved initiating contact through in-person street intercepts conducted in different cities across Germany and the Netherlands. Since the locations of Flink Hubs are publicly accessible information, it was convenient to locate and engage with Flink workers during their breaks or less busy work periods. The interviews were not conducted during the initial contact due to time constraints within delivery breaks. Instead, only email addresses were exchanged, and participants received a follow-up email with further details, the opportunity to pose questions, and a request to arrange an online interview. Furthermore, the emails outlined the procedures for privacy and the handling of interviewee data. Two significant challenges encountered during the street intercepts greatly complicated the recruitment process. Firstly, a substantial number of workers were immigrants or students abroad lacking the necessary language

proficiency. Secondly, a prevailing sense of distrust was observed when approaching individuals randomly on the streets, as if there were hidden agendas or ulterior motives. These challenges were successfully addressed through the application of snowball sampling techniques (Palinkas et al., 2015). By having Flink workers who had already participated in interviews reach out to their colleagues, a larger number of workers could be engaged. This approach also facilitated the establishment of a foundational level of trust, as the co-workers who had already been interviewed could share their experiences with their colleagues.

The overall aim of the data collection was to achieve information saturation through a high number of interviews which Adler (2012) suggests achieving with a sample size of twelve interviews in the context of qualitative research undertaken by a single researcher. In accordance with Adler's (2012) recommendation and considering the sense of information saturation, the recruitment process was concluded after conducting a total of 12 interviews, leading to the formation of the following sample: Out of the 12 interviewees, the majority (10) were employed part-time at Flink, primarily as working students. All 12 participants were male, falling within the age range of 19 to 31 years. The sample primarily comprised temporary migrants hailing from countries such as Turkey, Pakistan, India, Italy, and France. Work experience at Flink varied from as little as 2 months to a maximum of 2 and a half years, with most workers commencing their employment at Flink within the span of a year.

Lastly, all interviews adhered to the guidelines and standards set forth by the University of Twente. This research was carried out with the explicit approval of the University of Twente's ethics committee, responsible for evaluating research proposals to ensure compliance with ethical standards, GDPR regulations, and Dutch law. Additionally, all communication, including emails containing information for potential interviewees, was carefully overseen and refined by experienced researchers at the University of Twente.

### Operalisation

In the following table, the operationalisation of the identified autonomy dimensions into interview questions is listed. Two sets of questions are not based on autonomy dimensions but of a more general nature. This is done to investigate conditions under which the work is conducted and to explore dimensions that have not been mentioned in the theoretical framework. Additionally, an iterative questioning method, incorporating the inquiry "Describe a typical day/delivery at Flink," was introduced. This approach enabled a deeper understanding of Flink operations, revealing significant aspects valued by the workers through more generalized inquiries about their daily routines and priorities.

Table 3.

*Operationalisation of autonomy dimensions*

| **Concept** | **Sub concepts** | **Questions** |
|---|---|---|
| General information | | 1. What age are you?<br>2. Which city are you working?<br>3. How long have you been working for said company?<br>4. What is your function?<br>5. Do you have another occupation besides working for the mentioned company?<br>6. Describe a typical day working for Flink. |
| Scheduling autonomy<br>*Freedom to decide on the scheduling, sequencing or timing of their work activities* | | 7. How is the work scheduling organized? |
| | Work pace<br>*How much work should be done given a certain time window* | 8. What regulations are in place in terms of number of deliveries or time needed for a delivery?<br>9. What are the consequences if these regulations are not met? |
| | Working hour<br>*How much time a week/month should be spent working* | 10. What decisions regarding your working hours are done by yourself?<br>11. How are the working hours organized? (Working in shifts or log into the working up freely?) |
| | Part-timing<br>*Freedom to choose to work part-time* | 12. Do you believe part-timing is generally accepted at your company? (How about switching from full-time to part-time?) |
| Method autonomy<br>*Freedom to choose a procedure to go about the work* | | 13. How is the routing from the warehouse to the customer or between several customers determined? |
| | Workplace<br>*Location of the work.* | 14. How is your company organized locally? (Organized in Cities or city districts)<br>15. What say do you have on where you work?<br>16. What say do you have on how to perform the work? |

| | | |
|---|---|---|
| | Kind of work<br>*Freedom to choose different types of work within an organization* | 17. When do you choose between different functions within the company (e.g., rider or picker)?<br>18. What say do you have yourself in your function? (rider or picker?) |
| Performance evaluation autonomy<br>*Freedom to decide how the work performance should be evaluated* | | 19. How is your performance measured? (e.g., number of successful deliveries tracked, customer ratings)<br>20. What would you change on the current performance measurement system? (e.g., include a new matrix)<br>21. What say do you have in what is considered good performance? |
| | Work criteria<br>*Freedom to co-determine what 'work' is comprised of*<br>Work goals<br>*Freedom to co-determine what the finished job requires* | 22. What could make a delivery unsuccessful? |
| Explorative Questions / Open-ended questions | | 23. If you could, what would you change about your job?<br>24. Is there an aspect of your job (that was not addressed so far) you would want more freedom over? |
| Datafication | | 25. What kind of work information is tracked? (Distance travelled, deliveries made, tips earned)<br>26. Do you feel the information collected is used to improve/enrich your work?<br>27. Do you feel too much information is collected?<br>28. Do you think more information is collected without you knowing about it? |
| Automation | | 29. What processes in your work are automated?<br>30. How does automation help you perform your work?<br>31. How does automation hinder you from performing your work? |

| | |
|---|---|
| | 32. Do you feel like some automated processes should be done by a worker (Can you give an example?) |
| Decision-making | 33. What day-to-day decisions regarding your work are not made by yourself? (Who decides?)<br>34. How do these decisions influence your work? (Do they help your work process or hinder it? Or both? Can you name an example?<br>35. Regarding the decisions not made by yourself, do you think you should be able to make these decisions? (Why? Could you make better decisions? |

## Data analysis

Following the approach outlined by Fereday and Muir-Cochrane (2006), a thematic analysis was employed to code and analyse the primary data. The data were coded in a hybrid coding process that includes deductive and inductive coding iterations.

