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On the Epistemic Role of Narrative Features in Determining Unsubstantiated Scientific Practices

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Abstract

Purpose: This study explores the disciplinary narrative structured in a specific scientific context: cancer research. Specifically, it examines the narratives of ten biologists vis-à-vis the use of machines and consumables within a cancer research lab in Belgium. The aim is to answer the following main research question: What is the relationship between the scientists and the lab's machines and consumables?

Design: A qualitative analysis is conducted over 18 months of a) participant-observation recordings, b) semi-structured individual interviews, and c) collective interviews with ten lab scientists. The analysis is guided by Walter Fisher's narrative paradigm and Mona Baker's narrative features.

Findings: The findings expose a problematic relationship between the scientists and their lab machines and suggest that scientists trust machines and consumables unquestionably. This problematic relationship is evidenced as the scientists' narratives violate four narrative features: 1) temporality, 2) causal emplotment, 3) relationality, and 4) selective appropriation. The study claims that these narrative features are well-positioned to identify unsubstantiated scientific practices.

Keywords: cancer research lab, narrative features, narrative paradigm, unsubstantiated scientific practices

1. Introduction

1.1 Narrativity We Live by

Can we genuinely exist beyond the realm of stories? Can we make sense of any situation, be it remembered, imagined, or expected, without recalling the repertoire of our past stories? Storytelling is as old as the origin of language, and the first verbal symbols and gestures (Burke, 1966), and humans have been telling stories since the beginning of humanity (Clair et al., 2014). Many social sciences and humanities scholars have utilized and applied narrative theory to various collected data. Furthermore, narrativity has emerged as a fundamental theoretical foundation underpinning many disciplinary and multidisciplinary fields that aim to reveal how a narrative can be used as a communicative and analysis tool to transfer information and knowledge to the public. In addition, scholars within the philosophy of science argue that "scientific facts are not the result of uncovering independent truth but instead, are constructed objects resulting from the intersection of many social factors, including narratives" (Dahlstrom, 2021, p. 2). This study employs a narrative approach to explore the disciplinary narrative in a scientific context. Specifically, it examines the interaction between scientists and their lab machines and consumables, as embedded in the narratives of ten biologists who work in cancer labs. The study qualitatively analyzes data from semi-structured interviews and direct observations involving the scientists' narratives.

1.2 Narrative Theory

Many scholars (Bruner, 1986; Somers, 1992, 1994, 1997; Avraamidou & Osbourne, 2009; Chatman, 1978; Norris et al., 2005; Toolan, 2001) have contributed to narrative theory and narrative features, as well as they have applied it in different social sciences contexts. Due to the nature of the current research study, the analysis of the empirical part of this paper is guided by Walter Fisher's narrative paradigm and Mona Baker's narrative features to analyze and uncover the unique perspectives of scientists regarding their interactions with lab equipment and consumables.

Walter Fisher's narrative paradigm (1984, 1985a, 1985b, 1987, 1989, 1997) is the bedrock of our narrative theory exploration. Fisher's work extends the scope of narratives beyond moral or personal dimensions to encompass their relevance in social and political life. He contends that we can communicate and comprehend stories about human experiences through narratives, bestowing meaning. Fisher's assertion that narration is fundamental to human communication is profound. He emphasizes that stories inform each other, and their mutual influence is vital to understanding the interplay between communication and human identity. In this light, Fisher paints individuals as storytellers who make decisions based on "good reasons." These reasons are evaluated through "narrative probability" and "narrative fidelity," determining a narrative's coherence and trustworthiness. According to Fisher, the narrative paradigm empowers people to engage in specialized debates and stories, enabling them to assess expert narratives against these standards. Thus, combining narrative probability and narrative fidelity enables experts to align with the demands of "narrative rationality" (1984). Narrative probability hinges on a story's features and sequence of elements, ideas, and actions, focusing on coherence and consistency. On the other hand, narrative fidelity assesses a story's truthfulness and alignment with values like truth, goodness, beauty, health, and wisdom. A narrative must adhere to factuality, relevance, and consistency criteria. For Fisher, a well-constructed narrative meets the benchmarks of narrative rationality and serves as a reliable guide for belief and action.