In the first iteration, the interviews were coded deductively using three a priori-defined categories: Datafication, Automation and Decision-making. Additionally, during the coding process, sub-categories were formed. For example, datafication was further divided into locational data or temporal data. Further, differentiation was undertaken if interviewees described data collection or theorized about potential data collection. In the second iteration, an inductive approach was followed to delve deeper into the data. This involved identifying potential characteristics of AM that could not be categorized in the first iteration. By using this inductive method, the analysis aimed to uncover novel insights and patterns that might not have been initially apparent, allowing for a more comprehensive exploration of the AM phenomenon. In the final iteration, the category of autonomy was introduced. This encompassed subcategories such as scheduling, method, and performance evaluation autonomy. Special emphasis was placed on understanding how the categories defined in iterations 1 and 2 influenced autonomy. This iterative approach allowed for a more nuanced exploration of the interplay between the previously defined categories of AM and autonomy, shedding light on the enabling and/or restraining nature of AM.

Throughout the interview process, direct inquiries about autonomy were intentionally avoided, recognizing the intricacy of this concept and acknowledging the potential challenges participants might face in articulating their thoughts on it. The intricate nature of the concept of autonomy was mirrored in the complexity of the coding process. Codes often found resonance in the term "freedom" as the closest approximation. However, beyond this alignment, the codes frequently manifested themselves in the

articulated experiences and sentiments of the interviewees. The coding approach aimed to systematically translate the spoken language of participants into tangible concepts of autonomy.

Employing a thematic analysis, recurring patterns and key elements were identified within the participants' language. Instances where interviewees expressed discontent, such as "This is annoying because I have to do this or that" or "I can't choose because my phone tells me what to do," were meticulously coded to capture manifestations of perceived autonomy restraining. Conversely, expressions like "I can freely choose in the app" were categorized to signify instances of autonomy enabling. This nuanced coding process not only enabled a comprehensive understanding of the participants' intricate experiences but also served as a bridge between the complexity of their narratives and the analytical precision required for data interpretation.

# Results

The following section provides a presentation of the qualitative data collected during this study, shedding light on the characteristics of AM in regard to worker's autonomy. Through interviews with Flink employees and an extensive review of the existing literature on AM, collected information could be attributed to AM characteristics. Before delving into the exploration of AM, the following section serves as an introduction to the distinctions between Flink workers and other platform-based delivery workers. Additionally, a case description of the work processes at Flink is given and insights into the various actors involved within the Flink work process are provided. The Flink detour is necessary, as a basic comprehension of Flink and its work process helps with the understanding of how and where in the process AM characteristics influence autonomy.

## Flink and its distinctive attributes

Prior research on AM within the food delivery spectrum has focused on the gig economy with research analysing companies like Deliveroo and UberEATS. Flink does not operate within the gig economy. Although Flink facilitates its workers and customers, just like companies within the gig economy, Flink's involvement is not limited to intermediation but is far more prominent. For example, Flink operates so-called dark stores, which it self-references as hubs, defined as a retail facility or warehouse designed for fulfilling online orders rather than serving customers in a traditional sense. The term 'dark' signifies that the store is not open to the public for regular shopping but is used to pick, pack and prepare orders for delivery. Another distinctive criterion of Flink can be seen in the contract between Flink and its workers. Flink workers receive pay based on a contractually stipulated hourly rate. This means workers receive the same pay independent of the number of deliveries made. Additionally, working hours are subject to regulations that are determined by the jurisdictive conditions of the country in which the worker is employed. For example, German students are allowed to work a maximum of 20 hours a week which results in Flink issuing a 20-hour per week contract to its employees. In the Netherlands,

Flink riders are employed under a zero-hour contract, which indicates that while they are officially obligated to work a minimum of 0 hours, there exists no upper limit on the hours they may be required to work. Nevertheless, working hours are typically regulated on a weekly basis (see section datafication-work scheduling). Having established some of the key differences between Flink and gig economy workers the attention will now shift to the work process of a Flink rider. Each delivery varies in its execution, necessitating the following description to delineate an ideal delivery scenario. Not all participants within Flink are universally involved in a standard delivery, henceforth, the subsequent list comprehensively enumerates all actors, electronic tools, and applications potentially engaged in the process.

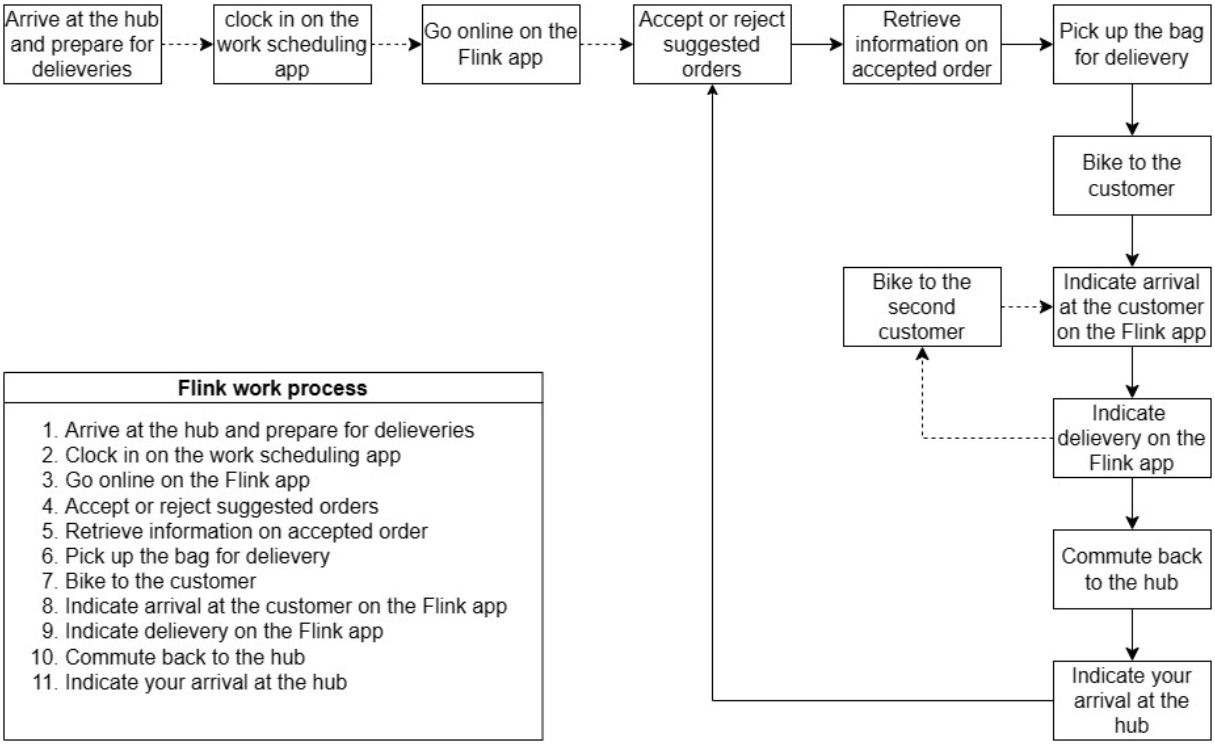
## Work process

Prior to commencing their workday at Flink, riders are required to input their availabilities using a third-party app not developed specifically for Flink. This external app enables workers to set their weekly working hours. It features a workweek interface, allowing workers to propose preferred shifts, which undergo managerial approval. Once approved, the worker receives a fixed work schedule for the upcoming week.

The work process starts with the rider arriving at the hub. Ideally, the rider arrives before the beginning of the actual working hours so that there is enough time to prepare the necessary equipment like the bike, its batteries and bike bags. It was also reported that the bike and battery number have to be entered in a list to track ownership, enabling identification in case of damage, loss, or any related issues. After the worker is ready two different apps are in use. First, the worker has to indicate in an app that he or she has started working. The mentioned app tracks the working hours with a timer counting down the expected work time. Second, the worker then goes online on the Flink app which tells the work allocation system that the worker is available for deliveries. The worker remains on standby, and upon receiving an order through the Flink app, there is the option to either accept or decline it at the worker's discretion. There are cases of multiple customers combined in a single delivery, for example, in the case of customers being located in close proximity, but this example will continue as a single order. After the rider has accepted the delivery, customer information, destination, and navigation details, along with the bag number, which was packed by the picker, are transferred to the worker's phone. After that the rider picks up the bag with the food for delivery at the Flink hub. The right bag is either numbered or equipped with a QR code so that the rider knows which bag to put into the bicycle bags. After that, the worker rides to the customer, where the arrival at the location has to be denoted in the app. Once the delivery is handed to the customer, the worker has to again tell the app, that the delivery is completed successfully. After that, the rider bikes back to the hub. After arriving at the hub, the worker indicates that he is available for a new delivery and the cycle continues.

Figure 1

*Flink work process*




# Datafication

Datafication, as used in this thesis, is a term employed to characterize the comprehensive data collection methods within the AM process. It is important to note that, based on the collected data, datafication in isolation does not exert a direct influence on autonomy. Moreover, it might be arguable that mere data collection, in isolation, might not even qualify as Algorithmic Management since it doesn't encompass active management by algorithms. The impact of data collection on autonomy manifests in two distinct ways. Firstly, as a foundational element for the other two AM characteristics. Meaning both automation and decision-making need data to function, thus datafication enables or restrains autonomy as a prerequisite of other AM characteristics. Secondly, workers' awareness of data collection and the potential for surveillance may subtly shape their behaviour, thereby constraining autonomy.

As expected, Flink gathers the personal information, like the worker's name, of all employees as part of the hiring process. This data is a prerequisite for the employment contract before the commencement of the actual work. Furthermore, this information is also input into both the work scheduling app and the Flink app. This aspect of datafication generally increases the workplace autonomy of workers as their digitized personal information enables workers to log into different hubs, mostly within a city, and choose their place of work.

Next to the working place, all work scheduling is done over the app which streamlines and centralizes the process of managing worker availabilities and shift assignments. Employees have the freedom to decide when to work based on their availability. Furthermore, this second app also verifies whether the work hours are being adhered to. At the start of each shift, an employee must select the shift's commencement, officially marking the beginning of their work. Within the app, a timer then counts down, enabling the worker to track how many hours they have left to work based on their approved weekly availabilities. This provides information for employees on the one hand and serves as a monitoring mechanism for employers on the other. The app facilitates an increase in scheduling autonomy, allowing workers the freedom to choose their working hours on a weekly basis. All interviewed Flink workers appreciated the provided flexibility. For instance, interviewee 10 highlighted the advantages of zero-hour contracts: '*So basically, many people have zero-hour contracts. This is amazing for students. The beauty of this work is like you have weekly announcements for the next schedule, so if you don't want to work in the next week, you don't have to apply for any.*' This flexibility enables workers to pursue the job on a part-time basis or alongside their university studies. While the app offers workers the freedom to set their own schedules on a weekly basis, it also blurs the boundaries between workplace and free time. Workers are expected to input their availabilities during their free time, raising questions about the demarcation between work and personal life. Moreover, although the app provides the convenience of scheduling the next week's working hours consistently at a specific time, it inadvertently pressures workers to engage with it during their free time. This expectation requires workers to be consistently available on their phones to input their hours promptly. Failure to do so may result in other workers securing their desired time slots, intensifying the need for workers to engage with the app during their personal time. The insistence on entering availabilities, for example routinely every Friday evening, might ultimately diminish a proportion of autonomy gained from the self-scheduling. Another drawback resulting from the self scheduling through the means of an app as expressed by interviewee 2*: 'So basically, your selecting the shift if it was available. There are many people that, they are like just taking every single shift and they are like waiting:" What I am gonna do this week". They take them all and then they are putting them available after and I cannot get my shifts.'* By taking all the shifts in the system and by that maximizing their work scheduling autonomy workers inadvertently reduce the freedom of other workers as they are limited in the selection of their shifts. This example demonstrates how workers can affect each other's autonomy with the help of an app.