According to Fisher, the narrative paradigm enables a critical analysis of human communication, helping determine whether a piece of discourse is a reliable and trustworthy guide for thought and action in the real world. It also scrutinizes storytellers, co-authors, and participants in creating communication. Fisher's focus on narratives interpreted and acted upon by those who hear them provides a method to evaluate stories and their acceptance by audiences, thereby influencing their decisions and actions. This approach reflects Fisher's view of people's decisions, actions, and behaviors as stories, evaluated by narrative rationality, which, in turn, is governed by the principles of narrative probability and fidelity.

Typology and the four critical narrative features. Mona Baker (2006) further expands our understanding by categorizing narratives into four types based on a typology introduced by Somers and Gibson (1994): ontological narrative (personal), public narrative (shared), conceptual (disciplinary), and meta-narrative (macro-level). Narratives are personal stories that individuals construct about their place in the world, experiences, and history, often relying on collective narratives. On the other hand, public narratives circulate within broader social and institutional contexts, such as the media, family, or nation, and may evolve in response to political and social shifts. Conceptual or disciplinary narratives are narratives and explanations constructed by scholars within their fields of inquiry. Finally, meta-narratives are shared across cultures and countries, transcending geographical and cultural boundaries, and can influence contemporary historical actors.

1.3 Mona Baker's Four Features: Our Theoretical Framework

Most importantly, Mona Baker (2006) identified four key features that play a pivotal role in shaping our comprehension of narratives in the social sciences. They are: 1) temporality, 2) causal emplotment, 3) relationality, and 4) selective appropriation. These features shape our comprehension of narratives in the social sciences and provide a deeper understanding of how narratives function and are constructed.

The first narrative feature—temporality (time)—refers to the arrangement of events in a narrative sequence and how it imparts meaning. In a narrative, events are presented chronologically and organized to create a sense of significance. Timing and order of events within a narrative play a crucial role in how we perceive and interpret the story. The sequence of events is imbued with meaning, making some events more prominent or impactful.

The second feature, causal emplotment (causality), is weaving independent events into a coherent sequence. It involves identifying cause-and-effect relationships between events and giving them a sense of purpose and significance. This element assigns moral and ethical implications to events, making them meaningful to the narrative's overall message. It enables interpretation and understanding by providing a framework for linking events, even when people may hold differing opinions about the same facts.

The third feature – relationality (contextuality) – insists that events and narratives must be understood within the broader context of other events and narratives. This feature highlights the interconnectedness of events, emphasizing that it is challenging for the human mind to make sense of isolated or disconnected events. To fully understand a narrative, one must consider how it relates to other narratives and the larger context in which it is situated. Relationality underscores the importance of understanding the web of relationships and dependencies between events and narratives.

Finally, the fourth feature (selective appropriation or selectivity) involves strategically including or omitting elements from reality within a narrative. Narrators choose what to highlight and suppress, determining which events and narrative elements are included and which can be excluded. This process shapes the narrative's message and perspective. Narrators may selectively appropriate reality to advance a particular agenda, emphasize certain aspects, or downplay others, ultimately influencing the narrative's interpretation and impact.

This study uses these four narrative features due to their significance in shaping human understanding and interpretation of narratives. More precisely, the analysis focuses on the four narrative features, as follows: 1) the time of their practices (e.g., when did they start doing what they are doing?); 2) the cause (e.g., what made them take this or that decision?) 3) the context (e.g., are their practices related to specific circumstances?) and 4) selectivity (e.g., do their narratives favor specific elements while playing down other aspects related to their scientific practices?).

2. Method

2.1 Background

The Method section describes how the study was conducted, including conceptual and operational aspects. This ethnographic study was conducted in an Oncology lab in Belgium. The lab includes ten members and is part of a research pole comprising four labs. The lab members are postdoctoral and doctoral researchers, technicians, and the director or Chief investigator. They come from Belgium, France, Spain, the Netherlands, and Tunisia and hold university degrees from these countries. The lab director served as a postdoctoral fellow and research associate at the Brigham and Women's Hospital and was an instructor in medicine at Harvard Medical School, Boston. As indicated on the lab website, they have made 255 publications and several patents and achieved an H index of 81 in 2022.