The preceding examples primarily centred on gathering contextual information outside of work hours, whereas the following examples examine the collection of data within the actual work processes. The first display of datafication is the internal timers during a delivery. The total duration of the delivery is tracked, including the times for individual segments, such as the time it takes to reach the customer, the duration it takes for the customer to accept the package, and the return journey to the hub. These times also need to be stored, as evident from the fact that at the end of each shift, employees receive a statistic indicating the percentage of deliveries made within the timeframe promised by Flink. The imposition of

timers exerts pressure on workers, influencing their pace of work and consequently restricting their method autonomy in managing their own work pace which can be demonstrated by the quote of interviewee 6 who said: '*It's challenging, man. They track every delivery time from some central hub, and there's this constant pressure to hit every deadline. You know, there's a manager overseeing everything, and I really don't want any problems with him.'* This becomes particularly challenging when considering the variability in each delivery, impacted by factors like distance and current city traffic. Despite these variables, there exists a predetermined timeframe within which every single delivery is expected to be completed, further challenging the workers' autonomy in regulating their work pace. Additionally, at the end of each month, every employee receives a summary of their performance, including a breakdown of total deliveries and deliveries made on time.

The second significant data collection aspect becomes apparent in the drivers' location tracking. As soon as the delivery personnel activates their Flink app, their location is made available to the shift lead at the hub. The perception of the interviewees regarding the data collection was generally negative. As interviewee 4 expressed his frustration: *'They [the shift leads] have like two big screens where they can see every single rider that is out. My location is always tracked while I am out for deliveries and I have to worry that I'm not working fast enough or that I'm in the wrong place'*. This has implications on the method autonomy as workers have to worry about their location in relation to the given navigation route, which could lead workers to follow the given route instead of taking their own path.

Another observation that was a prevalent trend is that many workers are either unaware of the specific data, and its uses or exhibit a degree of indifference toward the data collection process. Many of the respondents were certain that, in addition to the information they must directly input into the app, other data was being collected. However, the specifics of what those data points might be could not be further specified. Other respondents exhibited an indifferent or resigned attitude towards data collection, with interviewee 12 stating: *'Since I don't know exactly what they take, the amount, I wouldn't say if it's too much and frankly, we are in 2023. Everything's online. Google and others the way they control everything. So, like they collect data, they all collect too much data. But it's like that so can't really go against it unless you want to live in the jungle without Internet and people or I don't know.'* In terms of autonomy this can be considered problematic as researchers have been criticising the opacity of AM processes and a failure to understand them has been related to a loss of autonomy as workers cannot take part in the process without understanding it (Jarrahi et al., 2021).

During the interviews, another area of discussion revolved around how performance is assessed. Apart from the previously mentioned criteria of punctuality and the number of deliveries, as listed in the monthly review, no performance matrices were reported. While, for example, all workers' tips are tracked, according to the respondents, this is solely for payment purposes and not utilized for performance measurement. In general, the performance measurement, as in the example above, was

heavily criticized because it focuses on measuring idle time without considering the context, as described by interviewee 9:*' You know what really gets to me is the limited visibility [as in relevance] of the data. Whether I'm taking an extra break at the park or trying to fix my bike, a delay is a delay, and for me, that means a poor mark on my performance record at the end of the month or angry calls from the shift lead, and they don't even know what's going on.'* The fear of receiving poor marks or facing consequences for delays, regardless of the circumstances, can create stress and pressure. This pressure may restrain method autonomy as employees might feel compelled to prioritize appearances of productivity over managing their work in a way that suits them best. In light of the discontent expressed by workers regarding the existing performance measurement system and their limited ability to influence or discuss performance assessments with supervisors, it seems that performance evalutation autonomy is restained under algorithmic management.

Lastly, workers appreciated that all communication with customers took place through the app. All delivery information and any comments were consistently accessible. The reported benefit of this approach is that the app can be set to multiple languages, enabling translations of comments to occur. This gives workers the freedom to work in an international setting, as interviewee 3 described:' *The customer may have some indications for you, because sometimes the place is really hard to find so they can write a note over there [meaning the app]. No matter is in Dutch, Chinese, Greek doesn't matter because you can copy-paste, it and translate it on Google Translate.*' The instance illustrated by interviewee 3 showcases a form of method autonomy, wherein the employee has the freedom to select the language for certain job facets, enabling them to effectively work in the Netherlands despite possessing limited Dutch language proficiency.

## Automation

Automation, as described in this thesis, optimizes the efficient handling of extensive data and facilitates the self-operating of specific tasks or processes for workers. In the subsequent subsection, the interview findings on automation are detailed, establishing connections to the concept of autonomy.

The first example of automation within Flink is intricately linked to the previously mentioned datafication. Flink not only gathers data through various internal timers but also utilizes these timers, as articulated by interviewee 5:*' The system is so nice [ironically as worker was annoyed by the system]. It's calculates every minute you spend on the job. For example, when you go there, it always says within how many minutes you arrive there, and it has an own time, like it assign you that. It's waiting, expect you to arrive to the customer within like 12 minutes and if you go there more than 12 minutes, it's directly become red. There's a big screen in the hub and it says your delayed'.* This instance highlights how the Flink app goes beyond merely tracking timers; it effectively utilizes them to autonomously alert workers through push notifications and signal shift leads with a visual alarm. These messages, coupled with the awareness that the shift lead is notified, exacerbate the stress generated by the timers, consequently

restricting workers' method autonomy by pressuring workers to operate at a faster pace, ultimately constraining their ability to regulate their work pace autonomously.

Another case of automation involves the assignment of deliveries to Flink workers. Each order is dispatched to a Flink worker's phone, prioritized based on their return from the previous delivery. This prioritization operates as a ranked list, with the worker returning first placed at the top; subsequent arrivals are subsequently positioned. Deliveries are then allocated systematically by an algorithm following this list. Within the Flink work process explanation, reference was made regarding the rider's ability to accept or decline orders, hinting at a level of method autonomy. However, insights from the interviews indicated that this method autonomy seems illusory. There are three reasons why declining is not a viable option for the workers. Interviewee 2 highlighted a possible consequences of rejecting an order: *'Then if you didn't want to get it, you can reject it. But when you reject it, you are being offline and like each day if you did it for four times, you are getting out of the system and you have to talk your manager again. So, it seems you have the right but you don't have the right.'* This quote underscores the negative repercussions associated with refusing an order, extending to potential suspension from work and necessitating a discussion with management. It also emphasizes worker's perception that method autonomy appears to exist but is, in reality, constrained. The second reason revolves around the persistence of declined orders. Even though riders can theoretically refuse deliveries, Flink as a company does not reject orders. This means that an order can be declined by a rider, but Flink still expects that the hub fulfils every order. This results in the scenario where even after a worker rejects an order repeatedly, logs off, and restarts the system, the same order resurfaces. This highlights the futility of declining orders, as the system continues to present the same unwanted tasks. The third reason introduces ethical and collegial considerations and can be further explained by an exhibit of interviewee 7: *'If I turn down an order when I'm alone here, it's like a loop, I keep getting the order. And when there's someone else, they get the sh*t order, especially if it's my friend working with me, I can't do it. Not fair, you know? It's just the system, not something we change.'* This means when one worker turns down an unfavourable order, it results in the order being offered to another colleague. This practice, if widespread, may disrupt a positive work atmosphere, as it can lead to an imbalance in task distribution. Such an imbalance, favouring easy tasks for some and burdening others with challenging ones, undermines the solidarity among co-workers and ultimately reducing the method autonomy to reject delieveries.

Numerous long-term workers at Flink mentioned that the automatic delievery allocation system was recently introduced. Prior to this change, delivery assignments were at the discretion of the shift lead. They had the authority to offer breaks to workers who had completed substantially more orders than their colleagues, allowing others to catch up in the number of deliveries. In the context of this study, no shift leads were directly interviewed. However, based on the information provided by the riders, it can

be inferred that the shift leads have also lost method autonomy due to the system change, consequently impacting rider method autonomy as well. Essentially, riders were unable to rely on or approach shift leads to balance the workload, consequently resulting in riders having less influence over work pace and method autonomy. However, based of the information provided by seasoned employees, it is apparent that the former system encountered challenges aswell, as articulated by interviewee 6: *'Some employees which has been working for like long. You know like for years or something, they do have this connections with the shift lead where they can choose their order. They just go to this PC and they choose the order by themselves like the nearby orders. Employees who is like joined, who is new and they just give far away orders to them. So this is kind of biasness that I see to be honest. And yeah, there are some employee that they sit there you know.And don't work because the friends with the shift leader. '* This observation is noteworthy as it highlights varying levels of autonomy among workers under different systems. Initially, the control rested with the shift lead, prompting workers to rely on social connections to enhance their method autonomy in delivery allocation. However, with the implementation of the new automated system, these workers experience a reduction in method autonomy. This shift benefits other riders who lack connections with the shift lead, allowing the algorithm to establish a fairer system in these aspects.

## Decision-making

Decision-making involves the application of diverse algorithms using historical, future-oriented, and optimization-based approaches to analyse, anticipate, and recommend optimal actions within set parameters and constraints.

The most significant decision managed by the algorithm concerning Flink workers involves determining the route from the hub to the customer. As previously highlighted, upon accepting the order, the Flink app dictates the route to be taken. This results in a loss of method autonomy and can be frustrating for workers. As interviewee 4 described: *'The app is fine when it works. But, you know, especially with regular customers, I just know the routes better. The app doesn't know where the entrances to houses are or that I have to go through courtyards, so sometimes I end up on different streets following the GPS.'* The above-mentioned quote gains particular significance in light of the datafication and automation previously described, where location data is used to influence workers. The system not only measures where the worker is at all times but also where they should be and workers cannot choose their own path as they have to fear actions by the shift lead.

One countermeasure reported by the interviewees was the usage of other navigation services like google maps. Interviewee 11 descirbed the advantages as follows:'...*because sometimes the app, it's not that well, it's faulty so it basically puts you in totally different area. So instead of going to the north you're going to the South this happened for me. Many people [ talking about co workers] they advise me like to use Google. Google Maps because it works. It works better first of all and there is no tracking from*

*Flink and in case you are skipping a turn or whatever it's just reroutes you really fast. This doesn't have with the with the Flink app'.* In this scenario, the issue does not solely lie in the app-driven navigation, as all interviewees utilized navigation tools to varying degrees. However, Google's navigation, which does not offer tracking to the shift leads, functions more effectively, allowing the option to reroute for convenience. Consequently, workers actively opted for greater autonomy by avoiding Flink's management tools, favouring Google's more responsive navigation and by that sidestepping the tracking feature.

Having identified multiple instances of workers experiencing a restraining effect on autonomy, the subsequent examples will elucidate how automated decisions by the system either assist or impede workers in carrying out their tasks. The first example revolves around the algorithm's determination of the order size, considering both the quantity and weight of the products. Each bike typically accommodates three bags for product storage. Interviewee 8 encountered an exceedingly large order assigned by the system, leading to challenges in meeting delivery deadlines and causing issues with their supervisor. *'One time I encountered a problem and my manager told me that I was so slow and she tried to give me a Abmahnung [German for formal warning or written reprimand] , but then I rejected and I didn't get it. While I really had a problem, it was so busy and I took one order, which is a huge order like more than, I guess more than 80 bottles. It's included more than only 80 bottles, which is not appropriate for only one rider. I was a kind guy and I said that it's so busy, so I can't take it by only myself. Normally you need to go with a as such big order with at least two riders, but I tried it only myself and my manager told me on the way I was too slow while my bike is full of the kilogrammes and even cannot go fastly. And if I go fastly I would definitely get injured. This is part of the problem everything is calculated as in a normal way, but sometimes you really had some like chain problems with your bike or you get injured'.* This particular example illustrates various previously mentioned aspects, such as the limited informativeness of the gathered data and the inability to decline 'incorrect' orders. When coupled with potentially flawed decision-making algorithms, it showcases how the absence of autonomy, becomes probelmatic for workers. The second example illustrates how the system's decision-making enables worker's autonomy by affording them to serve multiple customers on a single bike ride. According to the participants, the same order consolidation posed challenges for managers in the old system during peak times. Workers generally appreciate this option as it allows them to receive multiple tips in less time compared to delivering orders separately. Interviewee 7 mentioned: *'Like some time ago, we got double or triple orders added to the system. Basically, smaller orders in the same direction are then delivered together. This is great because I can earn like three tips in a little more time of a single delivery.'* Just as in the previous example, the new system also poses problems for the workers. As, for example, reported by interviewee 12 who explained: *... I said that it's usually gives the same direction for the orders, but sometimes the app it not works efficiently and it gives two different, but which are totally so far from them[eachother]. Sometimes technology it's, usually gives, efficient to the work but sometimes it's giving disadvantages.'* These two examples illustrate the