Plenty of machines are in the lab; some are simple, and others are sophisticated. The first author sometimes followed one researcher in his or her day journey from one machine to another, and sometimes, he sat by a particular machine and asked different researchers the same question about it. He always opened the discussion with this question: "what does this machine do?"; he had received straightforward and similar answers such as: "it gives you this or that measure". He asked other questions, such as: "but what does it particularly do to be able to find this or that measure?" At this level, answers start to become different, usually depending on the participant's profile. Then, usually, the third question is: "do you trust this machine?". This question almost always triggered some surprise. Usually, the lab members answered it straightforwardly as: "yes" followed by "hopefully". However, some answers were more sophisticated from time to time. Then the fourth question was "How do you know this machine measures what you want to measure?". It is at this level that the participants' answers become considerably different. Some said they didn't know how, although they had said they were sure the machine was well-designed to do its work correctly. Depending on the machine, some could explain how it works. Some said that they should not go into those details and that as long as the machine is working, they should not waste their time thinking about such "philosophical" issues because they do not have time for that.

On different occasions, maintenance technicians were noticed to be visiting the lab to fix machines. Usually, the technician is received by one of the postdocs, who tells him what sort of glitch the machine is having and then leaves him fixing the machine without necessarily trying to learn from him more about how the machine enables them to know what they want to know. The technician spends some hours and sometimes a couple of days fixing the machine and then calls the designated postdoc to test that everything is fine to go away finally. The lab members seem to only doubt or think about machines when they make errors. We decided to include this inquiry in the interview series at this level. The concern is precisely the trivialization of the risk emanating from the possibility that machines are not measuring what they are supposed to measure. Machines may be consistent, but they may measure other things, not precisely what the participants want them to measure (Latour, 1987).

In addition to machines, the lab members consume products that range from substances such as medium, trypsin, powders, gels, and the like, to small tools such as pipettes, plates, tips, filters, and many more. These consumables have to be certified and purchased from a reliable provider because their chemical composition may influence the cancer cells and, therefore, skew the research results. The consumption of these products is ongoing every second, all around the clock. The lab members are constantly consuming without stopping. Research operations are only possible with these products in terms of how research is currently designed. The first author asked the postdoctoral researchers, who confirmed that almost everything is purchased from providers and that their research heavily depends on them (they all confirmed this during the interviews, too). We wanted to know if the lab controls these products to ensure they do not skew their experiments. Surprisingly, all the lab members said these products come from highly reputable providers that perform checks and controls in their firms, meaning they trust them and do not need to check after them. We wanted to make sure that if mistakes are made in these products, the consequences are mild. Again, they all said these products had to follow strict rules and specifications; otherwise, they would skew the experiments. Discussions with the postdocs left us with the impression that the lab only doubts the quality of these consumables if something wrong happens. The wrong "thing" that they all referred to was if experiments are not consistent, but we were thinking that if some products are consistently not as described, they would not be able to know. We decided to include this inquiry in the next interview series. The concern is precisely the trivialization of the risk emanating from the possibility of the purchased products being different from what is described and, hence, consistently skewing their experiments.

2.2 Method and Research Questions

The study employs a qualitative narrative analysis approach, as the analyzed corpus of the case study consists of the narratives of the ten cancer lab scientists. These narratives were gathered through eighteen-month observation and semi-structured interviews. Following the data collection, a systematic analysis was conducted to examine how the scientists structured the disciplinary narrative of the lab.

The data analysis in this study focuses on the narratives presented by ten scientists who work in a cancer research lab in Belgium. This process was achieved through a combination of direct observation and semi-structured interviews. The primary aim was to understand how the personal narratives of the scientists contribute to the overall disciplinary narrative of the lab, specifically regarding the relationship between scientists and lab machines, as well as scientists and consumables. As told by the scientists (our informants), this relationship offers insights into unsubstantiated scientific practices within the cancer research lab. Our data and analysis target the larger scientific community (i.e., social scientists, sociologists, and philosophers of science), who are particularly interested in studying other scientists' practices.

The study addresses the following main research question and its sub-questions through analysis:

RQ1: How do scientists rationalize their scientific practices through their narratives?

RQ1a: To what extent do scientists' narratives align or diverge with one another?

RQ1b: What mechanisms contribute to the development of (mis)trust in lab machines?

RQ1c: How do scientists incorporate the use of consumables?