adverse impact of automated decision-making without human involvement on workers. Especially, if the workers practically do not have the method autonomy to decide which order to take.

In summary, the results underscore the intricate interplay between datafication, automation, and decision-making, highlighting instances of both autonomy enabling and restraining within these processes. The nuances revealed through these findings shed light on the complex dynamics shaping workers' autonomy in a delievery work settings. The table presents a detailed overview of the identified autonomy dynamics within each process.

Table 4.

*Instances of Autonomy enabled and restrained in Datafication, Automation, and Decision Making processes*

| **Instance** | **Type of Autonomy** | **Description** |
|---|---|---|
| Datafication: Gathering Personal Information | Autonomy enabled | Digitized personal information enables workers to log into different hubs and choose their place of work, offering scheduling autonomy. Workers can decide when to work based on their availability. |
| Datafication: Work Scheduling Apps | Autonomy enabled | App-based scheduling grants employees the freedom to set their working hours on a weekly basis, providing flexibility for part-time work or alongside studies. |
| Datafication: App Usage Impact | Autonomy restrained | Blurs the boundaries between work and personal life, requiring consistent engagement with the app during personal time. Failure to input hours promptly might impact scheduling autonomy. |
| Datafication: Workers Affecting Each Other | Autonomy restrained | Workers affecting each other's autonomy by manipulating shift availability, reducing scheduling freedom for others. |

| Instance | Type of Autonomy | Description |
|---|---|---|
| Datafication: Internal Timers during Delivery | Autonomy restrained | Timers exert pressure on workers, influencing work pace and restricting autonomy in managing their pace. |
| Datafication: Location Tracking | Autonomy restrained | Worker's concern over location tracking impacts method autonomy, influencing route choice and fear of repercussions from supervisors. |
| Datafication: Workers' Awareness of Data Use | Autonomy restrained | Lack of understanding or indifference towards data collection undermines workers' autonomy in the process. |
| Automation: Delivery Order Allocation System | Autonomy restrained | Automated delivery assignments limit the worker's ability to refuse orders, imposing negative consequences for declining orders. |
| Automation: Performance Measurement | Autonomy restrained | Emphasis on measuring idle time without context impacts worker autonomy, leading to frustration and a sense of unfairness. |
| Datafication: App-based Communication | Autonomy enabled | All communication with customers through the app provides accessibility to delivery information, benefiting workers by enabling translations and ease of access to comments. |
| Datafication: App-driven Navigation | Autonomy enabled | Workers actively opt for external navigation services like Google Maps, sidestepping the tracking feature and favoring more responsive navigation, thus seeking greater autonomy. |
| Automation: Algorithmic Route Determination | Autonomy restrained | Dictation of routes by the app limits worker autonomy, causing frustration due to the lack of consideration for specific conditions or knowledge of the worker. |
| Automation: Automated Decision on Order Size | Autonomy restrained | Large, automated orders hinder meeting deadlines and pose physical challenges, |

| Instance | Type of Autonomy | Description |
|---|---|---|
| | | limiting worker autonomy to accept or decline such orders. |
| Automation: Algorithmic Order Consolidation | Autonomy enabled and restrained | Consolidation allows for serving multiple customers, enhancing autonomy; however, flawed algorithms or system errors can lead to challenges or problems for workers, limiting their autonomy. |
| Automation: Change in Delivery Assignment | Autonomy Shift | Shift from manual to automated assignment systems changes workers' autonomy levels, impacting fairness and workload distribution among workers. |
| Automation: Automation of Delivery Assignment | Autonomy restrained | Automated system restricts worker autonomy, allowing declined orders to reappear persistently, leading to a perceived lack of real choice in declining orders. |
| Decision Making: Workers' Concern with Routes | Autonomy restrained | App-dictated routes limit worker autonomy, frustrating workers who have better knowledge of routes or need to follow dictated paths to avoid supervisor actions. |
| Decision Making: Use of External Navigation | Autonomy enabled | Workers opt for external navigation tools like Google Maps for greater autonomy, avoiding the app's limitations and tracking features. |
| Decision Making: Automated Decision on Route | Autonomy restrained | Automated decision-making on routes hinders worker autonomy, leading to frustrations due to flawed algorithms or system errors. |
| Decision Making: Impact of Automated Decisions | Autonomy enabled and restrained | Automated decisions improve some aspects while causing challenges in others, impacting worker autonomy positively or negatively based on specific scenarios. |

# Discussion

The necessity of this paper stemmed from a unidimensional perspective regarding the interplay between algorithmic management and autonomy. Existing research predominantly portrayed AM in a negative light, often construing it as a control mechanism that solely diminishes autonomy, thus casting it as a net disadvantage for workers. This thesis aims to expand the discourse surrounding AM's impact on autonomy by shifting the focus towards both its enabling and restraining influences. Achieving this necessitated a comprehensive exploration of theoretical frameworks, dissecting the components of AM and autonomy to precisely delineate their interconnections. For this purpose, AM was deconstructed into three characteristics: datafication, automation and decisionmaking. Autonomy was divided into three main dimensions namely method autonomy, scheduling autonomy and performance measurement autonomy. Based of the close examination of AM and Autonomy the following research question guided the paper: *What characteristics of algorithmic management enable and/or restrain different dimensions of autonomy?* The exploration of the research question was expected to yield a deeper understanding of the intricate dynamics between algorithmic management and the various dimensions of autonomy, thus providing valuable insights into the interplay between technological systems and individual agency in contemporary workplace environments.