3. Results

The study identified two inquiry points prior to conducting the tape-recorded interviews to assist the analysis process and eventually to respond to the paper's main research questions. The first inquiry focused on using machines in the cancer research lab. The lab houses an extensive assortment of machines encompassing various sophistication levels. These machines vary from highly advanced and complex systems to more straightforward and essential equipment. The first author employed a combination of research methods to gather information, including direct observations, by closely shadowing each researcher throughout their workday. It also included conducting semi-structured interviews both on an individual basis and in collective settings. The questions during these interviews were designed to prompt discussions about the participants' experiences and roles in the lab. These questions included: "What does this machine do?", "What makes it capable of finding certain measures?"; "Do you trust this machine?"; and "How do you know it measures what you want to measure?". The responses to these questions varied, ranging from straightforward answers to more sophisticated responses. Among the participants, there was a range of knowledge and understanding regarding the inner workings of the machines. While some participants were able to provide detailed explanations of how the machines operated, others needed a more limited understanding. However, even those with a more limited understanding expressed confidence in the machines' design and functionality, indicating their trust in the equipment's reliability. A few participants considered specific questions " philosophical " and did not have time to engage in such discussions. Overall, the data collected from these interviews provides insight into the diverse perspectives held by the scientists in the lab and how these perspectives shape the lab's disciplinary narrative on the relationship between lab machines and scientists.

During our observations within the lab, we noticed the presence of maintenance technicians who visited on several occasions to repair the machines. Generally, upon the technician's arrival, they are greeted by one of the postdoctoral researchers, who informs them about the specific malfunction of the machine. Following this, the postdoctoral researcher delegates the responsibility for machine repairs to the technician and does not seek further knowledge about the technical aspects involved. The technician spends several hours, or sometimes a couple of days, fixing the machine before calling the designated postdoctoral researcher to confirm that the machine is functioning correctly, and then he departs. The laboratory members appear to take the functioning of the machines for granted, only giving them significant attention when malfunctions occur. Recognizing the significance of this issue, we determined it was essential to include this inquiry in the interviews. The concern stems from the potential risks associated with trivializing machine performance. Machines are functioning consistently, but this consistency may only sometimes indicate that they are measuring what the participants intend them to measure (Latour, 1987). We need to consider the implications of machine performance beyond simply their functional consistency.

The second research inquiry deals with the consumption of consumable materials in the cancer lab. The lab utilizes various products, including mediums, trypsin, powders, gels, and small tools such as pipettes, plates, tips, and filters. These consumables must be certified and sourced from a trustworthy provider, as their chemical composition can impact the research results obtained from the cancer cells. The continuous consumption of these materials is a crucial aspect of the lab's research operations, as it would only be feasible with them. In order to investigate the management and control of these consumable materials, the first author conducted semi-structured interviews with the participants. The results of these interviews confirmed that the products are purchased from reputable providers who perform their checks and controls; hence, the lab trusts the quality of these products. However, the interviews also revealed the potential risk of trivializing the consequences if the purchased products were not as described. This inquiry was included in the subsequent interview series due to the concern regarding the possible trivialization of the risk of the purchased products consistently skewing their experiments. Despite the strict rules and specifications for these consumables, it is crucial to ensure that they meet the described standards, as any errors can significantly impact the research results.

Our study investigates how scientists rationalize their scientific practices, given Mona Baker's (2006) four narrative features identified in the theoretical framework section. We base our analysis on how much they trust machines and consumables. The following five questions were asked in the individual and collective semi-structured interviews: 1) What processes do you typically follow to verify your results? 2) Do you trust machines? 3) Do you trust products from other companies? 4) What is the proportion of operations performed by other parties in your experiments? 5) Can you provide a diagram that illustrates the different stages or operations in your current research?

3.1 On the Use of Machines

One postdoctoral researcher responded to the question "do you trust machines?", determinedly by saying "yeah". When I told him "is it like you have to trust them or you need to trust them?" he confirmed his position, by saying: "no, they are designed to do what they are doing". When I asked him "and how do you know they are functioning u:h for example measuring what you really want to measure?", he started to figure out that the question is meant to go into deeper discussions. At this level, he acknowledged that he does not know and that his relationship with the machine is rather down-to-earth: "((sighing)) I don't know it's (.) just they are designed like that (.) it's like if you're using Word but you type a double b you see the double b on the screen you know that the machine is doing the right stuff (.) so ((sighing))". I tried to make this position problematic, by saying machines may be like black boxes and we are not sure if they are doing what we really want them to do, but he confirmed again that this is not a concern for him: "Yeah that's why you pay a lot for these machines (.) so if if they start not to work (.) sometime you can have trouble and then you call the man from the company (.) and he can he can he can come to see what's going wrong (.) sometimes of course it will take you one or two months to see that there is something going wrong with the machine". For this postdoc, machines are not to be doubted. We can obtain machines that ensure validity and reliability as long as we pay a lot. He added that the only issue is troubleshooting but not to question their validity as long as they are up and running. Therefore, even after I explained my point to this postdoc, he continued to consider it not an issue to be concerned about, which is quite understandable for a PhD student still in his first month in the lab. The postdoc may be focused on his research proposal and is not yet well-positioned to rethink everything. However, his use of the "you" pronoun suggests that his position is not only his but rather a 'reasonable' one and that doing otherwise is perhaps a waste of time or unworthy.

I went even further and explained to this postdoc that people who designed the machines may be not as knowledgeable as himself in terms of biology, and may also be profit-driven, so the machine may be not doing what he is assuming it is doing, but he said "[Yeah but that's that's YOU (.) that I have to work with the machine in the right way (.) so the man designed the machine to uh sense fluorescence (.) so then you use the primer data fluorescence and the machine is going to sense the fluorescence (.) just going to give you the amount of fluorescence in your in your wells that's all". Again, for this postdoc the problem is in "you" not in the machine. Although we were speaking in general and not even about a particular machine, he basically said that "the man" (which he does not know) who designed the machine knows what to do. At this level, I would understand this postdoc's position to be rather defensive. He perhaps felt uneasy to step back and acknowledge the sense that I meant when I said machines can be problematic. Perhaps he did not want to contradict himself, so he preferred to keep the same position.

The lab director said right from the beginning that "he had to trust them", acknowledging that it is a matter of obligation rather than a choice. I explained to the lab director that what I meant by the question is if he is sure that the machine is measuring what he (as a biologist) wants it to measure, not just being sure that the machine is running well or is well calibrated. He said "yes". When I explained my idea, he said that machines can be consistent and well-calibrated, but they may not be measuring what we want to measure, he said *"I don't ask myself these kind of questions (.) I'm I I consider that is being measured is uh reflects the the reality (.) I I don't doubt the except if if again we have obtained ten times the same thing and the eleventh time we do the experiments we have u:h we have uh bizarre behavior than we could start to check whether is the machine is is working properly but we we do the maintenance of the machine in order to: to to get them: uh as uh as efficient as possible (.) this is uh usually checked for the machine why you have them the highest risk of uh of problems this is checked by companies uh who knows the machine better than than we do and who come to validate them using specific QC protocols or quality control protocols (.) so we we are prone to to believe (.) the machine".*

The lab director's account, on the one hand, admits that he never doubted that the machine in the way that I explained before, but he added that the providers should be doing their job correctly because they have specific controls. After I explained again to the lab director, he almost repeated the same idea, which is basically that they buy from highly reputable providers and that the machines *"have been validated by by others uh (.) so uh we we have reference on on what we should get with ourselves"*. The lab director, who had already said that he does not ask himself such questions, now told me that he does not purchase black boxes, a term which I did not use myself: *"We discuss with colleagues already using the machines, so we make our minds in order to (.) finally buy the machine which (.) for which we are convinced that it does measure what we (.) u::h want to s to be measured, and then it's a real it does truly reflect the parameter we uh which is the one to investigate so we uh uh it's not like we we're dealing with the black box we're dealing with a machine which is uh which have been validated by others uh (.)". The lab director's account serves him to say that they know what they do, and that before they purchase machines, they make good decisions based on a reasonable strategy, which is asking "others," again without accounting on what makes him say that they do not buy black boxes or how they know that they measure what they are supposed to measure.*

A technician did almost as the postdoc and the lab director, but acknowledging that she does not master these areas. She said that she trusted machines because others also do*: "Because I don't, I don't really know u::h machines and stuff like that but u::h if it is used by everybody like I have to trust them ((laughter))".* When I tried to explain more, she interrupted me by saying*: "[it's not stupid people who're making those machines".* The technician here joined the postdoc by assuming that people who make machines know what to do, so we do not need to doubt their work. I told her that because these people are profit-driven, so for example they are supposed to work more on convincing you that their machines are able to do what you need, which is not necessarily correct. For me it is the biologists who are supposed to ensure that the machines that they are using are in effect doing what they want them to do. However, again, Joanne insisted that *"Yes they must produce something it's like it's not like u:h for example if you use a ma machine to:: to check the concentration and stuff like that it's not a stupid thing (.) it's correct". Then, we focused on a specific apparatus as an example, but again Joanne kept on describing how to use the machine and the technique while I tried to reformulate my point again and again – that I am not speaking about the use or the calibration of the machine, but about how we can make sure that they really reflect what we think they are measuring. Ultimately, the technician said that she does not know and that she will ask about that: "I don't know [ ] maybe if I ask I will know"; I said "ok", she said "I will get the answer".*