A broad observation suggests that the characteristics of AM exhibit both enabling and restraining capabilities. Particularly noteworthy are the autonomy-enhancing aspects, which stand out amidst existing scientific narratives. In general there is a affinity among workers for the convenience that AM provides. In the realm of datafication, managing scheduling via an app notably enhances scheduling autonomy. A prime example of this is seen in students working as riders, who can adjust their work schedules on a weekly basis, allowing them to tailor their work around their student and personal lives. This specific advantage stands out as the primary area of consensus among researchers regarding the positive influence of algorithmic management, particularly evident in platform-based work settings like Uber, Lyft, and Uber Eats (e.g., Healy et al., 2017; Lee et al., 2015; Möhlmann & Zalmanson 2017; Rosenblat & Stark, 2016). Another recurrent theme in the platform economy, which this paper could verify concerning Flink, is the utilization of datafication as a means of implementing control mechanisms as already theorized by research from Duggan et al. (2020) and Kellogg et al. (2020). While datafication appears to have no direct impact on autonomy, the perpetual awareness of being monitored in terms of delivery times and location imposes significant stress on workers. Even though workers are aware that managers may not consistently monitor their specific activities, the mere possibility exerts pressure, significantly shaping their behaviour to an extent where a loss of autonomy becomes discernible. The described impact of limiting autonomy is further accentuated by the opacity of algorithmic processes, as outlined by Jarrahi et al. (2021). When workers either fail to comprehend these

processes or lack interest in them, they become unable to actively engage, consequently forfeiting their ability to participate effectively and ultimately diminishing their autonomy.

In terms of automation, the main factor influencing autonomy was the automated delivery allocation, aligning with previous research on platform dynamics (Duggan et al., 2019; Lee et al., 2015; Rosenblat & Stark, 2016). While workers theoretically have the option to decline deliveries, limitations, such as the system going offline after too many refusals, practically curtail this choice. A distinct observation within Flink was the emergence of a social element. Flink's closed system means rejected deliveries stay within the platform, creating a dilemma for workers who might impact colleagues, often friends, by rejecting 'undesirable' deliveries. This observation could not be made within the gig economy, as all employees work independently of each other. The case of Flink highlights the significant role context plays in shaping the relationship between AM and autonomy. However, even the automatic delivery allocation had its proponents. According to reports, more experienced workers gained advantages by forming friendships with the shift lead. An advantageous aspect of an algorithm lies in its impartiality; it operates without favouritism, allocating tasks objectively to all workers. This example illustrates that while some workers may experience a loss of autonomy due to algorithmic management, it can result in an improved work situation for the majority of workers.

Regarding decision-making, a significant reduction in autonomy stemmed from the automated navigation employed from the hub to the customer's location. Workers were mandated to use the internal app, restricting their ability to choose alternative routes, despite potentially possessing better knowledge of the city or specific destinations. However, this observation presented nuances, as workers often resisted using the designated app and opted for their preferred navigation applications. Other navigation applications offered superior navigation and live re-routing, especially when a wrong turn was taken. Disregarding the provided software and opting for alternatives is an instance of workers asserting their autonomy by bypassing the given systems and taking charge of their own method autonomy, as previously illustrated by Kellogg et al. (2020) within the gig economy framework. Primarily, this highlights that individuals (or workers) cannot be removed from the AM-autonomy equation. After all, a system or app is only as effective as its acceptance by the users.

Additionally, automated decision-making exhibited enabling characteristics. A computer's capability to oversee numerous deliveries concurrently and consolidate them based on quantity or proximity allowed for bundling deliveries situated near each other. This bundling task, arguably beyond human capacity, especially in real-time and with the speed of a computer, was appreciated by riders for the convenience it offered. In terms of autonomy, it provided riders with more flexibility in their workflow, thereby enhancing their method autonomy.

A further, unprecedented observation is the restraining of autonomy of managers by AM. Through reports from experienced employees at Flink, some of whom have worked as shift leads themselves, it

became apparent that with the shift in the delievery allocation system as described in the results section, managers lost the ability to allocate deliveries to their staff. The system now assigns all deliveries to employees based on a simple decision model, the first worker to arrive at the hub secures the order. Prior to the implementation of this new system, managers had the ability to distribute the workload among workers equally. This example illustrates how management by algorithm takes away certain aspects of the job from actual managers. Consequently, managers have less influence on the workflow and experience a reduction in method autonomy. This phenomenon is currently unconsidered in the current debate. An intriguing avenue for research could explore how middle managers navigate the loss of their competencies to algorithms and, in turn, how this influences the frontline workers.

An intriguing aspect observed in this study is the influence that individual intervention or human involvement holds within the relationship between algorithmic management and autonomy. In semi-automatic systems where human input remains essential, the efficacy of control mechanisms rests heavily on managerial actions prompted by the data. Within Flink, managers oversee up to 30 riders simultaneously, necessitating their attention to be divided to an extent were addressing individual issues, such as a single delayed delivery, becomes challenging. Furthermore, the human factor significantly influences the direct impact of datafication on autonomy. Some workers exhibit minimal stress when under observation during work, displaying unaltered behavior and consequently experiencing a lesser loss of autonomy compared to others. A third illustrative example pertains to personal autonomy. Observations revealed instances where workers took and later released entire shifts in the work schedule, showcasing a gain in autonomy for some but resulting in a loss of autonomy for others. This emphasizes that autonomy is not solely tied to algorithmic management but also intertwines with individual behaviors.