The participants, who initially did not understand my concern about whether they are sure that their machines measure what they want them to measure, later assured that they know how they inherently function without providing concrete explanations, no matter how much the interviews solicited details and examples. Therefore, I am skeptical that their trust is about the machines' validity and not reliability (i.e., no matter how robust and precise the machine can be). Although they insisted (especially in the collective interview) that they understand machines very well, their first reactions were completely different; i.e., they trust machines like black boxes (examples: "I don't ask myself these questions", "we pay a lot for these machines", "it's not stupid people who're making these machines"). Secondly, the participants said that "almost everything" is purchased readymade. They used: "almost everything" and "everything" and percentages from 75% to 100%. They additionally said that entrusting "90%" or "everything" to external providers is "good" and persistently described it to be unproblematic, but this position was again based on a common sense idea, i.e., that providers would not have any interest to cheat or to do their job incorrectly, otherwise they would lose business. Furthermore, the research found that if any of these purchased products are systematically altered for any reason, they would skew their research results without being able to figure it out. The researchers would only be able to discover "cheating" if the alteration occurs between one batch and another in the middle of an experiment and when the skew is possibly visible. Moreover, even when they discover glitches, they cannot determine it by themselves. They would rather seek clarifications and solutions from the providers. The two latter situations illustrate how the lab does not control its own experiments, because it excessively entrusts: a) to machines, assuming that their measures and calculations really correspond to what the researchers want to measure, and b) to consumables' manufacturers, assuming that they do not have interest to alter anything.

3.2 On the Use of Consumables

About how heavily the lab depends on providers, one postdoc said: "it's indeed when you think about that it's u::h (.) probably like 80% or something of the stuff is ready, but we mostly do is (.) combining the different things in different settings to have different conditions and just (.) see what happens (.) what basic sources originally might happen yeah (.) already pre-made by the providers". This means that the risk that the postdoc referred to applies to 80% of their research, which is outside their control (because it is provided readymade). The postdoc accounted for the risks that they run because of the situation of not checking other things. He called this situation "an inherent risk," although his first account (during observation) reflected a completely different position where things seemed to be under complete control. This is a pertinent example of why more than fully structured questionnaires are needed to understand issues like these, no matter how significant the number of participants is. We were only able to find out that the "inherent risk" was initially played down through detailed discussions and discourse analysis.

Furthermore, only after asking researchers to draw a diagram to cite all the products they need in their current research did they realize how much they depend on external providers. One of them said: "oh it's a lot ((laughter))", which suggests that he discovered this situation for the first time. Then, when I asked him to account for this situation, he said: "No it's again crazy it's so many parameters for things that can go wrong" and immediately justified this situation by saying "but it's (.) I think it's one of the only ways because you cannot control (.) you have no time effort options to get all these materials you cannot create them yourself". By doing this, he is again playing down the risks of what he himself called "so many parameters for things that can go wrong" by justifying this situation with the impossibility of producing these products by themselves. The scientist's account means that working with "so many parameters for things that can go wrong" is acceptable because we cannot manufacture these products at home. Additionally, I did not suggest or ask that they should try to manufacture these products locally. It was rather his own alternative that he deemed to be impossible by himself. This scientist's account urges us only to see two options, one of which is not possible: Either to accept the risk of getting the wrong products used in "80%" of the research or to think about manufacturing everything, which is impossible. Hence, with this way of putting things, I was not able to imagine that there are other alternatives. Based on the risk that the scientist has just described, I am enquiring why cancer research labs would not consider finding other feasible ways to ensure that what they get from providers is identical to what they want.

4. Discussion

In the previous section, the discussion about the relationship between scientists, machines, and consumables reveals how unsubstantiated some essential scientific practices are within the cancer research lab. In examining the scientists' narratives, a clear violation of the first narrative feature, temporality, becomes evident. The interviews reveal that these scientists have a temporal disconnect, as they interact with machines and consumables with little awareness of their historical context and timeline (when they felt the need to use such machines and how they were designed to respond to their own and specific needs?). They only emphasize the current functionality of the machines, as seen in the lab director's response: "I don't ask myself these questions." This focus on immediate usability neglects the temporal dimensions of machine evolution. It underscores the need for a more comprehensive narrative that accounts for these tools' historical evolution and context.

The study also uncovers a significant gap in the scientists' narratives concerning the causal emplotment of machines and consumables in their research processes. During the interviews, it became evident that most scientists need more in-depth insights into how the machines they use are engineered. They demonstrate trust in the machines' reliability but fail to question the intricacies of their inner workings (validity). This lack of causal emplotment is reflected in their reliance on the assumption that competent individuals made machines. The scientists insisted that they fully understood how the lab machines function; however, their first reactions were completely different, i.e., they trusted machines like black boxes, as one scientist noted: "We pay a lot for these machines." Another scientist said, "I don't ask myself these questions," while another claimed, "It's not stupid people who're making these machines." This narrative gap highlights the flawed relationship between scientists and these essential tools.

One of the key findings of this study is the unidirectional relationship between scientists and machines, indicating a need for relationality. The narrative suggests that there's minimal dialogue and collaboration with the machinery. Participants assume that machines reliably measure what they intend without engaging in a deeper dialogue with these instruments. This unidirectional perspective is evident in statements such as: "They are designed to do what they are doing" and "Machines can assure validity and reliability." These examples from the scientists' narratives assure that the scientists do not doubt their relationship with the lab machines. As long as they pay a lot, they can obtain machines that can ensure validity and reliability. The absence of relationality in these narratives underlines the need for a more nuanced understanding of the interaction between scientists and their tools (i.e., this is a research lab, not a lab for analyses).

Finally, the participants demonstrate selective appropriation in their relationship with consumables, as they consistently downplayed the significance of scrutinizing the quality and origin of these materials. Throughout the interviews, they express trust in the providers of these consumables, even though they need more detailed knowledge of the products' creation or quality control measures. This selective appropriation is evident in their statements, such as: "We trust them because others do" and "It's not stupid people who're making those machines." This narrative reflects a form of trivialization, where the importance of ensuring the quality of these materials is downplayed in favor of assuming they meet specified standards.

5. Conclusions

This study uncovers essential insights into unsubstantiated scientific practices as told by scientists who work in a cancer research lab in Belgium. The study has revealed intriguing aspects of scientists' interactions with lab machinery and consumables through direct observations and semi-structured interviews. Four key narrative features, namely temporality, causal emplotment, relationality, and selective appropriation, were examined in the scientists' narratives to gain a better understanding of these interactions.

The study exposes a need for more historical context and knowledge among the scientists regarding the development of lab machines and consumables, as well as limited insights into the functioning of machines and the creation of consumables. The narratives also expose a one-sided relationship between scientists and machinery, marked by trust in the machines' reliability without deeper engagement.

This empirical research contributes to advancing our understanding of scientific knowledge as embedded in the scientific practices of those who work within a research lab. By highlighting the applicability of the four narrative features to the scientific context, this study emphasizes the significance of a more comprehensive narrative approach and future research studies in scientific contexts. Such an approach can improve research rigor, enhance interdisciplinary collaboration, and mitigate potential research risks. It also has implications for education, methodological development, and the promotion of transparent research practices, fostering more robust and trustworthy scientific work.

While this empirical research provides valuable insights, it is essential to acknowledge its limitations. One limitation is that the findings are specific to the context of the cancer research lab in Belgium and may not be directly generalizable to other scientific disciplines or settings. Additionally, the study relies on self-reported data from the scientists, which may introduce response bias or a limited scope of understanding. Further research in different scientific domains and with larger sample sizes could help validate and extend these findings. Additionally, a more comprehensive exploration of the nuances and complexities of scientists' interactions with machinery and consumables is warranted for a more in-depth understanding of the subject.

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Authors contributions

Dr. Fadi Jaber and Dr. Salaheddine Mnasri were responsible for study design and revising. Dr. Salaheddine Mnasri was responsible for data collection. Dr. Fadi Jaber drafted the manuscript and Dr. Salaheddine Mnasri revised it. Dr. Marina Jovic conducted proofreading and reformatted the manuscript as per submission guidelines. All authors read and approved the final manuscript.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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The journal’s policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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Appendices

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