Ultimately, the context in which AM operates plays a pivotal role in shaping the dynamics of autonomy within the workplace. Contextual factors encompass a wide array of elements, including the specific platform or company, the nature of tasks, the degree of human involvement, and the social interactions among workers. For instance, observations within Flink highlighted how the closed system and the interconnectedness among workers influenced the impact of AM on autonomy, diverging from the dynamics observed in traditional gig economy settings. Additionally, the context elucidated nuances in the influence of AM characteristics, such as datafication and automated decision-making, as their effects varied depending on the specific operational setup and the level of managerial oversight. This contextual variability underscores the need for a nuanced understanding of how AM interacts with autonomy, emphasizing the significance of context-specific analyses when evaluating the impact of technological systems on individual agency in the workplace. Ultimately, recognizing the contextual intricacies becomes imperative in comprehending the multifaceted relationship between AM and autonomy.

## Limitations and Recommendations

While the study's findings provide valuable insights, it is crucial to address certain limitations and explore their practical implications in real-world contexts. A central limitation arises from the complexity of the technology integrated into the system, surpassing the understanding of the workers. Their lack of specific knowledge about the system's functioning occasionally posed challenges in exploring its characteristics comprehensively. However, despite this obstacle, querying the workers was imperative. Autonomy, being a personal phenomenon, relies heavily on perception, an aspect best understood from those at the baseline of operations. An intriguing angle worth exploring further is the inclusion of perspectives from managers or even the creators of the algorithmic management system. Gathering insights directly from these stakeholders could offer a wider view, providing nuanced understandings of the design intent, managerial decision-making criteria, and the broader organizational objectives that shaped the algorithmic system. Especially, given that one of the observations was that managers are directly influenced by AM, and their autonomy can be both enabled and/or restrained by it.

Another theme that warrants consideration is the methodological approach undertaken in this thesis, specifically the deconstruction of algorithmic management and autonomy, revealing challenges that become apparent in hindsight. Regarding AM, the original resource for the characteristics utilized in this thesis comes from Meijerink and Bondarouk (2021), which described AM as a process. This work took that process and categorized it into three independent characteristics. However, it became apparent that such a perspective is not always advantageous as these characteristics are not entirely independent. It's noteworthy that, based on the acquired data, datafication by itself does not directly influence autonomy. Additionally, one could argue that mere data collection, in isolation, may not meet the criteria for Algorithmic Management, as it lacks the active management aspect by algorithms. Datafication serves as a foundational element for the other two AM characteristics – both automation and decision-making rely on data to function. Thus, datafication either enables or restrains autonomy as a prerequisite for other AM characteristics. Similarly, automation and decision-making are intricately intertwined, given that most decisions made by an AM system can be viewed as automated decisions. If one seeks inspiration from the methodology employed in this thesis, future studies should pay attention to the extent to which the three characteristics can be distinguished. Concerning autonomy, it can be affirmed that, for this study, breaking down the three autonomy dimensions into sub-dimensions brought little additional value, as most interviews were too general to permit coding in smaller dimensions. The three primary dimensions method, scheduling and performance evaluation autonomy proved adequate for the analysis.

Lastly, a two practical recommendation for refining future systems which could be used by creators of algorithmic management systems. First, datafication only has an indirect impact on autonomy as a controlling mechanism, shaping workers' behaviours. This revelation suggests a valuable

recommendation for future system designs—prioritizing clarity regarding data collection and utilization. By ensuring transparency in the collection processes and outlining the purpose behind data usage, designers can maintain control levels while mitigating worker stress. This approach minimizes the fear of the unknown and the sense of constant surveillance, fostering a more conducive work environment for employees interfacing with these systems. Secondly, it is crucial to meticulously consider which competencies managers delegate to the algorithm. It is essential to bear in mind that algorithms, like any system, are susceptible to errors. Therefore, managers should not relinquish the authority to challenge or modify algorithmic decisions. Failure to do so may result in the loss of autonomy not only for the workers but also for the managers in the worst-case scenario.

# Conclusion

Returning to the research question, the findings presented, along with table four, demonstrate that datafication, automation and decision-making are characteristics of algorithmic management that enable and/or restrain autonomy. Concerning autonomy, it appears that AM predominantly impacts method and scheduling autonomy, while performance evaluation autonomy plays a secondary role. Table 4. Illustrates a detailed breakdown of the enabling and restraining factors. Returning to the initial problem addressed in this work, which was the prevalent negative portrayal of AM in scholarly discourse, particularly regarding the surveillance of workers and its detrimental impact on their autonomy. The nuanced observations made here indicate that there is no finite answer whether AM enables or restrains autonomy, given its multifaceted nature and the high dependence on contextual factors. This thesis was successful in identifying three potential contextual factors, recognizing that there are likely more, and the three identified serve as a foundational starting point for future scientific endeavours. First, the human factor is pivotal in the algorithmic management-autonomy interplay because it determines how individuals respond to and interact with the implemented technological systems, shaping the ultimate impact on their autonomy within the workplace. Second, to what extent the algorithmic management system aids or replaces a manager is contingent upon the manager's capacity to streamline tasks and improve system misjudgements, fostering a nuanced dynamic between AM and worker's autonomy. Third, the autonomy-AM interplay is significantly influenced by the technological infrastructure supporting the algorithmic management system. The intricacies of how the algorithm is programmed, its compatibility with different devices, and the user interface on which it operates all contribute to shaping the user experience and, consequently, the impact on autonomy.

In conclusion algorithmic management does not restrain autonomy nor does it enable autonomy. It does both, often at the same time. The reality is too complex for a binary assertion. More detailed investigations, similar to the depth strived for in this paper, are essential to approach a more accurate depiction of reality.

In my perspective, algorithmic management operates in a manner reminiscent of most technology. Technology itself is not inherently good or bad; it's the way people develop, deploy, and utilize it that

determines its impact. Technology can serve beneficial purposes, enhancing efficiency and well-being at the workplace. However, when wielded irresponsibly or with malicious intent, it can also lead to negative consequences. The ethical considerations, intentions, and actions of those employing technology often dictate whether it has positive or adverse effects.

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